Welch Allyn® 1500 Patient Monitor

Directions for use

Software version 1.0.X

Welch Allyn®

Advancing Frontline Care™

For information about any Welch Allyn product, call the nearest Welch Allyn representative.

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Heart of Mortara™ Oridion. OxiMax WORKS HERE CE 0123 WelchAllyn®

Contents

1 Safety

User responsibility

- The numerical and graphical results and any interpretation given must be examined with respect to the overall clinical condition of the patient and the general recorded data quality.
- The indications given by this equipment are not a substitute for regular checking of vital functions.
- This monitor is only to be used by those trained in its operation or repair.
- Ensure that the personnel have read and understood these operating instructions and in particular this chapter "Safety."
- Damaged or missing components must be replaced immediately.
- It is the owner's responsibility that the valid regulations for safety and prevention of accidents are observed.

Intended use

- The Welch Allyn® 1500 Patient Monitor patient monitoring unit is designed for the monitoring of vital parameters such as ECG, SpO_2, $etCO_2$, non invasive blood pressure (NIBP), invasive blood pressure (IBP), temperature and respiration of a patient.
- The device is intended to be used by qualified doctors or trained medical personnel.
- The device is not suitable for transport.
- There is no danger for patients with pacemaker.
- The device is intended for the monitoring of one patient at a time.
- The device is not designed for sterile use nor is it designed for outdoor use.
- Do not use this monitor in areas where there is any danger of explosion or in the presence of flammable gases.
- The device is classified CF . It is defibrillation protected when the original accessories are used. However, as a safety precaution when possible, remove the electrodes before defibrillation.
- This product is not designed for direct cardiac application.
- The arrhythmia module is not intended for use with neonatal patients.
- The ST-analysis module is not intended for use with neonatal patients.

Organizational measures

- Before using the monitor, ensure that an introduction regarding the monitor functions and the safety precautions has been provided by a medical product representative..
- Observe the operating instructions and maintenance instructions.
- These operating instructions do not override any statutory or local regulations, or procedures for the prevention of accidents and environmental protection.

Safety

WARNING Mount the monitor securely so that there is no possibility of it falling on the patient or floor.

WARNING If uncertain about the accuracy of any measurement, first check the patient's vital signs by alternate means, and then make sure the monitor is functioning correctly.

WARNING Do not touch the monitor during defibrillation.

WARNING To ensure patient safety, none of the ECG electrodes including the neutral electrode, nor the patient or any person with simultaneous patient contact, must come in contact with conductive parts, even when these are earthed.

WARNING Immediately report any changes that impair safety (including operating behavior) to the person responsible for servicing the monitor.

WARNING Do not place any liquids on the monitor. If liquid is spilled over the monitor, immediately disconnect the monitor from the mains and dry. The monitor must be serviced before reusing.

Caution This manual, and especially these safety notes, must be read and observed.

Caution Electrical installation of the room or the building in which the monitor is to be used must comply with regulations specified by the country in which the equipment is to be used

Caution Ensure the monitor is always mounted on a Welch Allyn approved bracket or stand. The monitor is unstable at angles greater than 5 degrees when not secured.

Safety equipment

Operating the monitor without the correctly rated fuse, or with defective cables, constitutes a danger to patient safety. Therefore:

Caution Do not operate the monitor if the ground connection is suspect or if the mains lead is damaged or suspected of being damaged.

Caution Damaged cables and connections must immediately be replaced.

Caution Electrical safety devices, such as fuses, must not be modified.

Caution Blown fuses must only be replaced with the same type and rating as the original

Alarms

WARNING Do not silence the audible alarm if patient safety may be compromised.

WARNING Always respond immediately to an equipment alert because the patient may not be monitored during certain alarm conditions.

WARNING Before each use, verify that the alarm limits are appropriate for the patient being monitored.

WARNING Check the audible alarm silence duration before temporarily silencing the audible alarms.

Operation with other devices

Caution Do not use the monitor in or near an MRI suite.

- Only use accessories and other parts recommended or supplied by Welch Allyn. Use of other than recommended or supplied parts may result in injury, inaccurate information and/or damage to the monitor.
- Accessory equipment connected to the analogue and digital interfaces must be certified according to the respective IEC standards (e.g. IEC/EN 60950 for data processing equipment and IEC/EN 60601-1 for medical equipment). Furthermore all configurations shall comply with the valid version of the system standard IEC/EN 60601-1-1. Anyone who connects additional equipment to the signal input part or signal output part configures a medical system, and is therefore responsible that the system complies with the requirements of the valid version of the system standard IEC/EN 60601-1-1. If in doubt, consult the technical service department or your local representative.
- Any other equipment used with the patient must use the same common earth as the monitor.
- Precautions must be observed when using high frequency devices. Operating high frequency electro-surgical equipment in the vicinity of the monitor can produce interference in the monitor and cause incorrect measurements. Use patient cables recommended by Welch Allyn to avoid possible signal interference during ECG acquisition.
- There is no danger when using the ECG monitor simultaneously with electrical stimulation equipment. However, during defibrillation, keep discharge paddles away from the monitor ECG lead wires, electrodes, any other monitor sensors, and other conductive parts in contact with the patient.
- If the patient cable should become defective after defibrillation, a lead-off indication is displayed and an audible alarm is issued.
- Portable communication equipment, HF two-way radios and devices marked with the symbol can affect this monitor (see "EMC compliance" on page 70).

Networks and internet

- When the monitor is part of a network, (LAN, HIS, etc.), transmitting over a telephone network or any other transmission /reception medium, or if exposed to the Internet or other networks that are not secure, appropriate security measures must be provided to protect the patient data stored.
- Patient security and security of the network is the sole responsibility of the user.

Maintenance

WARNING Danger of electric shock. Do not open the monitor case. There are no user serviceable parts inside. Servicing may only be carried out by a qualified technician authorized by Welch Allyn.

WARNING Before cleaning and to isolate the mains power supply, switch the monitor off and disconnect it from the mains by removing the plug.

Caution Do not use high temperature sterilization processes (such as autoclaving). Do not use E-beam or gamma radiation sterilization.

Caution Do not use solvent or abrasive cleaners on either the monitor or cable assemblies.

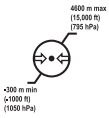
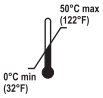
Caution Do not immerse the monitor or cable assemblies in liquid.

Symbols

These symbols appear in this user guide.

	WARNING Warning statements in this user guide identify conditions or practices that could result in personal injury.
	Caution Caution statements in this user guide identify conditions or practices that could result in damage to the equipment or other property.

The following symbols appear on the monitor, or accessories.

Symbol	Definition	Symbol	Definition
	Potential equalization (earth ground)		CF symbol. This monitor is classified safe for internal and external use. However, it is only defibrillation protected when used with the original Welch Allyn patient cable!
	The monitor can be recycled.		Recycle the monitor and battery separately from other waste. Refer to www.welchallyn.com/weee for collection point and additional information.
CE 0123	Notified body of the CE certification (TÜV P.S.).		Note accompanying documents.
	Altitude limits		Humidity limits
	Keep away from sunlight		Stacking limit
	Temperature limits		Keep away from rain
	This way up		Fragile
	CO_2 in		CO_2 out
	Temperature		NIBP

The following symbols appear on the screen.

Symbol	Definition	Symbol	Definition
	Alarm off		Patient mode symbols; neonate, pediatric, adult
	Acuity connected		Acuity not connected

Additional terms

Implied authorization

Possession or purchase of this monitor does not convey any express or implied license to use the monitor with replacement parts which would alone, or in combination with this monitor, fall within the scope of one or more patents relating to this monitor.

Terms of warranty

Your monitor is warranted against defects in material and manufacture for the duration of one year (from date of purchase). Excluded from this guarantee is damage caused by an accident or as a result of improper handling. The warranty entitles free replacement and labor of the defective part. Any liability for subsequent damage is excluded. The warranty is void if unauthorized or unqualified persons attempt to make repairs.

In case of a defect, send the apparatus to your dealer or an authorized Welch Allyn service center. The manufacturer can only be held responsible for the safety, reliability, and performance of the apparatus if:

- assembly operations, extensions, readjustments, modifications, or repairs are carried out by persons authorized by the manufacturer.
- the monitor and approved attached equipment is used in accordance with the manufacturer's instructions.

Note There are no express or implied warranties which extend beyond the warranties hereinabove set forth. Welch Allyn makes no warranty of merchantability or fitness for a particular purpose with respect to the product or parts thereof.

Note This equipment has been tested and found to comply with the limits for a class A digital device, pursuant to both Part 15 of the FCC (Federal Communications Commission) rules and the radio interference regulations of the Canadian Department of Communications. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with this instruction user guide, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

WHEN USED IN CANADA: To prevent radio interference to the licensed service, this device is intended to be operated indoors and away from windows to provide maximum shielding. Equipment (or its transmit antenna) that is installed outdoors is subject to licensing.

2 Introduction

The monitor is designed for adult, pediatric and neonatal use. It has a 15-inch screen for comprehensive vital data monitoring. The monitor can be used with mains power (100 – 240 VAC) or with an internal battery.

Standard features

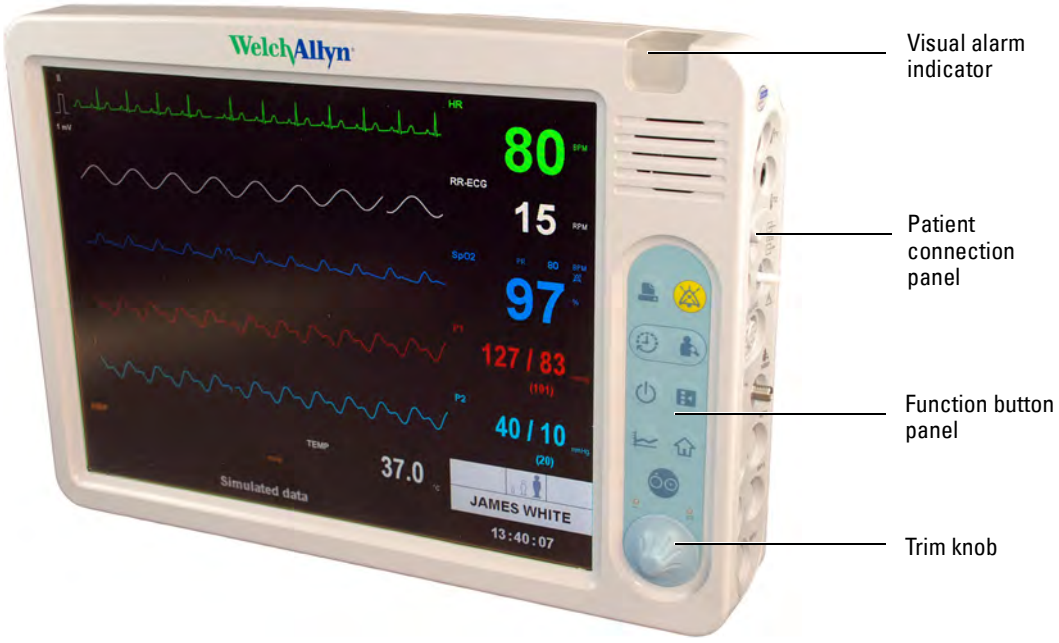
- Function buttons and trim knob for easy operation
- 15-inch color screen
- Measuring results and trends can be printed automatically or manually
- Vital parameters such as:
  - ECG (3, 5 or 12 lead)
  - Heart rate
  - Respiration
  - SpO_2
  - Invasive blood pressure
  - Temperature
  - Non Invasive Blood Pressure

Options

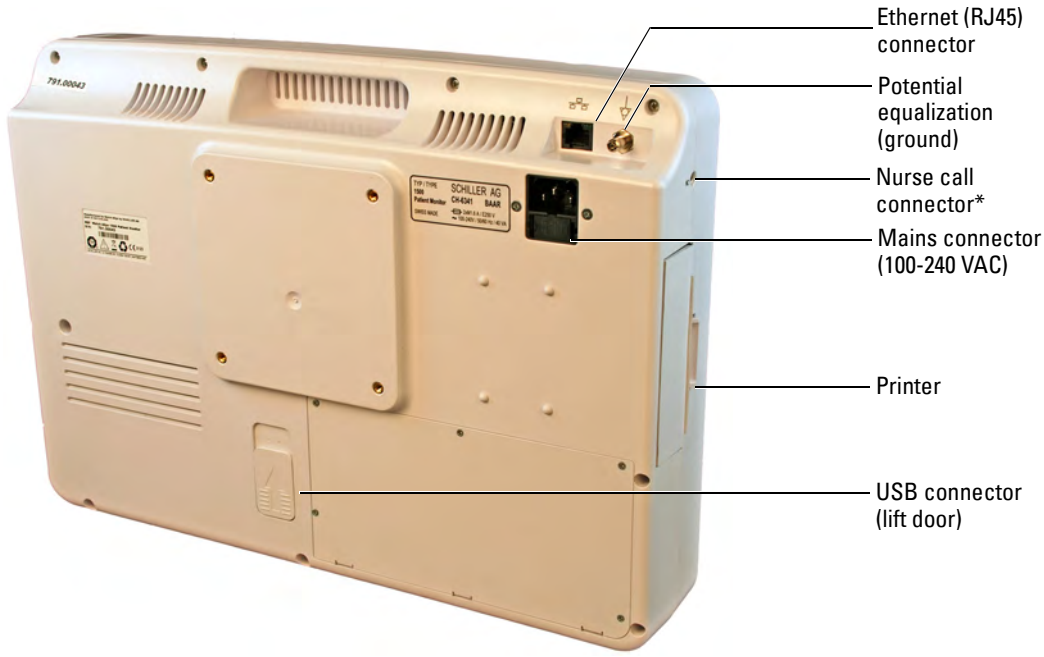
- Printer
- $etCO_2$
- Central Station via Ethernet (Welch Allyn Acuity)
- Resting ECG with interpretation
- Resting ECG with interpretation and measurements
- Arrhythmia analysis
- ST analysis

The Welch Allyn® 1500 Patient Monitor

Front panel

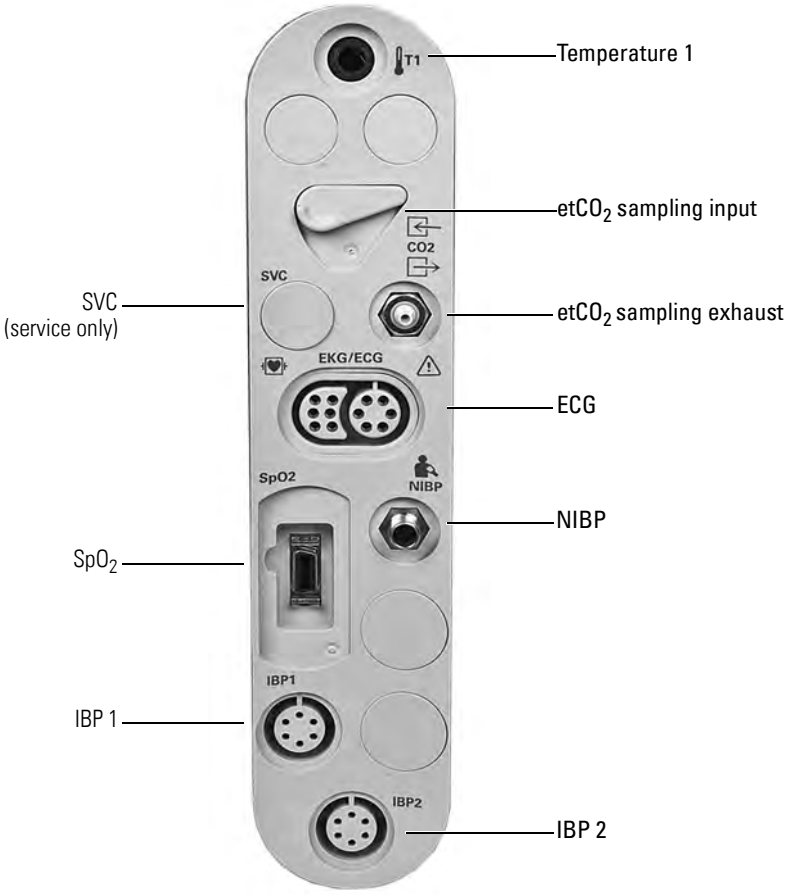


Back panel



*The nurse call can be used to give an external indication of a parameter alarm.

Connection panel



Note The connection panel layout will vary according to the options installed.

Patient connection panel options

Two connection panels for the monitor are available depending on the options specified. The panels are as follows:

	SpO_2 (Nellcor)	NIBP	IBP (x2)	ECG	Temp	CO_2 (Oridion)
Panel 1	•	•	•	•	•	
Panel 2	•	•	•	•	•	•

Function buttons

Print
Printout of three waveforms and all parameters. The waveforms and print settings are defined in the Printer menu (see "Recorder" on page 75). Note that an auto printout can also be obtained when a limit is violated. This is also defined in system setup.

Alarm silence
Silence Icon of an audible alarm or confirmation of displayed messages. The silence icon time is defined in the Setup/Administrator menu (see "General and alarm settings" on page 74).

NIBP measurement interval
Interval setup for non-invasive blood pressure measurement or switch-off of the interval measurement (see "Automatic blood pressure measurement" on page 47). Saves patient data.

NIBP measurement
Start or stop of the non-invasive blood pressure measurement (see "Start a single NIBP measurement" on page 47).

Standby
In standby mode patient monitoring is interrupted and the screen is blank. Monitoring is resumed when any button is pressed.
Note when the monitor is connected to Acuity, different options are given.

Setup
Display of the Setup menu. The required menu item can be selected by turning the trim knob and pressing. Saves patient data.

Trend
Displays trend data (see "Trend data" on page 21). Saves patient data.

Home
Pressing this button closes opened dialogues and returns to the monitoring screen.
Any settings that were changed in the opened dialogue screen are saved.
Pressing this button is the same as selecting OK on the opened dialogue screen.

ON/OFF
Press to switch the monitor on.
Press and hold for 4 seconds to switch the monitor off.
The LEDs below this button indicate:

- Left LED - mains power is connected to the monitor.
- Right LED - mains connected to the monitor and internal battery being charged.

Trim knob
The trim knob is used for navigation, value selection and value change. Use as follows:

1. Turn the trim knob to the left or right to select a field or value. A white frame appears around the field.
2. Press the trim knob to open the menu of the selected parameter field or value.
3. Turning the trim knob to the left or right to select the desired value.
4. Press the trim knob to apply the changed value.

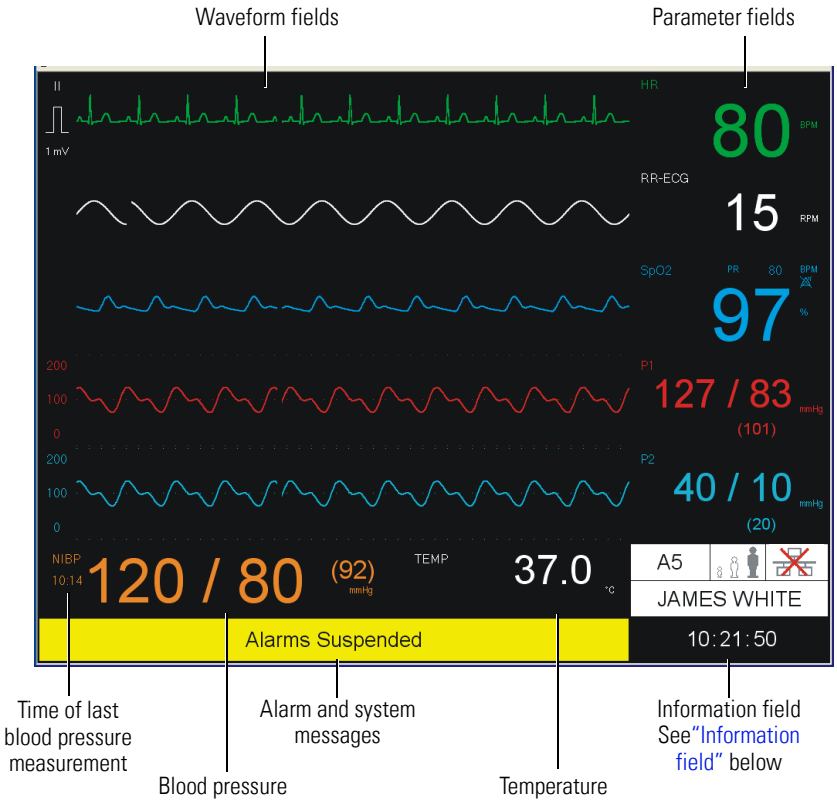
Setup menu overview

Press to enter the Setup menu and adjust the following settings and options:

Parameter	Settings/Submenus
Alarm Suspend	Silences all alarms for a set period. The silence time is defined in the Administrator menu (alarms).
Arrhythmia[1]	Arrhythmia limits and alarm levels. Pacer Display and analysis (on/off).
Alarms	Alarm overview. All alarm limits and Print on Alarm settings.
Speaker Volume	Speaker volume.
HR/PR Tone Volume	Heart beat volume.
Waveforms	Defines the wave forms to be displayed and the size and sweep speed.
Recorder[2]	Defines the data on the printout.
Parameters	Enable/disable $ETCO_2$ and invasive blood pressure.
12-lead Resting ECG[3]	View electrode status, and take a resting ECG. After the resting ECG has been taken, the option to obtain a printout is given.
Patient Information[4]	Enter/edit patient ID and patient data.
Patient Mode	Adult/Pediatric/Neonatal.
Restore User Defaults	Reset all setting to user defaults (see next entry).
Administrator	**Configuration** Display of monitor ID, network settings, options, etc. This is for information only. **Alarms** Alarm settings - silence time, suspend time, etc. This requires a password to enter (see "Settings" on page 73). **System** Time date settings, volume, units (cm/in, kg/lb), etc. and also the event log and CO_2 calibration timer. This screen requires a password to enter (see "Settings" on page 73). **Communications, Service and Factory** These menu options are for service and factory personnel and can only be accessed by password only. Details are given in the service handbook.
Close	Exits the setup menu.

1. The arrhythmia option is only viewable when the arrhythmia option is installed.
2. The recorder option is only viewable when the printer is installed
3. The 12-lead resting ECG option is only viewable when the resting ECG option is installed
4. The patient Information menu option is not available when an Acuity enabled monitor is not connected to Acuity.

Display overview



Information field

Top line

The left box displays the patient's room number (entered in the patient data screen). If the monitor is connected to the Acuity, the room number is taken from Acuity.

The middle box displays the patient mode (Neonatal, Pediatric, or Adult) indicated by the highlighted icon.

The right box indicates the monitor's network connection:

Connected to Acuity.

Acuity enabled but no connection.

When the Acuity option is not installed, this box remains blank.

Middle line

Displays the patient name. If the monitor is connected to the Acuity, the patient name is taken from Acuity.

Bottom line

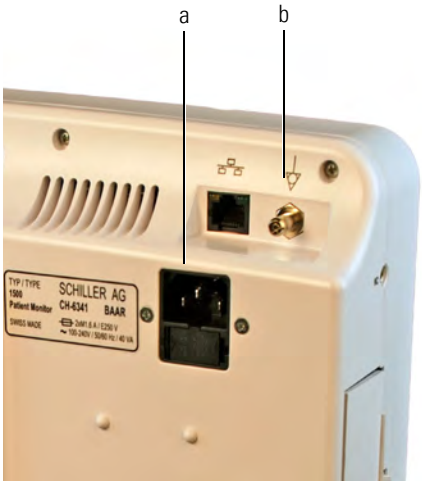
Displays the current time. When mains is not connected a battery symbol is also displayed to the left of the time see "Battery operation" on page 17.

3 Operation

Startup and initial preparation

WARNING Danger of electrical shock. Do not operate the monitor if the ground connection is suspect or if the mains lead is damaged or suspected of being damaged.

Connect and power up



1. Connect the mains cable to the rear of the monitor **(a).**
2. Connect the potential equalization (ground) cable to the central potential equalization lug **(b)**.
3. Press the **On/Off** button (confirmed by a beep).
4. Confirm the **New Patient** dialogue with Yes or No.
   - Yes: Previous patient data is deleted. The patient data can be entered via the setup menu (Setup > Patient data) see "Patient information" on page 76.
   - No: Previous patient data, if any, is used.
5. Check the settings.

Caution Ensure that the patient or any person with simultaneous patient contact does not come in contact with conductive parts of any connectors including the RJ45 connector and the USB connector when the cover is opened.

Turn the monitor on or off

To turn the monitor on, press the **On/Off** button .

To turn the monitor off, press the **On/Off** button for approximately 4 seconds. The following message is displayed when the monitor is shutting down.

Monitor is shutting down

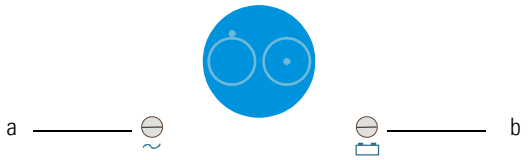
please wait.

Power supply

Mains connected

When the mains supply is connected, the mains LED is illuminated (**a**). When the mains supply is connected, and the battery is recharging both mains LED (a) and the battery LED (**b**) are illuminated.

For battery recharging see "Recharging the battery" on page 63.



Mains interrupted

Note If the mains supply is interrupted, the monitor automatically switches over to battery operation. The user settings are maintained.

Disconnect from the mains

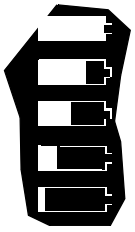
To isolate the monitor from the mains, disconnect the mains cable.

Battery operation

Two batteries are available for the monitor:

- Lithium-Ion battery. This type of battery will provide power for approximately two hours when fully charged.
- Lead acid battery: This type of battery will provide power for approximately one hour when fully charged.

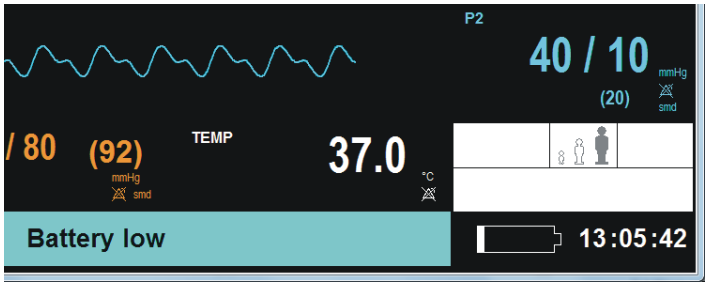
When running on battery power the battery symbol is displayed next to the time. The battery indicator gives an approximate guide to the capacity of the battery:



- Full = between 87.5% and 100% capacity.
- 3/4 full = between 62.5% and 87.5% capacity.
- Half full = between 37.5% and 62.5% capacity.
- 1/4 full = between 12.5% and 37.5% capacity
- Empty = between 0% and 12.5% capacity.

When the battery capacity is close to depletion:

- the alarm message **Battery low** appears
- the battery symbol flashes



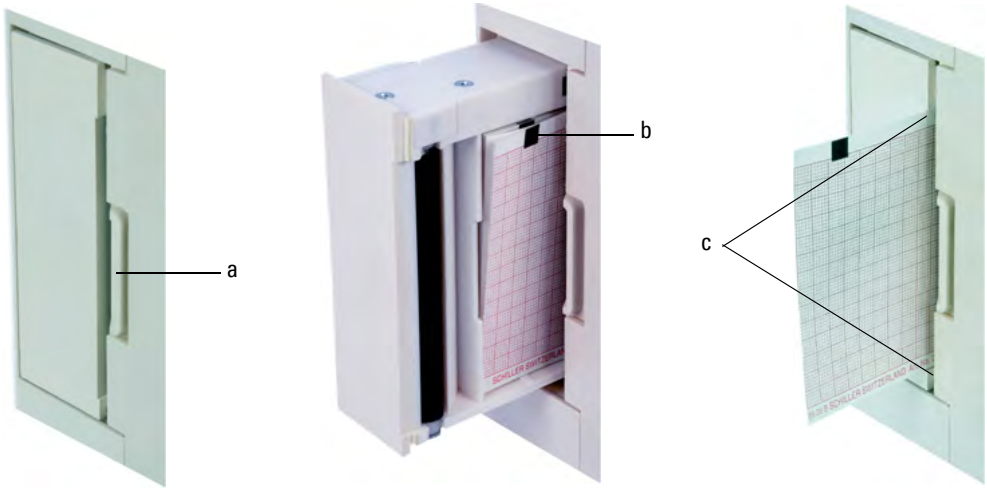
- an audible alarm beep is heard
- the visual alarm indicator flashes blue

- After a few minutes if the monitor is not connected to the mains supply, the message **Battery nearly depleted** is displayed and a continuous beep is heard; the monitor switches off. If mains is connected during this period the monitor remains on.

Connect the monitor to the mains supply. For battery recharging see "Recharging the battery" on page 63.

Inserting recorder paper

Note The monitor is delivered without printing paper installed. Only use original Welch Allyn printing paper. The thermal paper is sensitive to heat, humidity, and chemical vapors. Store the paper in a cool, dry and chemical free area.



1. Pull the locking catch **(a)** to the front. The paper tray is unlocked.
2. Pull the paper tray out.
3. Insert paper and pull the beginning of the paper out. Make sure that the paper mark **(b)** is facing to the top.
4. Reinsert and close the tray. Be sure that the paper lies exactly between the rails **(c)**.

Initial settings

Caution Only authorized personnel, trained in the operation of this monitor, are qualified to do the setups in the following menu.

1. Press the **Setup** button .
2. Use the trim knob to enter password (the clinical password for the Alarm and the system sub-menus is **49, 48, 46**, see "Administrator" on page 77)
3. Select parameters and change values. Press to confirm the setting.
4. The general alarm settings including silence time, and alarm delay time are given in the menu:

Administrator > Alarm

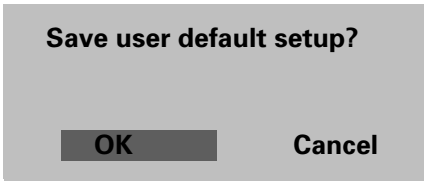
The general settings including height and weight units, time and date, and the setting to connect to Acuity are given in the menu:

Administrator > System

Note Details of the settings in the Administrator menu and the passwords are given in the settings section (see "Administrator" on page 77).

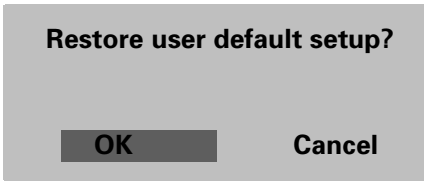
Saving the user-defined settings as default

All monitor settings, including alarms settings, are remembered until the monitor is switched off. To save the user defined settings as default, select **Administrator > System > Save U**ser Defaults. You are prompted to confirm:



Restoring the user settings

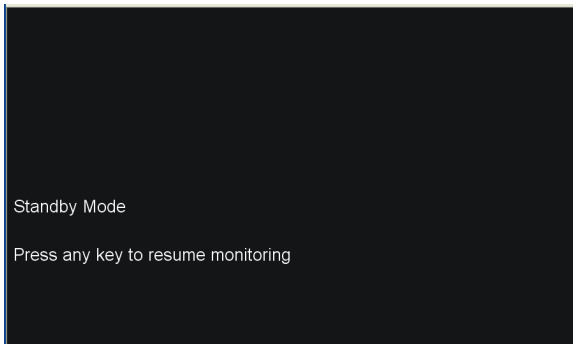
1. Press the **Setup** button .
2. Select **Restore User Defaults.** You are prompted to confirm:



Standby mode

This mode is selected to temporarily interrupt the monitoring of the patient until ready to resume. All patient data is saved.

When the **Standby** button is pressed, the following screen is displayed:



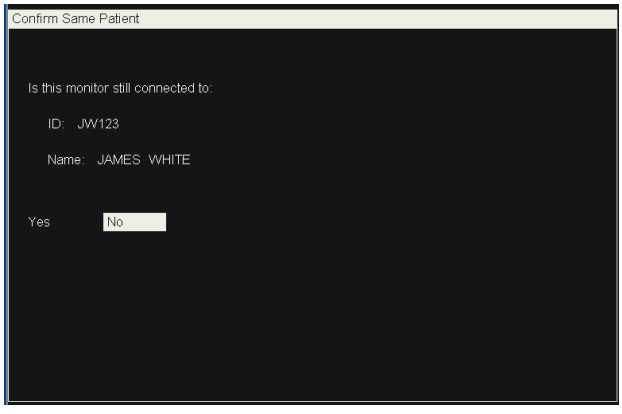
Note If a patient has not been confirmed, all patient data is lost when standby mode is entered.

Note When the monitor is connected to Acuity, different options are given.

- The message **Standby Mode - Press any key to resume monitoring** is displayed on the monitor until any button is pressed.

WARNING In standby mode, vital signs data and alarms are no longer displayed or collected.

You are prompted to confirm the same patient:



If no is selected, patient data is deleted.

Note After exiting standby mode, ensure that the NIBP intervals are re-armed by manually starting an NIBP measurement.

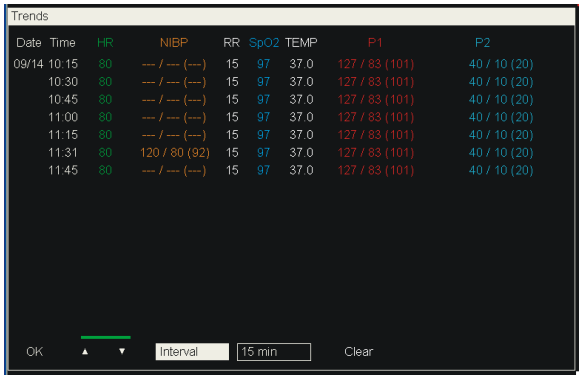
Trend data

The measured values are entered in the set intervals and additionally after every manual NIBP measurement. The monitor can store 24 hours of trends at 1-minute intervals.

- Trend data is deleted when a new patient is entered.
- When the memory is full, the oldest trend data is overwritten.
- The display interval for the table can be selected using the **Trend** button .
- 1 minute, 5 minute, 15 minute, 1 hour, and 4 hour intervals can be selected.

Displaying trend data

Press the **Trend** button .



- Previous measurements are displayed using the up/down icons.
- Use the trim knob to select the trend display interval with the pull down menu in the **Interval** setting.
- The **Clear** option deletes all trend data.
- The **Print** option prints all displayed trend data.

Defining display waveforms

Note Only ECG leads are available for waveform 1.

1. Press the **Setup** button .
2. Select **Waveforms**.

3. The waveforms 1 through 5 are configured through the pull-down menus.
4. Set the amplitude for each waveform according to preference and signal strength. Set the sweep speed (for all waveforms) according to preference and patient.

Note The RESP and CO_2 sweep speed values are not configurable.

5. Select **OK** to save.

Settings via a parameter field

1. Select the desired parameter measurement field using the **trim knob**. A white frame appears around the selected field.
2. **Press the trim knob to display the menu**. The following example is displayed when the Heart Rate settings screen is selected. Other setting screens are similar:

3. See "Saving the user-defined settings as default" on page 19 to save the settings as your user defaults.

4 Alarms

Display of alarms

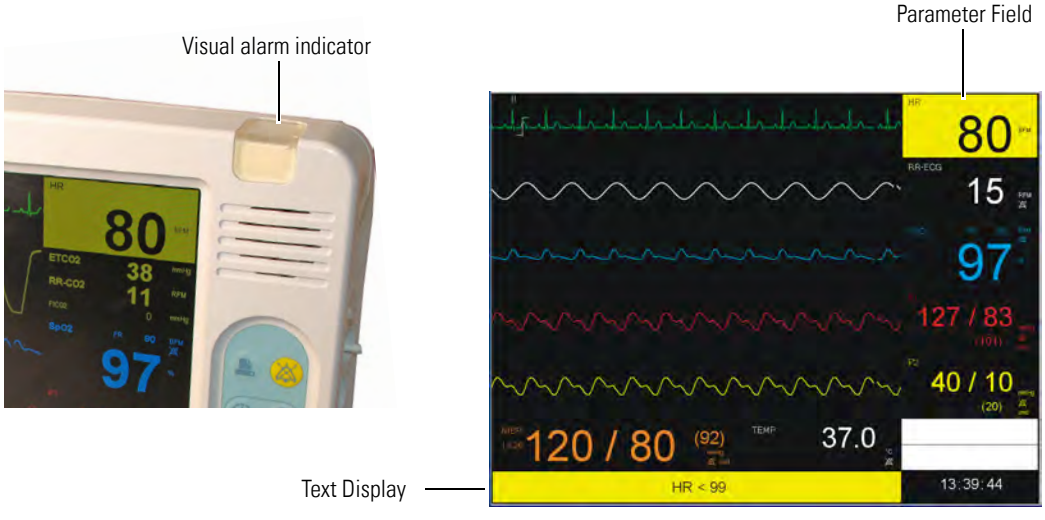
During initial powerup

No alarms are displayed if no patient is being monitored.

During monitoring

There are three alarm priorities:

Alarm type	Priority	LED visual alarm indicator	Audible signal	Display
Technical	Low	Blue	Single deep tone every 2 seconds	Text display in the alarm status field at the bottom.
Parameter	Medium	Yellow (flashes with parameter field)	Two tone high/low every second.	Text display in the alarm status field at the bottom.
				Yellow flashing parameter field.
Parameter	High	Red (flashes with parameter field)	Three high tones every second.	Text display in the alarm status field at the bottom
				Red flashing parameter field.
Lethal	High	Red (flashes with parameter field)	Three high tones every second.	Text display in the alarm status field at the bottom
				Red flashing parameter field.



Silencing an alarm

Acknowledging an alarm

Alarm Limit

Press the Alarm Silence button . The audible alarm is silenced for 1, 1.5 or 2 minutes. The visual parameter alarm continues to be displayed.

After the defined silence time, the audible alarm is reactivated. The silence time is defined in **Setup > Setup Administrator> Alarms > Alarm Silence Time** (see "Administrator" on page 77).

Technical Alarm

A technical alarm can be acknowledged by pressing the **Alarm Silence** button . This alarm is not reactivated.

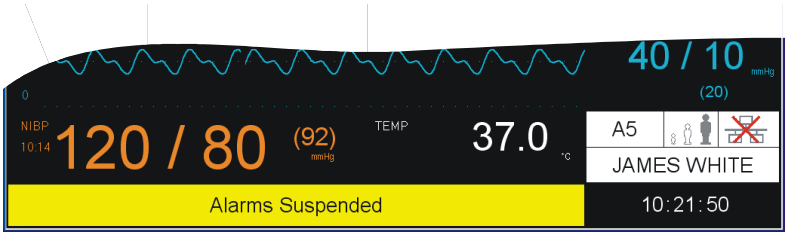
Suspend all alarms

The Alarm suspend is used to deactivate all alarms caused by for example, disconnecting patient cables, loose electrodes or relocation of the patient. The alarm is suspended for a duration of 1, 1.5, or 2 minutes. During this time the message **Alarms Suspended** is displayed.

The alarm suspension time is defined in the menu **Setup > Administrator> Alarms > Alarm Suspend Time** (see "Administrator" on page 77).

1. Press the **Setup** button .
2. Select **Alarm Suspend.**

   A message is given in the message bar indicating that the alarms have been suspended.



If you wish to reactivate the alarms before the set duration, press the **Setup** button again . The menu entry is changed to **Alarm Resume**. Select this option to reactivate.

Turning off an individual parameter alarm

WARNING The audible alarm is silenced permanently. The settings are not reset. Physiological alarms of the patient are silenced. Use this function only if disconnecting a sensor from the patient for a long period of time.

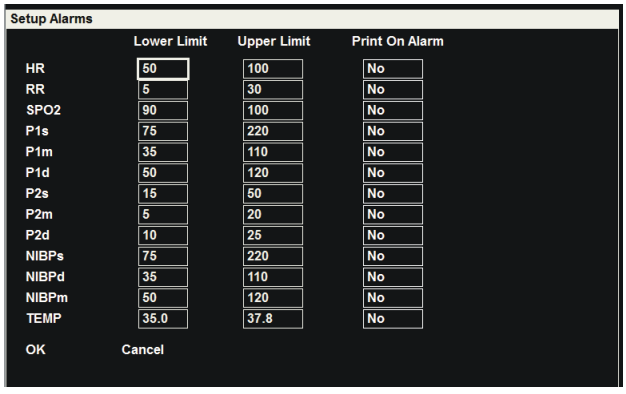
1. Individual alarms can be inhibited via the **Alarms** menu (see below) and in any parameter measurement field by using the **trim knob** to select a parameter (a white frame appears around the selected field) and pressing the **trim knob** to display the menu for that parameter.
2. Switch off an individual limits by selecting the limit setting and rotating the trim knob to the maximum limit until off is selected.
3. The alarm off symbol is displayed in the respective measurement field.

Note A setting is available in the administrator menu, that prevents the HR / PR alarm from being switched off (see "Administrator" on page 77).

Alarm limit setting

Note All alarm limits are reset to the default system settings after confirming a new patient, if they have not been stored as user defaults (see "Saving the user-defined settings as default" on page 19).

1. Press the Setup button **.**
2. Select the menu item **Alarms.**
3. Use the trim knob to scroll through the alarm settings and select the limits.



Note The Alarm settings for arrhythmia are detailed in the Arrhythmia menu option in the setup menu.

Physiological Alarms

Alarm abbreviation	Description	Priority
SpO_2 low/high	Oxygen saturation of the blood	Medium
PP low/high	Peripheral pulse of SpO_2	Medium
RRECG low/high	Respiration rate impedance	Medium
Apnea limit	Apnea time limit exceeded	Medium
CO_2 low/high	Inspiratory CO_2	Medium
$RRCO_2$ low/high	Capnographic respiration rate	Medium
$etCO_2$ low/high	End-tidal expiratory CO_2	Medium
NIBPs low/high	Systolic blood pressure	Medium
NIBPm low/high	Mean average blood pressure	Medium
NIBPd low/high	Diastolic blood pressure	Medium
HR low/high	Heart rate	Medium
Pxs Art low/high	Invasive systolic blood pressure	Medium
Pxm Art low/high	Invasive mean blood pressure	Medium
Pxd low/high	Invasive diastolic blood pressure	Medium
Temp low/high	Temperature in degrees Fahrenheit or degrees centigrade.	Medium

Note All technical alarms are low priority.

5 Monitoring

Note Values are only displayed when the ECG cable or at least one sensor is connected. If a sensor is disconnected, a technical alarm is issued. The measured value will no longer be displayed if the sensor is disconnected and the alarm is acknowledged.

General

- Connect the ECG electrodes, the NIBP cuff, the SpO_2 sensor, the CO_2 sensor and the temperature sensor to the patient as required.
- As soon as the sensors are connected the corresponding indication appears on the display.
- Check or set the alarm limits (see "Alarms" on page 23).

Note This section gives a general overview of the parameters that can be measured with the monitor. It is aimed at medical professionals only, and no specific medical direction is given or implied; any instructions given here do not overrule local medical directives.

The individual parameter menu settings are selected with the trim knob, described previously (see "Settings via a parameter field" on page 22)

ECG

WARNING In order to minimize interference and the danger of burns to the patient, only use Welch Allyn ECG cables. Keep the ECG cable as far away as possible from any electrosurgical cables. Make sure that the electrosurgical return conductor (neutral) is properly attached to the patient and that a good contact is made.

Patient preparation

Caution The guidelines in this section are given as an overview only. They are not a substitute for, nor do they overrule manufacturers documentation and instructions or departmental procedures.

The quality of the ECG trace is dependent on the degree of contact resistance between the electrode and the skin. To ensure the lowest resistance, the following points must be observed:

1. Shave the areas where the electrodes are to be placed.
2. Use alcohol to thoroughly clean the areas where the electrodes are to be placed.
3. When applying the electrodes, make sure that there is a layer of gel between the electrode and the skin.

Note To maintain the quality of signals during long-term monitoring, the electrodes should be replaced at least every 48 hours. Over longer periods, the electrode gel may dry out and the patient's skin can be irritated by the gel or adhesive. When replacing electrodes, do not position the new electrodes on exactly the same locations but a little to the side of the original positions.

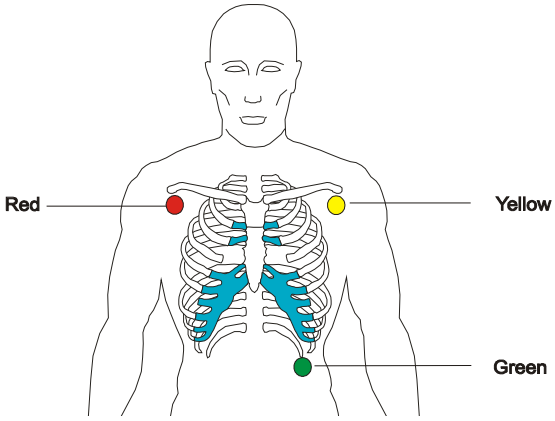
Connecting the ECG patient cable

Note

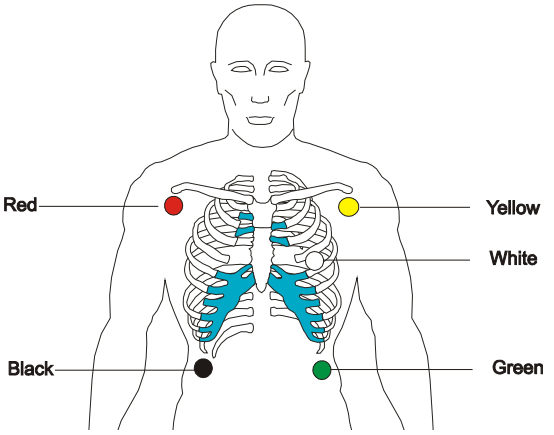
- When an electrode falls off or the resistance of an electrode is too high, a lead-off indication is displayed and an audible alarm is issued.
- Color code: the colors shown here are according to IEC requirements. The AHA color configuration is shown in "Electrode identification and color code IEC/AHA" on page 31.

WARNING Danger of destroying the monitor during defibrillation! The monitor is type CF protected only when the original Welch Allyn patient cables are used.

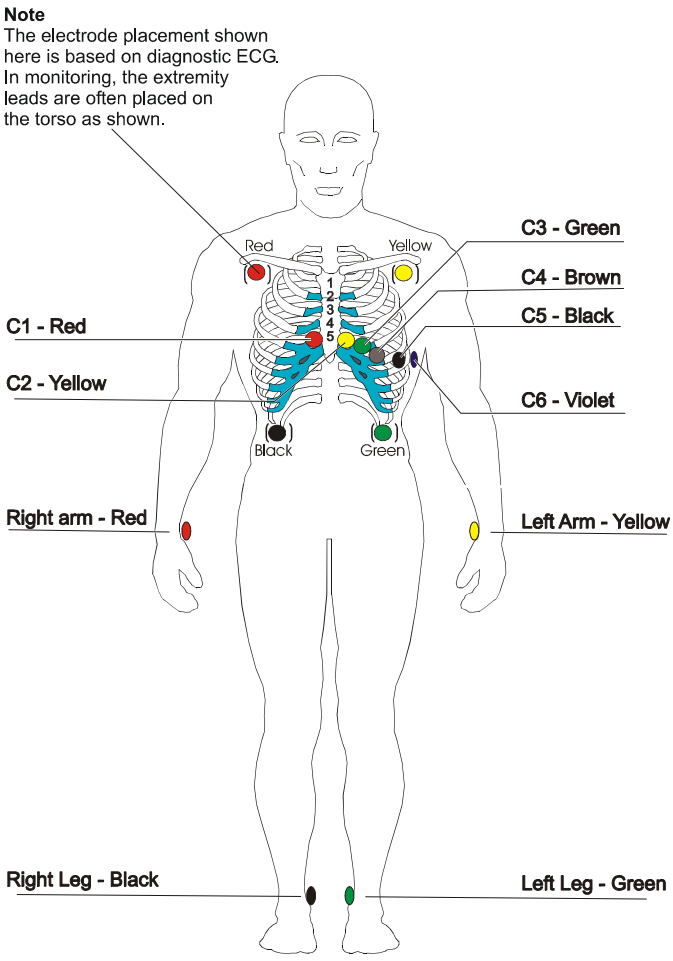
3-lead



5-lead



12-lead



Note This graphic shows the IEC color configuration. The AHA (U.S.) color configuration is shown in "Electrode identification and color code IEC/AHA" on page 31.

Electrode identification and color code IEC/AHA

The electrode placements shown in this manual are labelled with the colors according to IEC requirements. The equivalent AHA colors are given below.

	IEC (Europe)		AHA (U.S.)	
System	Electrode identifier	Color	Electrode identifier	Color
Limb	R	Red	RA (right arm)	White
	L	Yellow	LA (left arm)	Black
	F	Green	LL (left leg)	Red
Chest	C1	White/Red	V1	Brown/Red
	C2	White/Yellow	V2	Brown/Yellow
	C3	White/Green	V3	Brown/Green
	C4	White/Brown	V4	Brown/Blue
	C5	White/Black	V5	Brown/Orange
	C6	White/Violet	V6	Brown/Violet
Neutral	N	Black	RL (right leg)	Green

Pacemaker monitoring

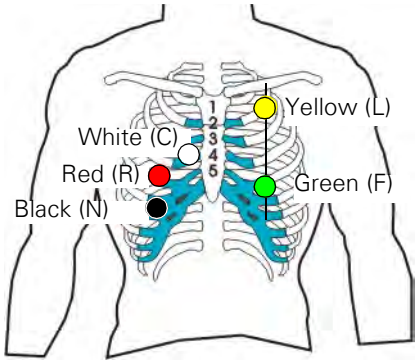
WARNING Patients with a pacemaker must be observed continuously because the heart rate from the pacemaker might still be registered in case of a cardiac arrest or some arrhythmias. See specification "Technical data" on page 87 for disclosure of the pacemaker pulse rejection capability of this monitor.

WARNING Pacemaker monitoring is not possible with ECG cables that have unshielded lead wires. Ensure that only shielded lead wire ECG cables are used when monitoring patients that have a pacemaker.

WARNING Welch Allyn recommends to apply an SpO_2 sensor in addition to the ECG measurement and to set the alarm range for the peripheral pulse (PP) in the range of the heart rate (HR), or to set the HR source in the SpO_2 menu to SpO_2 (see "SpO_2 settings" on page 52.)

3- and 5-lead cables for pacemaker patients

The following illustration shows the electrode placement with a 5-lead patient cable for optimum results for patients with an implanted pacemaker.



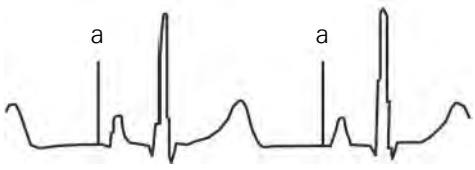
With a 3-lead patient cable, only R, L and F are connected.

IEC	AHA
Black (N)	Green (RL)
Red (R)	White (RA)
Yellow (L)	Black (LA)
Green (F)	Red (LL)
White (C)	Brown (V)

Activating the pacer display

1. Select the HR measurement field using the trim knob. A white frame appears around the measurement field.
2. Press the trim knob to display the menu.
3. Scroll down to the pacer display option and select yes.

Pacemaker spikes are presented as vertical lines (a) on the ECG trace. These vertical lines represent neither magnitude nor duration of the pacemaker pulse but are purely time relative.



Note The Analyze Pacer setting is not applicable.

ECG display

A maximum of five leads can be displayed on the monitor. ECG 1, 2 and 3 are the ECG waveforms set up in the Waveform Display menu. See "Defining display waveforms" on page 22.

1. Press the **Setup** button .
2. Select **Waveforms.**

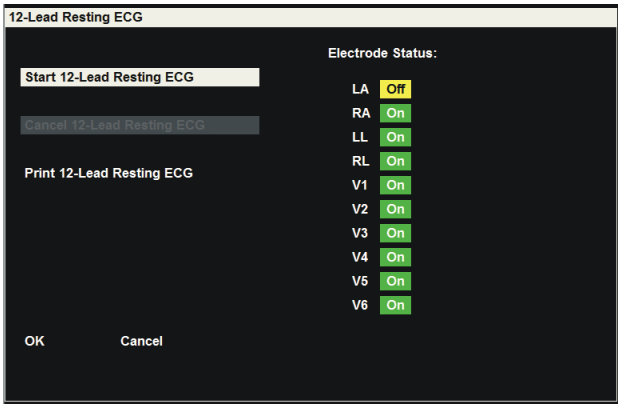
12-lead resting ECG (option)

With this option it is possible to record a 12-lead resting ECG. One resting ECG can be stored at a time. The resting ECG cannot be viewed on the monitor but can be exported to Acuity and can be printed on the internal printer at any time.

Note The 12-lead resting ECG is an option and only appears when enabled.

Taking a resting ECG

1. Press the **Setup** button .
2. Select **12-lead ECG.**



3. Check electrode status. Ensure the green On is displayed for all electrodes - this indicates that the electrode resistance is within acceptable range to obtain a valid reading.
4. Select **Start 12-lead Resting ECG**. The message **Rest ECG Analysis - in Progress** is displayed while the resting ECG is being taken. This is followed by **Rest ECG - Complete.**
5. The resting ECG remains in memory until a new patient is defined or the ECG is overwritten with a new recording.

ECG menu settings

Note The parameter settings are selected with the trim knob. (See "Settings via a parameter field" on page 22).

The default settings are in bold.

Main menu	Parameter	Description
Setup HR	ECG Lead	Lead selection I, **II**, III, V, AVL, AVR, AVF
	Size	2.5, 5, **10**, 20 mm/mV
	HR/PR source[1]	**ECG**, SpO_2, P1 ART
	HR/PR Tone[1]	Off/ on[2]
	ECG Filter	Select Diagnostic or **Monitor** Two predefined filter settings can be selected. These defined filter options define the cut off frequency for the Myogram, Baseline and Mains filters. The filter definitions and the corresponding filter cut-offs are defined as follows:

	Baseline	Myogram	Mains
Diagnostic	0.05 Hz	150 Hz	as set
Monitor	**0.50**	**35 Hz**	as set

Single ECG	Yes/**No**, select lead **I**, II, III, or V. Select this option to analyze one ECG lead.
Pacer Display	Yes/No displays pacer pulses relative to time but not representative of either amplitude, duration or polarity.
Analyzer Pacer	Yes/No - not applicable.
HR lower limit	25 - 118 (**50**)
HR upper limit	52 - 250 (**120**)
Cal	Generates a simulated 1 mV calibration impulse on the curve.

1. This can also be set in the Setup SpO_2 menu.
2. If SpO_2 is selected, the pitch of the beep corresponds to the SpO_2 saturation. A high pitched beep indicates a high saturation.

Note A setting is available in the administrator menu, that prevents the HR / PR alarm (upper / lower limit) from being switched off (see "Administrator" on page 77).

ECG alarms

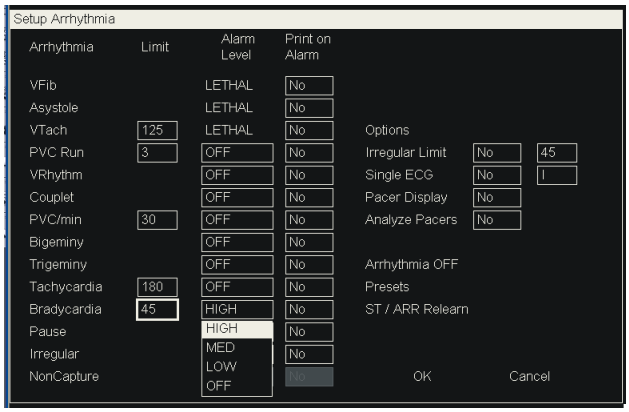
Alarm	Cause	Remedy
HR – asystole/ASY	No QRS detected for 4 seconds	Check the patient ECG signal lower than 0.5 mV
HR – ventricular fibrillation/VF	No organized ventricular rhythm detected	Check the patient ECG signal lower than 0.5 mV
HR – artifact	Patient has moved	Calm the patient
	Bad electrode	Checking the electrode pads
	Interferences by other devices	Remove source of the interference
HR > [upper limit] HR < [lower limit]	Heart rate higher/lower than alarm limit	Check the patient
HR – lead off	Electrode lose/defective	Check and reapply/replace electrodes
	Patient cable defective	Replace the patient cable

Arrhythmia

Arrhythmia settings

Note The arrhythmia menu entry is only displayed when the full arrhythmia option is enabled.

1. Press the Setup button .
2. Select Arrhythmia.



The default settings are in bold.

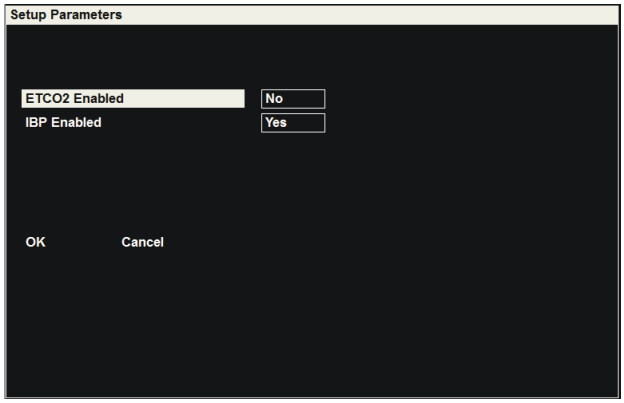
Main menu	Parameter	Description
Setup Arrhythmia	VFib	Alarm Level - Lethal (cannot be changed), Print on alarm Yes/**No**
	Asystol	Alarm Level - Lethal (cannot be changed), Print on alarm Yes/**No**
	VTach	VTach Limit 100 to 200 (**125**), Alarm Level - Lethal (cannot be changed), Print on alarm Yes/**No**
	PVC run	PVC run 3 to 6 (3) Alarm Level (High, Medium, Low, **Off**), Print on alarm Yes/**No**
	VRyhthm	Alarm Level (High, Medium, Low, **Off**), Print on alarm Yes/**No**
	Couplet	Alarm Level (High, Medium, Low, Off), Print on alarm Yes/**No**
	PVC/min	PVC/min 1to 30 (**30**) Alarm Level (High, Medium, Low, **Off**), Print on alarm Yes/**No**
	Bigeminy	Alarm Level (High, Medium, Low, **Off**), Print on alarm Yes/**No**
	Trigeminy	Alarm Level (High, Medium, Low, **Off**), Print on alarm Yes/**No**
	Tachycardia	Tachycardia 150 to 250 (**180**) Alarm Level (High, Medium, Low, **Off**), Print on alarm Yes/**No**
	Bradycardia	Bradycardia 20 to 100 (**45**) Alarm Level (High, Medium, Low, Off), Print on alarm Yes/No

Setup Arrhythmia	Pause	Alarm Level (High, Medium, Low, Off), Print on alarm Yes/**No**
	Irregular (irregular rhythm)	Alarm Level (High, Medium, Low, **Off**), Print on alarm Yes/**No**. This is an irregularity in the R to R interval over a series of at least 16 non-ventricular beats. The number of beats analyzed is given in options.
	Non-capture (pacemaker non-capture)	Alarm Level (High, Medium, Low, **Off**), Print on alarm Yes/**No**. This is for pacemaker patients with the analyze pacers option enabled (see options below) - a beat does not directly follow a pacer.
Options	Irregular Limit	Yes/**No**, set limit between 45 and 120 (**45**)
	Single ECG	Yes/**No**, select lead **I**, II, III, or V. Select this option to analyze one ECG lead.
	Pacer Display	Yes/**No** displays pacer pulses relative to time but not representative of either amplitude, duration or polarity.
	Analyze Pacers	Yes/No - not applicable
	Arrhythmia OFF	Sets all alarms to off except VFib, Asystole and VTach which remain set at the highest alarm level.
	Presets	Resets all arrhythmia settings to the factory default.
	ST / ARR Relearn	Approximately 15 - 20 complexes are used to set the parameters (duration, amplitude, etc.) for Arrhythmia analysis. Select this option to redefine the template used.

Respiration rate

The RR measurement field is not displayed if the $etCO_2$ field is active.

If the RR should be measured via the ECG instead of $etCO_2$, the $etCO_2$ measurement field must be deactivated as follows:



Press the Setup button , select Parameters and deactivate $etCO_2$ (No).

Note The RR signal is measured via the R (RA) and F (LL) electrodes of the ECG cable (impedance measurement). After the patient is connected, about 30 seconds can elapse before a reliable value is displayed.

Respiration rate settings

The parameter settings are selected with the trim knob, described previously (see "Settings via a parameter field" on page 22).

The default settings are in **bold**.

Main menu	Parameter	Description
Apnea	Apnea time	6, 10, **15**, 20, 25, 30 seconds
Setup RR	RR Upper Limit	30 to 159 (**30**)
	RR Lower Limit	2 to 29 (**5**)

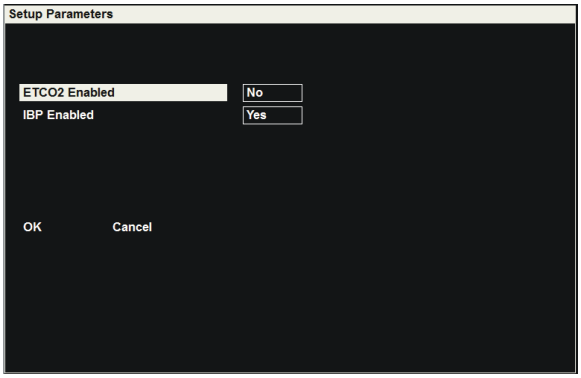
Respiration rate alarms

Alarm	Cause	Remedy
RR out of range (too high)	The patient's RR is too high for accurate measurement	Check the patient
	Electrical interferences from other devices	Remove source of the interference
	Signal disturbed due to frequent artefacts caused by bad electrode contact	Check and reapply/replace electrodes if required
RR lead off	Electrode loose/defective	Check and reapply/replace electrodes
RR artifact	Patient has moved	Calm the patient
	Interferences by other devices	Remove source of the interference
	Bad electrode	Check/replace electrodes
RR > [upper limit] RR < [lower limit]	RR AF is higher or lower than alarm limit	Check the patient

$etCO_2$ measurement

If the $etCO_2$ measurement field is not displayed it means that it is not enabled in the parameter settings.

Press the Setup button , enter the menu **Setup/Parameters** and activate $etCO_2$.



Introduction

The Oridion sensor is the only approved sensor for $etCO_2$ monitoring.

WARNING Carefully route the filter line to reduce the possibility of patient entanglement or strangulation.

WARNING The filter line may ignite in the presence of oxygen when directly exposed to laser, ESU devices, or high heat. When performing head and neck procedures involving laser, electrosurgical devices or high heat, use with caution to prevent flammability of the filter line or surrounding surgical drapes

WARNING When using a sampling line for intubated patients with a closed suction system, do not place the airway adapter between the suction catheter and endotracheal tube. This is to ensure that the airway adapter does not interfere with the functioning of the suction catheter.

WARNING Loose or damaged connections may compromise ventilation or cause an inaccurate measurement of respiratory gases. Securely connect all components and check connections for leaks according to standard clinical procedures.

WARNING Do not cut, remove any part, kink or crush the sampling line. This could lead to erroneous readings.

WARNING If too much moisture enters the sampling line (i.e., from ambient humidity or breathing of unusually humid air), and the sampling line cannot be cleared, the message Filter Line Blockage appears in the message area. Replace the sampling line once the filter line blockage message appears.

Caution In high-altitude environments, $EtCO_2$ values may be lower than values observed at sea level, as described by Dalton's law of partial pressures. When using the monitor in high altitude environments, it is advisable to consider adjusting $EtCO_2$ alarm settings accordingly.

Caution Microstream® $EtCO_2$ sampling lines are designed for single patient use, and are not to be reprocessed. Do not attempt to clean, disinfect, sterilize or flush any part of the sampling line as this can cause damage to the monitor.

Caution Dispose of sampling lines according to standard operating procedures or local regulations for the disposal of contaminated medical waste.

Caution Before use, carefully read the Microstream $EtCO_2$ sampling lines Directions for Use.

Caution Only use Microstream $EtCO_2$ sampling lines to ensure the monitor functions properly.

Caution Dispose of Microstream $EtCO_2$ sampling lines according to standard operating procedures or local regulations for the disposal of contaminated medical waste.

Caution During nebulization or suction for Intubated patients, in order to avoid moisture buildup and sampling line occlusion, remove the sampling line luer connector from the monitor.

Caution Replace the sampling line according to hospital protocol or when a blockage is indicated by the monitor. Excessive patient secretions or a build-up of liquids in the airway tubing may occlude the sampling line, requiring more frequent replacement.

Preparing the Oridion sensor

- During nebulization or suction for Intubated patients, in order to avoid moisture buildup and sampling line occlusion, remove the sampling line luer connector from the monitor
- Replace the sampling line according to hospital protocol or when a blockage is indicated by the monitor. Excessive patient secretions or a build-up of liquids in the airway tubing may occlude the sampling line, requiring more frequent replacement.
- When connecting a sampling line to the monitor, screw the sampling line connecter clockwise into the monitor CO_2 port until it can no longer be turned, to ensure that it is connected securely to the monitor. This will assure that there is no leak of gases during measurement at the connection point and that measurement accuracy is not compromised.
- When the Caution message Blockage! appears on the screen indicating that the filter line which is attached to the handheld monitor is blocked, the monitor's CO_2 pump will stop pumping the patient's breath into the monitor for testing. First disconnect and reconnect the filter line. If the message still appears, disconnect and replace the filter line. Once a working filter line is attached to the handheld monitor, the pump will automatically resume operation.

$etCO_2$ settings

The parameter settings are selected with the trim knob, described previously (see "Settings via a parameter field" on page 22).

The default settings are in **bold**.

Parameter	Description
Size	**0 to 40 mmHg**, 0 to 60mmHg, 0 to 80mmHg
Units	**mmHg**/kPa
Apnea time	**6**, 10, **15**, 20, 25, 30 seconds
$EtCO_2$ lower limit	**25 mmHg** / 3 kPa
$EtCO_2$ upper limit	**60 mmHg** / 8 kPa
RR Lower Limit	**5/min**
RR Upper Limit	**30/min**
$FiCO_2$ upper limit	**5 mmHg** / 0.7 kPa

$etCO_2$ alarms

Alarm	Cause	Remedy
$etCO_2$ > [upper limit] $etCO_2$ < [lower limit]	$etCO_2$ is higher / lower than alarm limit	Check the patient
RR > [upper limit] RR < [lower limit]	RR is higher / lower than alarm limit	Check the patient
$FiCO_2$ > [upper limit]	$FiCO_2$ has exceeded alarm limit	Check the patient and ventilator
CO_2 needs calibration (displayed when CO_2 = 0 mmHg)	CO_2 measurement reading too low due to: • Soiled airway adapter • Incorrect calibration	Change the adapter; carry out zeroing if required
		Carry out zeroing

NIBP monitoring

WARNING To prevent extensive pressure on the extremity, it is very important to:

- Choose the correct cuff size.
- Check the initial pressure in the NIBP menu. The correct initial pressure for adults is 160 mmHg, for pediatric patients 120 mmHg, and for neonates 90 mmHg.

WARNING In case of long-term monitoring or automatic operation, the connected body areas of the patient and the extremity to which the cuff is attached must be checked regularly for signs of ischaemia, purpuras and/or neuropathy.

WARNING The cuff must not be attached to a limb that is already used for interventions such as infusions or SpO_2 measurement.

WARNING To prevent incorrect measurement results, make sure that the tube is not compressed.

WARNING To achieve correct arterial pressure measurement, the cuff must always be installed on the level of the right atrium.

- Ensure that the cuff is attached to the left or right upper arm.
- Note the cuff size for the respective patient type.
- Check the initial pressure in the NIBP menu.

Note The monitor sets the maximum pressure as follows:

- Adults: 270 mmHg
- Pediatric: 180 mmHg
- Neonate: 150 mmHg

Start a single NIBP measurement

1. Press the **NIBP start/stop** button .
2. The measurement can be stopped at any time by pressing the button again.

Automatic blood pressure measurement

1. Press the **NIBP measurement interval button** **.**
2. Select the interval between 3 minutes and 60 minutes, and confirm your selection with **OK**.
3. The message **NIBP interval – xx minutes** is displayed.
4. The first measurement is started after the interval is selected or can immediately be initiated by pressing the **NIBP start/stop** button .

Note After exiting the standby mode, ensure that the NIBP intervals are re-armed by manually starting an NIBP measurement.

Note These settings are reset when the monitor is switched off and automatic measurement must again be defined when the monitor is switched on.

NIBP settings

The parameter settings are selected with the trim knob, described previously (see "Settings via a parameter field" on page 22).

The default settings are in **bold**.

Parameter	Description
NIBP Interval	**Off**, 3, 5, 10, 15, 30, 60, 120
Format	**Sys/Dia** or Mean. This defines the main measurement to be displayed, that is the larger measurement displayed in the NIBP box. The secondary measurement is displayed smaller by the side of the defined measurement. Note that the mean measurement is shown in brackets. 
Initial Inflation Pressure	Adult: **160** Pediatric: **120** Neonate: **90**
NIBPs (systolic blood pressure) upper/lower limit	Adult **220/75** Pediatric: **145/75** Neonate: **100/50**
NIBPd (diastolic blood pressure) upper/lower limit	Adult **110/35** Pediatric: **100/35** Neonate: **70/30**
NIBPm (mean pressure) upper/ lower limit	Adult **120/50** Pediatric: **110/50** Neonate: **80/35**

NIBP alarms

Alarm	Cause	Remedy
NIBP needs service	No NIBP module detected	Switch off and restart
		Replace monitor
NIBP artifact cannot measure	Patient has moved	Calm the patient
	Max. required pressure is higher than the initial pressure of 160 mmHg.[1]	Repeat measurement. The monitor will automatically increase the initial pressure.
Cannot measure NIBP	Patient has moved	Check and calm patient
	Very unsteady pulse	Apply cuff to another extremity with less movement or more steady pulse
	Air tube plugged or leaking	Check tube and cuff
NIBP cuff leak	No cuff connected, or cuff or insufficiently fitted or defective	Check cuff position.
		Check cuff for tightness.
		Check if the cuff is connected to the monitor.
NIBP signal low	Blocked tube; kink in the tube	Check and replace the tube if required.
	Cuff not applied correctly	Reposition/check the cuff.
	Pulse too low for good measurement	Apply the cuff to another extremity where the pulse measurement is easier.
NIBP time too long	Inflation time exceeded (max. 135 sec.) due to interferences because the patient has moved	Check the patient (see also message "cannot measure").
		Repeat the measurement.
NIBPs < [lower limit]	Systolic pressure too low	Check the patient and alarm limits.
NIBPs > [upper limit]	Systolic pressure too high	Check the patient and alarm limits.
NIBPd < [lower limit]	Diastolic pressure too low	Check the patient and alarm limits.
NIBPd > [upper limit]	Diastolic pressure too high	Check the patient and alarm limits.
NIBPm < [lower limit]	Mean pressure too low	Check the patient and alarm limits.
NIBPm > [upper limit]	Mean pressure too high	Check the patient and alarm limits.

1. If the initial pressure is too low, the measurement is immediately restarted and the pressure is increased by 60 mmHg.

SpO_2 monitoring

- Pulse oximetry enables the continuous non-invasive monitoring of the functional oxygen saturation of the arterial hemoglobin and the peripheral pulse rate.
- The display shows the continuous progress of the numeric SpO_2, pulse rate, plethysmographic waveform and signal quality values.
- The displayed plethysmographic waveform is not proportional to the pulse volume.
- The update period of the measurement readings on the display is approximately 2 seconds.
- According to the relevant standards, the temporary alarm silence period can be set to a maximum of 2 minutes.

The peak wavelength and maximum optical power of the light emitted by the pulse oximeter probes can be especially useful to clinicians e.g. performing photodynamic therapy. They are as follows:

- Range of peak wavelengths: 600 nm to 900 nm
- Maximum light power output: <15 mW

WARNING Only use sensors recommended from Welch Allyn for SpO_2 measurement with the monitor. Other oxygen transducers (sensors) can impact the performance and give incorrect measurement readings.

WARNING The information in this manual does not overrule any instructions given in the SpO_2 sensor directions for use. Before using the sensor, carefully read the sensor directions for use.

WARNING Do not use the pulse oximeters or sensors during magnetic resonance image scanning. Induced current could potentially cause burns, and the pulse oximetry may affect the image and the accuracy of the measurements.

WARNING Do not use the pulse oximeter or sensors in or near the presence of MRI equipment or in an MRI suite.

WARNING Tissue damage can be caused by incorrect application or use of a sensor. Inspect the sensor site as described in the sensor directions for use to ensure skin integrity and correct positioning and adhesion of the sensor.

WARNING Do not use damaged patient cables, damaged sensors or a sensor with exposed optical components.

WARNING Substances causing disturbances: Carboxyhemoglobin can lead to falsely high measurement readings. Colors or substances containing colors that influence the natural blood pigments can also lead to incorrect measurement readings.

WARNING Exposure to excessive illumination, such as surgical lamps (especially those with xenon light source), bilirubin lamps, fluorescent lights, infrared heating lamps or direct sunlight, can affect the performance of an SpO_2 sensor. To prevent exposure to excessive illumination, ensure that the sensor is correctly applied and that it is covered with an opaque material, if required. If these measures are neglected, excessive illumination can lead to incorrect measurements.

WARNING Change the sensor's position at least every 4 hours.

SpO_2 settings

The parameter settings are selected with the trim knob, described previously (see "Settings via a parameter field" on page 22).

The default settings are in **bold**.

Parameter	Description
SpO_2 alarm pause	When the alarm is paused the message **SpO_2 Alarms Paused** appears in the message line. The alarm is paused until the sensor is reinstalled.
HR/PR source[1]	**ECG,** SpO_2, P1 ART (selection of the heart rate source). The source is displayed in brackets next to the HR parameter.
HR/PR tone[1]	**Off**, on[2]
SpO_2 lower/upper limit	**90/100** (lower/upper alarm limit for the oxygen saturation of the blood).

1. This can also be set in the Setup HR menu.
2. If SpO_2 is the HR/PR source, the pitch of the beep corresponds to the SpO_2 saturation. A high-pitched beep indicates a high saturation.

SpO_2 alarms

Alarm	Cause	Remedy
SpO_2 – check sensor	Defective SpO_2 sensor	Replace the sensor.
	Incorrect settings in the monitor	Check the monitor settings.
SpO_2 – check sensor placement	Poor sensor contact or sensor fallen off	Check the contact between the sensor and the patient.
	Sensor is disturbed by ambient light	Cover the sensor.
	Sensor defective (red light on the sensor is not lit)	Replace the sensor.
SpO_2 Low Perfusion	Sensor not properly applied	Check the sensor and reapply.
	Fingernail varnish on the finger	Remove fingernail varnish.
	Thick skin	Change finger
	Sensor failed	Change sensor
SpO_2 unplugged	SpO_2 not connected to the monitor	Connect sensor.
SpO_2 artifact	Patient has moved	Calm the patient
	Hemodynamic interference	Apply sensor to another extremity.
	Too thin skin	Apply sensor to a larger finger.
SpO_2 < [lower limit]	SpO_2 too low	Check the patient and alarm limits.
SpO_2 > [upper limit]	SpO_2 too high	Check the patient and alarm limits.
PR < [lower limit]	Pulse rate too low	Check the patient and alarm limits.
PR > [upper limit]	Pulse rate too high	Check the patient and alarm limits.

IBP monitoring

WARNING Carefully read the manufacturer's instructions before using the invasive blood pressure kit.

WARNING When applying the kit to the patient, make sure that absolutely no air penetrates the system.

WARNING To achieve correct arterial pressure measurement, the pressure sensor must be installed on the level of the right atrium.

WARNING If the pressure sensor's position is moved after calibration, this may give inaccurate values.

WARNING If an invasive catheter for blood pressure measurement is introduced into an arterial vessel, the circulation in the terminal vessels must be checked in regular intervals.

WARNING Single-use accessories must not be reused.

WARNING For patient safety, ensure that neither the electrodes nor the patient or persons touching the patient, come into contact with conducting objects, even if these are grounded.

WARNING Precautions must be observed when using high frequency devices. To prevent the incorrect IBP measurements, only use sensors that are protected against high-frequency radiation.

Note The kit and operating procedure vary according to manufacturer. Please consult the manufacturer's documentation for connection.

Note For warm-up time/ready for measurement and displacement for invasive transducers, refer to the documentation of the transducer manufacturer.

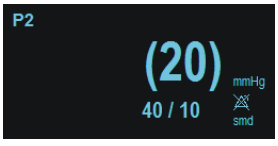
Note P1 is the only connection that can determine the HR/PR source.

Preparing IBP measurement

Refer to the manufacturer's directions for use for operating information for the IBP sensor.

IBP settings

The parameter settings are selected with the trim knob, described previously (see "Settings via a parameter field" on page 22).

Parameter	Description
Zero Set	IBP1, IBP2
Label	P1, P2
	ART
	PA
	RA
	LA
	CVP
	IPC
Size	-10 to 20 mmHg
	-10 to 60 mmHg
	- 0 to 150 mmHg
	- 0 to 200 mmHg
	- 0 to 250 mmHg
	- 0 to 300 mmHg
Format	**Sys/Dia** or Mean. This defines the main measurement to be displayed, that is the larger measurement displayed in the IBP box. The secondary measurement is displayed smaller below the main measurement. Note that the mean measurement is shown in brackets. 
IBP1s or IBP2s (lower and upper alarm limits for systolic pressure)	-30 to 76/77 to 300 (**75/220**)
IBP1m or IBP2m (lower and upper alarm limits for mean pressure)	-30 to 35/52 to 300 (**35/110**)
IBP1d or IBP2d (lower and upper alarm limits for diastolic pressure)	-30 to 35/37 to 300 (**50/120**)

IBP zero set

- Zero Set must be carried out before every application.
- To prevent incorrect measurement readings due to the sensor's physical null drift, calibrate the sensor every 24 hours.

Note Ensure the sensor is kept still during zero set. If the pressure sensor's position is moved during zero set, this can lead to incorrect values.

1. Move to the desired IBP measurement field (P1, P2) using the **trim knob**.
2. Press the **trim knob** to display the IBP menu.
3. Select Zero Set with the trim knob and press to carry out the zeroing.
4. The message P1 Zeroing appears followed briefly by P1 Zero OK.

Alarm	Cause	Remedy
IBP needs service	No IBP module detected	Switch off/on.
		Replace monitor.
IBP needs calibration	Zero-point sensor too high/low by more than ± 30 mmHg or unsteady pressure	Check tube system, sensor and valves.
		Re-calibrate the sensor.
IBP artifact	Loose sensor contact	Inspect the sensor and cable connection.
	A manipulation at the sensor, such as rinsing, has caused variation peaks of ± 150 mmHg	After rinsing, calibrate the sensor.
Incorrect IBP value displayed	Constant pressure (± 30 mmHg) during the calibration in the system	Check tube system, sensor and valves. Set three-way valve to ambient pressure.
		Re-calibrate the sensor.
IBPs < [lower limit]	Systolic pressure too low	Check the patient and alarm limits.
IBPs > [upper limit]	Systolic pressure too high	Check the patient and alarm limits.
IBPm < [lower limit]	Mean pressure too low	Check the patient and alarm limits.
IBPm > [upper limit]	Mean pressure too high	Check the patient and alarm limits.
IBPd < [lower limit]	Diastolic pressure too low	Check the patient and alarm limits.
IBPd > [upper limit]	Diastolic pressure too high	Check the patient and alarm limits.

Temperature monitoring

- Depending on the sensor type, the sensor can be applied to the ear, the skin or to rectum.
- To achieve a reliable measured value, independent of the measuring site, the measurement duration must be at least 2 minutes.

Temperature settings

The parameter settings are selected with the trim knob, described previously (see "Settings via a parameter field" on page 22).

The default settings are in **bold**.

Parameter	Description
Temp Units	**°C** or °F
Temp Lower Limit	Range: 15°C and 35.1°C (59°F and 95°F) Default: **35°C (95°F)**
Temp Upper Limit	Range: 15.1°C and 45°C (92.5°F and 113°F) Default: **37.8°C (100°F)**

Temperature alarms

Alarm	Cause	Remedy
TEMP unplugged	TEMP not connected to the monitor	Connect sensor.
TEMP needs service	The monitor has detected an error	Switch monitor Off/On or replace monitor.
TEMP out of range	The temperature is outside the measuring range of the monitor.	Check the patient or alarm limits.
	Sensor or monitor problem	Check the sensor and monitor. Switch the monitor off/on.
TEMP < [lower limit]	Temperature too low	Check the patient and alarm limits.
TEMP > [upper limit]	Temperature too high	Check the patient and alarm limits.

6 Acuity Central Station

Note Acuity connectivity is a licensable feature. To order this feature contact your Welch Allyn sales representative (see page ii).

Safety

WARNING Connect the monitor to an Acuity system only. Connecting to other networks could damage the monitor or injure the patient. If in doubt about the network jacks or devices, consult your facility's Administrator Engineering Department.

Caution Make sure the Acuity network cable is not damaged. The Acuity network cable is the sole link between the monitor and the Acuity Central Station

Caution When the monitor is not connected to the network there are no patient alarms or alerts at the Acuity Central Station.

Caution If you don't set alarm limits, the Acuity system uses preset settings (for arrhythmia test limits), and the power up default settings for the monitor.

Caution Accessory equipment connected to the analog and digital interfaces must be certified according to the respective IEC standards (e.g., EN 60950 for data processing equipment and EN 60601-1 for medical equipment). Furthermore, all configurations shall comply with the system standard IEC 60601-1-1. Anyone connecting additional equipment to the signal input or output connectors is configuring a medical system, and is therefore responsible that the system complies with the requirements of the system standard IEC 60601-1-1. If in doubt, consult your Administrator Engineering Department.

Introduction

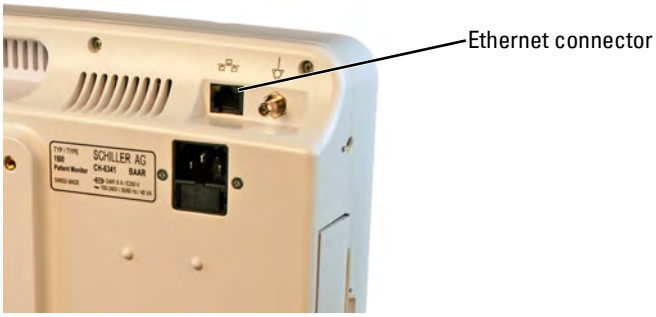
The Acuity Central Station provides central patient monitoring for monitoring devices connected to the network. The monitor communicates through a hardwired Acuity connection.

While connected to the network, the monitor sends patient data to Acuity. Acuity continuously analyzes the data and provides appropriate alarm or alert messages at the Central Station and other network devices such as a hallway message panel or the monitor itself. Acuity also stores the patient data for viewing or report printing.

If the monitor loses communication with Acuity, it continues to monitor the patient and display patient data. While not communicating with Acuity, the monitor continues to generate local patient alarms or alert messages. When connection is restored it automatically reconnects to Acuity and uploads trend information.

Connect to the Acuity Central Station

The ethernet connector (RJ45) is positioned on the back of the monitor.



Caution Ensure that only a Welch Allyn approved RJ45 cable assembly is used. Use of any other cable assembly may damage the monitor.

Note The network settings are defined by administrator.

Acuity operating instructions are given in the Acuity directions for use.

7 Maintenance

Maintenance interval

This software controlled monitor has undergone a software risk analysis to minimize any hazards associated with software defects.

The regular system maintenance must include a functional test according to the manufacturer's instructions. The test results should be recorded (see "Inspection and checklist report" on page 66).

Maintenance work not described in this section, e.g. battery replacement, may only be accomplished by a qualified technician.

The following table indicates the intervals and responsibilities of the maintenance work required. Local regulations in your country may stipulate additional or different inspection intervals and tests.

Interval	Maintenance	Responsible
Before use	Visual inspection of the monitor and cables	User
Every 6 months	Visual inspection of the monitor and cables	User
	Button check	
	Speaker check	
	LED check	
	Alarm check	
Every 12 months	Yearly test and test after repair according to IEC/EN 62353.	Qualified technician
	CO_2 Calibration[1]	

1. The need for calibration is based upon physical component changes that occur during use. The module requires its first calibration after 1200 operating hours or one calendar year, whichever comes sooner, and then after each 4000 operating hours or once a year, whichever comes sooner. The message **Calibration Due** appears when the hourly limit is reached. It is advisable to calibrate in the one-year maintenance program especially if the monitor is used for intermittent, short term use typical of patient monitors.

Visual inspection

Defective monitors or damaged cables must be removed from service until repaired or replaced.

Visually inspect the monitor and cables for the following:

- Monitor casing damaged or cracked, excessively scratched, etc.
- Damage to the LCD screen.
- Damage to sensor sheathing, mains and potential equalization cables.
- Damage to connection panels or connectors.
- Legibility of the labels on the rear of the monitor.
- Legibility of the annotation on the function button panel.

Button check

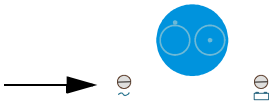
Press all buttons and trim knob and check that they work properly.

Speaker check

On switch-on beeps must be audible (see "Mains connected" on page 16).

LED check

Connect mains to the monitor and ensure the Mains LED is illuminated.



Disconnect the mains supply and leave the monitor on for 10 minutes. Reconnect the mains supply and ensure both the mains LED and the battery charge LED are illuminated.

Alarm check

The alarm check is performed with the SpO_2 sensor. Proceed as follows:

1. Connect the SpO_2 sensor to a volunteer and check that the measurement is within normal range.
2. Set the SpO_2 alarm to on and set the limit to the lowest setting (see "SpO_2 settings" on page 52), so that the alarm activates.
3. Check that the visual and audible alarms are activated.

Battery maintenance

The battery is maintenance free during its normal life.

- No maintenance is necessary during normal operation.
- If the monitor is not used, check and recharge the batteries every three months. The battery should not be allowed to fully discharge during storage.
- Replace the battery every 2 to 5 years (depending upon application). When the running time falls substantially under two hours (lithium ion battery), or one hour (lead acid battery), replace the battery.

Recharging the battery

Totally discharged batteries require the following times to charge:

- Lead acid battery: 80% capacity - 2.8 hours, 100% capacity 3.5 hours
- Li-Ion battery: 80% capacity - 2.5 hours, 100% capacity - 6.5 hours

It is possible to use the monitor when the battery is being charged; however, the charging time of the battery will be extended.

1. Connect the monitor to the mains but do not switch it on.
2. The LEDs for both mains and battery are illuminated.
3. The battery LED is extinguished when the battery is fully charged.

Battery disposal

WARNING Explosion warning. The battery must not be burned or disposed of in domestic trash.

WARNING Flammability and chemical danger. Do not open the battery.

WARNING Protect the contacts from shorting when disposing of the battery. Apply non-conducting tape to the contacts.

Batteries must be disposed of in municipally approved areas or sent back to Welch Allyn. See "Recycling monitor components" on page 71.

Inspecting and cleaning the monitor and accessories

WARNING Do not autoclave the monitor or any accessories.

WARNING Do not immerse the monitor 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.

WARNING Fire and electrical shock hazard. Always unplug the monitor from the electrical power outlet before inspecting or cleaning the monitor and accessories. Exposing any of these to liquids, such as cleaning solutions, while they are connected to electrical power could result in electrical shock or fire.

Before cleaning the monitor or any accessories, thoroughly inspect them.

- Look for any signs of damage and any improper mechanical function of buttons or connectors.
- Gently bend and flex cables, inspecting them for damage or extreme wear, exposed wires, or bent connectors.
- Confirm that all connectors engage securely.
- Ensure all transducers and accessories are within their expiratory date.
- Immediately report any sign of damage or malfunction to your service department.

To clean the monitor or any accessories, follow these steps:

1. Wipe the equipment with a cloth slightly moistened (not wet) with one of the approved cleaning solutions listed in "Cleaning instructions and cleaning solutions" on page 65.
2. Thoroughly wipe off any excess cleaning solution. Do not let the cleaning solution run into or accumulate in connector openings, latches, or crevices. If liquid gets into connectors, dry the area with warm air, and then check the equipment to confirm that it operates properly.

Caution Use only a cleaning solution recommended by Welch Allyn for this equipment. Use of any other cleaning solutions which have a high acid content or are otherwise inappropriate can cause damage to the equipment, including cracking and deterioration of the plastic case.

Caution Always follow the mixing/diluting instructions provided by the manufacturer of the cleaning solution.

Caution Never use any of the following solutions or similar products to clean the equipment: ethyl alcohol, ethanol, acetone, hexane, abrasive or scouring powder or material, any cleaning material that damages plastic.

Cleaning instructions and cleaning solutions

Equipment	Cleaning instructions	Approved cleaning solutions
Monitor[1]	Wipe with a nearly dry cloth moistened with cleaning solution. Thoroughly wipe off any excess cleaning solution. Do not let cleaning solution run into connector openings or crevices.[2]	70 % solution isopropyl alcohol; neutral mild detergent solution; all products designed for cleaning plastic.
ECG cable, extension cable	Consult manufacturer's instructions.	Mild detergent solution; also consult manufacturer's instructions.
SpO_2 cable, extension cable	Consult manufacturer's instructions.	Consult manufacturer's instructions.
Other accessories	Consult manufacturer's instructions.	Consult manufacturer's instructions.

1. The equipment can be disinfected to comply with OSHA requirements for cleaning and decontaminating spills of blood and other body fluids. (Federal OSHA blood borne pathogens standard: 29 CFR 1910.1030, 12/6/91.)
2. If liquid gets into the connectors, dry the area with warm air and then verify all monitoring functions.

Inspection and checklist report

In accordance with the maintenance interval detailed previously, the following check list should be copied and followed.

Monitor Serial Number: _____

Every six months

Inspection	Result	Checked							
General examination									
Visual inspection of the monitor.	monitor casing not broken or cracked.	❒	❒	❒	❒	❒	❒	❒	❒
Visual inspection of the LCD	LCD screen undamaged.	❒	❒	❒	❒	❒	❒	❒	❒
Visual inspection of all cable assemblies and sensors and accessories.	Electrode cable sheathing and connectors undamaged.	❒	❒	❒	❒	❒	❒	❒	❒
	No kinks, abrasion or wear in any cable assembly.	❒	❒	❒	❒	❒	❒	❒	❒
	All transducers and accessories are within their expiratory date.	❒	❒	❒	❒	❒	❒	❒	❒
Plug and socket connectors	Input/output connectors undamaged.	❒	❒	❒	❒	❒	❒	❒	❒
Button check	Buttons work.	❒	❒	❒	❒	❒	❒	❒	❒
Speaker check Switch the monitor on by pressing the On button	Switch-on beeps sounded. The standard screen is displayed.	❒	❒	❒	❒	❒	❒	❒	❒
LED check	Mains LED on when mains connected. Battery LED on when battery charging.	❒	❒	❒	❒	❒	❒	❒	❒
Alarm Check									
Connect SpO_2 sensor to volunteer	Measurement within range.	❒	❒	❒	❒	❒	❒	❒	❒
Set SpO_2 limit to lowest setting	Measurement out of range and visual and audible alarm activated.	❒	❒	❒	❒	❒	❒	❒	❒
Recurrent test									
Confirm the date of last factory inspections and test	If the monitor is due for a yearly test, have a qualified technician perform the test.	❒	❒	❒	❒	❒	❒	❒	❒
Date of Inspection:									
Inspector:									

Every 2 to 5 years

Inspection	Result	Checked				
Internal battery						
Replace battery if operation falls substantially under two hours (Lithium ion battery), or one hour (lead acid battery).	Replace battery	❒	❒	❒	❒	❒
Date of Inspection:						
Inspector:						

Replacing the fuses

WARNING Disconnect the monitor from the mains before changing the fuses.

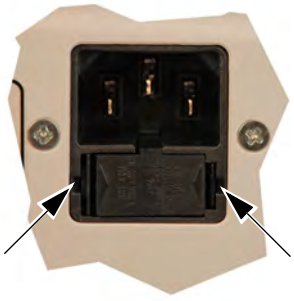
WARNING Blown fuses must only be replaced with the fuse types indicated in the below table.

Fuse types

Voltage range	Number	Fuse type
200-240 VAC	2	M 1.6A E 250V
M= Medium time lag E= Enhanced breaking capacity		

Changing the fuse

1. Disconnect the monitor from the mains.
2. Release the fuse holder by gently squeezing the side retaining clips and remove the fuse holder.



3. Replace both fuses. Re-insert the fuse holder until the two side clips snap in place.

Troubleshooting

General

Alarm/Condition	Cause	Remedy
Recorder out of paper	Paper tray empty	Insert new paper
Check paper	Paper jammed	Check paper
Recorder needs service	Printer error; paper not transported correctly; wrong paper	Check printer; check paper; wrong paper; paper not inserted correctly; have printer replaced.
Battery low	Battery capacity too low	Connect to the mains and recharge battery.
No HR/PR tone	HR/PR tone source setting	Set tone source to on.

EMC compliance

The monitor is designed for use in an electromagnetic environment in accordance with IEC/EN 60601-1-2, tables 201, 202 and 204. If the monitor is used in the vicinity of equipment labelled with the symbol "Non-ionic electromagnetic radiation"  , check the recommended minimum distance according to IEC/EN 60101-1-2, table 206. For further details, please refer to the service manual.

The following table lists devices and their typical frequency ranges and transmitting power, and the resulting minimum distances.

HF source	Transmitter frequency [MHz]	Power P [W]	Distance d [m]
Radio telephone (micro cellular) CT1+, CT2, CT3	885-887	0.010	0.23
Cordless DECT telephone, WLAN, UMTS handy	1880-2500	0.25	1.17
Mobile phone, handy USA	850/1900	0.6	1.8
Mobile phone, handy			
• GSM900	900	2	3.3
• GSM850, NMT900, DCS 1800	850, 900, 1,800	1	2.3
Walkie-talkie (rescue service, police, fire brigade, service)	81-470	5	2.6
Mobile telephone system (rescue service, police, fire brigade)	81-470	100	11.7

For transmitters not included in the above table, the recommended distance (d in meters) can be calculated using the following formulas:

Frequency range 0.15 – 80 MHz

- $d = 3.5 \div 3V \times \sqrt{P}$

Frequency range 80 – 800 MHz

- $d = 3.5 \div 3V/m \times \sqrt{P}$

Frequency range 800 MHz – 2.5 GHz

- $d = 7 \div 3V/m \times \sqrt{P}$

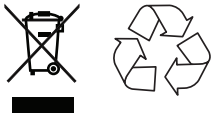
  - d = recommended distance in meters
  - P = transmitting power in watts
  - V = volts
  - m= meters

Mounting on a wall or stand

Follow the instructions given with the mount or stand. The mounting accessories are detailed in the Accessories section (see "Mounting" on page 83).

WARNING Always use Welch Allyn replacement parts and disposables, or products approved by Welch Allyn. Failure to do so may cause patient injury and invalidate the warranty.

Recycling monitor components



This monitor must be disposed of in a municipally approved collection point or recycling center when no longer used.

If no such collection point or recycling center is available, you can return the monitor to your distributor or the manufacturer for proper disposal.

Refer to www.welchallyn.com/weee for collection points and additional information.

8 Settings

Parameter settings

1. Move to the desired parameter measurement field using the trim knob. A white frame appears around the selected measurement field.
2. The selected menu is displayed by pressing the trim knob.

The settings available and default settings are given in the Monitoring section (see "Monitoring" on page 27).

- ECG / Heart rate / Pacemaker (see "ECG" on page 28).
- RR (see "Respiration rate" on page 40).
- $etCO_2$ / Respiration (see "$etCO_2$ measurement" on page 42).
- NIBP (see "NIBP monitoring" on page 46).
- SpO_2 (see "SpO_2 monitoring" on page 50).
- IBP (see "IBP monitoring" on page 54).
- Temperature (see "Temperature monitoring" on page 57).

General and alarm settings

The **Setup** menu is displayed as follows:

1. Press the **Setup** button .
2. With the **trim knob**, select the menu option.
3. Press the trim knob to display the menu.

The menu options are as follows:

Alarm suspend

Suspend all alarms for the period specified under the Alarm settings in the Administrator menu (see "Administrator" on page 77).

Arrhythmia

Note This menu entry is only available when the option is enabled.

Sets the Arrhythmia alarm settings, print on alarm and other options (see "Arrhythmia" on page 38).

Alarms

Sets the upper and lower alarm limits for all parameters. If a recorder is installed, a printout can be initiated when an alarm limit is violated.

Speaker Volume

Sets the speaker volume on a scale of 1 to 10. The volume is heard when scrolling through the values.

HR / PR Tone Volume

Sets the HR (from ECG), PR (from SpO_2), or P1 beep volume on a scale of 1 to 10. The volume is heard when scrolling through the values.

Waveforms

The default settings are in **bold**.

Main menu	Parameter	Description
Waveform	Waveform 1	I, **II,** III, V, AVL, AVR, AVF
	Waveform 2	I, II, III, V, AVL, AVR, AVF, **RESP,** CO_2
	Waveform 3	I, II, III, V, AVL, AVR, AVF, **SpO_2**
	Waveform 4	I, II, III, V, AVL, AVR, AVF, **P1**
	Waveform 5	I, II, III, V, AVL, AVR, AVF **P2**
	Amplitude	For ECG waveforms: 2.5, 5, **10**, 20 mm/mV
		For P1 and P2: -10 to 20, -10 to 60, 0 to 150, **0 to 200,** 0 to 250 and 0 to 300 mmHg
		For CO_2: **0 to 40,** 0 to 60, and 0 to 80 mmHg
		The setting for RESP and SpO_2 is **Auto**.
	Sweep Speed	6.25, 12.5, **25** mm/sec.

Recorder

Note This is only available when the recorder option is installed.

This defines the information to be printed. The default settings are in **bold**.

Main menu	Parameter	Description
SetUp Recorder	Waveform 1	**ECG1**, ECG2, ECG3, RESP, SpO_2, P1, P2, NIBP
	Waveform 2	ECG1, ECG2, ECG3, **RESP**, SpO_2, P1, P2, NIBP, OFF
	Waveform 3	ECG1, ECG2, ECG3, RESP, **SpO_2**, P1, P2, NIBP, OFF
	Recording time	5, **10**, 16 Seconds
	Recording Delay	0, **6**, 10 Seconds. This defines the duration of data that is printed before the print key is pressed. For example, if a delay of six seconds with a recording time of 10 seconds is defined (default), six seconds of data recorded before the print key is pressed is printed, followed by the subsequent 4 seconds.

Parameters

Enables or disables ST, $etCO_2$ and invasive blood pressure measurements.

12-lead resting ECG

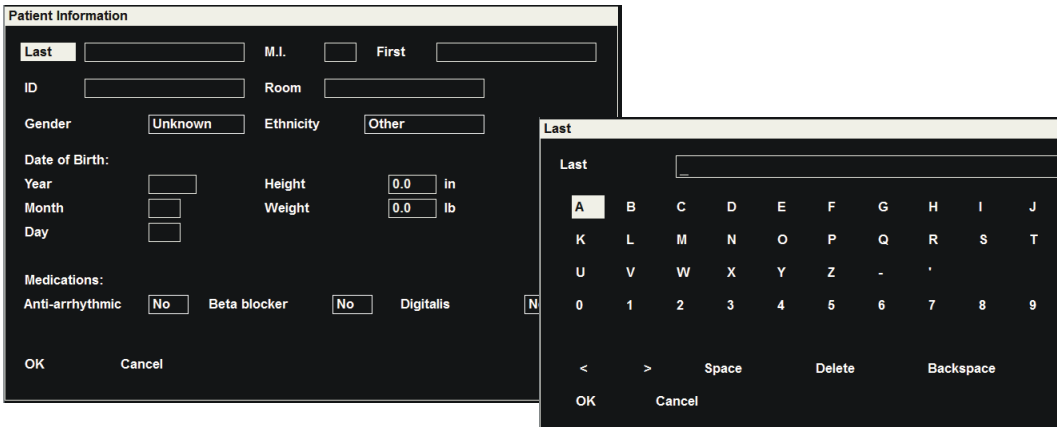
Note This menu entry is only available when the resting ECG option is enabled.

Take a resting ECG and option to print.

Patient information

Note The patient information menu option is not available when an Acuity-enabled monitor is not connected to Acuity.

Allows the entry of the patient name and ID, including gender, date of birth, ethnicity, height, weight, and drug categories.



Patient mode

Define the patient; select adult, pediatric, or neonatal.

Restore user defaults

The saved user settings are enabled. The user-defined settings are saved in the Setup System menu (see "Saving the user-defined settings as default" on page 19).

Administrator

The administrator and service screens provide system information and option settings.

The Administrator screens are entered from the settings menu:

Setup Menu > Administrator

Administrator sub-menus can only be accessed with a password. The passwords are divided into clinical, service and factory passwords and only clinical settings are available for the user. The other menu options on this menu are for Welch Allyn service personnel. Options are enabled in the service menu; please contact Welch Allyn. The passwords for the alarms and system sub-menus are as follows:

- Setup > Administrator > Alarms: **49, 48, 46** (Clinical Password).
- Setup> Administrator > System **49, 48, 46** (Clinical Password).
- No password is needed to view the Configuration. Other sub-menus are intended for service personnel only.

The Administrator menu is as follows:

Sub menu	Parameter	Description
Configuration		Monitor data such as serial number, software version etc. This is provided for information only and no settings can be made.
Communications		This provides the communication settings for service personnel only.
Alarms (password protected - see above)	Alarm Silence Time	**1**, 1.5 or 2 minutes. Time for which an audible alarm is silenced.
	Alarm Suspend Time	**1**, 1.5, or 2 minutes. Time for which all alarms are suspended.
	Can disable HR / PR Alarms	**Enabled/**Disabled. The menu item can prevent users from being able to turn off HR or PR alarms. When the setting is "Disabled", a user cannot turn off the HR or PR alarms.
	Alarm Delay	**On/**Off. If the alarm validation is enabled, alarm limits must be exceeded for at least 6 seconds for an alarm to be issued.
	Second Speaker Time	0 to 3 minutes (2 minutes). Time after which the secondary speaker is enabled. **For lethal and high level alarms the secondary speaker is activated in 30 seconds.**

Sub menu	Parameter	Description
System (password protected - see previous page)	Height units	Select Inches (in) or centimeters (cm)- sets the monitor's measurement units.
	Weight units	Select pounds (lbs) or kilograms (kg)- sets the monitor's measurement units. In neonate mode the units are automatically switched to grams.
	Acuity Enabled	Yes/**No**. Connects to Acuity. Note that Acuity can only be enabled when Enable Acuity connection in the service setup is set.
	Set Date and Time	Entry of the year/month/day/hour/minute
	Save User Defaults	With this function, values changed by the user can be saved (see "Saving the user-defined settings as default" on page 19)
	Show Event Log	Display of the monitor event log (see "Event log screen and CO2 calibration" on page 79).
Service		This provides settings, options and service information for service personnel only.
Factory		This menu is for factory use only.

Event log screen and CO_2 calibration

The event log screen provides software versions, module status and provides an event log. Full details are provided in the service handbook.

This screen also provides a counter for CO_2 calibration.

The event log screen is displayed as follows:

Setup Menu > Administrator > System > Event log

The following is a typical screen:

The **CO_2 Hours Until Cal Due**, is a counter that gives the operating time of the CO_2 module until calibration is necessary. If the counter is 0 when a CO_2 probe is connected, an alert message is displayed: **CO_2 calibration due** or **CO_2 service due**. Please contact a Welch Allyn service center.

Acuity alarm default settings

Adult settings

Parameter	Acuity range limit	Acuity lower limit (default)	Acuity upper limit (default)
HR	25 - 250	50	120
PR (NIBP)	25 - 250	50	120
PR (IBP)	25 - 250	50	120
PR (SpO_2)	25 - 250	50	120
SpO_2 SAT (%)	50 - 100	90	100
RR-ECG	2 - 150	5	30
RR-CO_2	2 - 150	5	30
Apnea Delay (s)	6 - 30	N/A	15
etCO_2 (mmhg)	0 - 99	25	60
etCO_2 (kPa)	0 - 13.2	3.0	8.0
inCO_2 (mmhg)	2 - 25	N/A	5
inCO_2 (kPa)	0.2 - 5.0	N/A	0.7
P1 Sys	-30 - 300	75	220
P1 Dia	-30 - 300	35	110
P1 Mean	-30 - 300	50	120
P2 Sys	-30 - 300	15	50
P2 Dia	-30 - 300	5	20
P2 Mean	-30 - 300	10	25
NIBP Sys	30 - 260	75	220
NIBP Dia	20 - 235	35	110
NIBP Mean	20 - 255	50	120
Temp (F)	59 - 113	95.0	100.0
Temp (C)	15 - 45	35.0	37.8

Pediatric settings

Parameter	Acuity range limit	Acuity lower limit (default)	Acuity upper limit (default)
HR	25 - 250	50	150
PR (NIBP)	25 - 250	50	150
PR (IBP)	25 - 250	50	150
PR (SpO_2)	25 - 250	50	150
SpO_2 SAT (%)	50 - 100	90	100
RR-ECG	2 - 150	10	45
RR-CO_2	2 - 150	10	45
Apnea Delay (s)	6 - 30	N/A	20
etCO_2 (mmhg)	0 - 99	25	60
etCO_2 (kPa)	0 - 13.2	3.0	8.0
inCO_2 (mmhg)	2 - 25	N/A	5
inCO_2 (kPa)	0.2 - 5.0	N/A	0.7
P1 Sys	-30 - 300	75	145
P1 Dia	-30 - 300	35	100
P1 Mean	-30 - 300	50	110
P2 Sys	-30 - 300	15	50
P2 Dia	-30 - 300	5	20
P2 Mean	-30 - 300	10	25
NIBP Sys	30 - 260	75	220
NIBP Dia	20 - 235	35	110
NIBP Mean	20 - 255	50	120
Temp (F)	59 - 113	95.0	100.0
Temp (C)	15 - 45	35.0	37.8

Neonatal settings

Parameter	Acuity range limit	Acuity lower limit (default)	Acuity upper limit (default)
HR	25 - 250	100	200
PR (NIBP)	25 - 250	100	200
PR (IBP)	25 - 250	100	200
PR (SpO_2)	25 - 250	100	200
SpO_2 SAT (%)	50 - 100	85	95
RR-ECG	3 - 150	10	75
RR-CO_2	3 - 150	10	75
Apnea Delay (s)	6 - 20	N/A	15
etCO_2 (mmhg)	0 - 99	25	60
etCO_2 (kPa)	0 - 13.2	3.0	8.0
inCO_2 (mmhg)	2 - 25	N/A	5
inCO_2 (kPa)	0.2 - 5.0	N/A	0.7
P1 Sys	-30 - 300	50	100
P1 Dia	-30 - 300	30	70
P1 Mean	-30 - 300	35	80
P2 Sys	-30 - 300	15	50
P2 Dia	-30 - 300	5	20
P2 Mean	-30 - 300	10	25
NIBP Sys	25 - 120	50	100
NIBP Dia	15 - 105	30	70
NIBP Mean	15 - 110	35	80
Temp (F)	59 - 113	95.0	100.0
Temp (C)	15 - 45	35.0	37.8

9 Accessories

WARNING Use only accessories supplied or recommended by Welch Allyn. Use accessories according to your facility's standards and manufacturer's recommendations. Always refer to the manufacturer's directions for use. To order accessories, contact your local Welch Allyn representative (see page ii).

Miscellaneous

Part number	Description
103700	Welch Allyn 1500 Patient Monitor multi-language directions for use
103601	3-pack thermal Z-fold paper
103610	10-pack thermal Z-fold paper
103611	100-pack thermal Z-fold paper

Mounting

Part number	Description
103440	Welch Allyn 1500 Patient Monitor pivot arm wall mount
103441	Welch Allyn 1500 Patient Monitor flush to wall mount
103442	Welch Allyn 1500 Patient Monitor rollstand
103443	Welch Allyn 1500 Patient Monitor drop on Mfg. plate

Batteries

Part number	Description
103461	Lead acid
103462	Lithium Ion

Cables

Part number	Description
103460	Ground cable, 6 mm MC PLUG
715316	Ethernet cable, 3 ft
715317	Ethernet cable, 7 ft
715318	Ethernet cable, 14 ft
103632	Mains cable, TYPE G
103633	Mains cable, TYPE E/F
103634	Mains cable, TYPE I
103635	Mains cable, TYPE J
103636	Mains cable, TYPE A
103638	Mains cable, TYPE B

Nellcor SpO_2

Part number	Description
103490	Nellcor SpO_2 cable, DOC-10
008-0054-01	DS-100A DURASENSOR, reusable

ECG

Part number	Description
103801	12-Lead AHA ECG shielded cable
103802	12-Lead IEC ECG shielded cable
008-0316-00	3-Lead ECG cable
008-0323-00	3-Lead ECG wire set
008-0313-00	5-Lead 10 ft ECG cable with lead wires, AHA
008-0313-01	5-Lead 10 ft ECG cable with lead wires, IEC

IBP

Part number	Description
008-0226-01	IBP cable F/MX900 & MX860
008-0233-00	IBP transducer, DISP. MX950(10)
008-0224-00	IBP domes, MX848

Temperature

Part number	Description
008-0230-00	Temperature sensor

NIBP

Part number	Description
008-0238-00	Adult/Ped NIBP hose for bladderless cuff
008-1024-00	Reusable cuff -11-1MQ,ADULT,1 TUBE,MQ
5084-87L-3MQ	Reusable cuff LG AD LONG 1-TUBE MQ
5082-83-3MQ	Reusable cuff SM CHILD 1-TUBE, MQ
5082-84-3MQ	Reusable cuff, CHILD, 1-TUBE, MQ
5082-85-3MQ	Reusable cuff, SM AD, 1-TUBE, MQ
5082-87-3MQ	Reusable cuff, LG AD, 1-TUBE, MQ
5082-88-3MQ	Reusable cuff, THIGH, 1-TUBE, MQ
5082-86-3MQ	Reusable cuff, ADULT, 1-TUBE, MQ
5082-93-4MQ	Soft cuff, SM CHILD 2-TUBE, MQ
5082-94-4MQ	Soft cuff, CHILD, 2-TUBE, MQ
5082-95-4MQ	Soft cuff, SM AD, 2-TUBE, MQ
5082-96-4MQ	Soft cuff, ADULT, 2-TUBE, MQ
5082-97-4MQ	Soft cuff, LG AD, 2-TUBE, MQ
5082-98-4MQ	Soft cuff, THIGH, 2-TUBE, MQ
5082-96L-4MQ	Soft cuff, AD LONG 2-TUBE, MQ
5082-97L-4MQ	Soft cuff LG AD LONG 2-TUBE MQ
5082-93-3MQ	Soft cuff SM CHILD 1-TUBE, MQ
5082-94-3MQ	Soft cuff, CHILD, 1-TUBE, MQ
5082-95-3MQ	Soft cuff, SM AD, 1-TUBE, MQ
5082-96-3MQ	Soft cuff, ADULT, 1-TUBE, MQ
5082-97-3MQ	Soft cuff, LG AD, 1-TUBE, MQ
5082-98-3MQ	Soft cuff, THIGH, 1-TUBE, MQ

A Technical data

System data

Manufacturer	SCHILLER AG for Welch Allyn
Monitor name	Welch Allyn® 1500 Patient Monitor
Dimensions	396 x 284 x 81 mm (15.6 x 11.2 x 3.2 inches)
Weight	5.0 kg (11 lbs) (with lead acid battery)
	4.5 kg (9.9 lbs) (with Li-Ion battery)
Mode of operation	Continuous
Power supply	Internal Charger
Voltage	100 – 240 V, 50 – 60 Hz
Power consumption	max 70 VA
Typical battery operating time	With the battery fully charged, 25°C, display on, NIBP measurement every 15 minutes, and with all paramters ECG/RESP/NIBP/Temp/SpO_2/IBP(x2)/CO_2:
	Lead Acid: approx. 1 hour
	Li-Ion: approx. 2 hours
Fuses	2 x M 1.6A E 250V
Environmental conditions for operating	
Temperature	10 °C to 40 °C (50 °F to 104 °F) at relative humidity of 30 to 80 % (non-condensing)
Atmospheric pressure	700 to 1060 hPa
Environmental conditions for transport and storage	
Temperature	-10 °C to 50 °C (14 °F to 122 °F) at relative humidity of 10 to 95 % (non-condensing)
Atmospheric pressure	572 to 1060 hPa
Monitor display	Color TFT LCD
Resolution	1024 x 768 pixels
Dimensions	30.7 x 23 cm (12 x 9 ins),15 in diagonal
Speed	6.25/12.5/25 mm/s

Printer	High-resolution thermal printer
Resolution	8 dots/mm (amplitude-axis), 40 dots/mm (time-axis) at 25 mm/s
Paper	Thermoreactive, Z-folded Width: 80 mm Length 20 m (approx.)
Print speed	25 mm/s
Printout length	10 second ECG recording on 4 pages
Recording tracks	3-channel display, with optimal width of 72 mm, automatic baseline adjustment
Printout	Curves, trend and saved values
Battery	
Battery type	Lead acid battery, 12 V
Capacity	2600 mAh
Recharging time	80% capacity: 2.8 hours 100% capacity: 3.5 hours (monitor switched off)
Battery life	up to 1000 cycles
or	
Battery type	Lithium-Ion battery, 10.8V
Capacity	7200 mAh
Recharging time	80% capacity: 2.5 hours 100% capacity: 6.5 hours (monitor switched off)
Battery life	min. 500 cycles
Connections	ECG
	SpO_2
	NIBP
	$etCO_2$
	Temperature
	Invasive blood pressure (x2)
Interfaces	Ethernet via RJ45
	Nurse call: Alarm delay at the signal output component <0.5 s Plug type: 1/8 in (3.5 mm) mini-phone jack stereo connector Tip: Normally closed Ring: Normally open Maximum switch current: 1A Maximum switch voltage: 30 V AC/DC Isolation: 1,000 Vrms for 1 min
	USB 1.1
Demo Mode	Simulated patient data including waveforms for training and education

Trend		
	Entries	All recorded parameters are saved
		Up to 1728 trend records can be saved (updated every minute)
		NIBP trends entered after each reading
	Format	The values displayed in tabular numeric format in intervals of 1, 5, 15, 60, and 240 minutes
		Page up/down trend view
Alarms		
	Alarm limits	The upper and lower limits can be selected for all parameters.
	Mode	All parameters: Adult/Pediatric/Neonate patient mode-specific limits
		Factory default or programmable settings for all patient modes
	Alarm indicators	Red, yellow, blue numeric
		Red, yellow, blue LED indicator
		Alarm(s) off indicator
		Alarm status message
		Audible alarm tone: high/med/low
	Alarm suspend	Suspend time user programmable: 1, 1.5 and 2 minutes
	Technical alarm	Alert: blue

Safety standards

Safety standard	IEC 60601-1/A2: 1995: Delta -consideration related to IEC60601-1:2005 incl. corrections 1:2006 and 2:2007:General requirements for basic safety and essential performance. Protection Class I Type CF.
	IEC 60601-1-4/A1: 1999: General requirements for collateral standard: programmable electrical medical systems.
	IEC 62366: 2007: Application of usability engineering to medical devices.
	IEC 60601-2-27: 2005: Particular requirements for the safety of electrocardiographic monitoring equipment..
	IEC 60601-2-30: 1999:Particular requirements for the safety, including essential performance, of automatic cycling non-invasive blood pressure monitoring equipment..
	IEC 60601-2-34: 2000:Particular requirements for the safety, including essential performance, of invasive blood pressure monitoring equipment.
	IEC 60601-2-49: 2001:Particular requirements for the safety of multifunction patient monitoring equipment.
	ISO 9919. Particular requirements for the basic safety and essential performance of pulse oximeter equipment for medical use.
	ISO 21647. Particular requirements for the basic safety and essential performance of respiratory gas monitors.
Protection class	Protection against electric shocks, Class I according to IEC/EN 60601-1 (with internal power).
Protection	This monitor is not designed for outdoor use (IPX0).
EMC	IEC/EN 60601-1-2: 2007: (class A).
Additional requirements	EN 1060-1 and EN 1060-3 (noninvasive blood pressure recorders part 1). EN12470-4 (Performance of electrical thermometers for continuous measurement).
Conformity	CE according to directive 93/42/EEC class IIb.

Measured values

ECG

Patient cable	3-lead, 5-lead, 10-lead cable Automatic 3, 5 and 10 lead detection Lead fault detection AAMI 6 pin and 12 pin connectors
Leads	Simultaneous, synchronous recording of up to nine active electrodes giving 12 leads
Filters	
Mains	50 Hz / 60 Hz / off
Bandwidth	0.05 Hz / 0.5 Hz , 35 Hz / 150 Hz
Input impedance	≥ 2.58 MΩ
Heart rate range	15 to 300 beats/min
QRS tone	on / off
Protection	ESU and defibrillator protected
Lead display	Selectable leads Selection of 1 to 5 simultaneous leads
Display update interval	1 second
Lead fail sense current	< 0.5 µA
Tall T-wave rejection	max. amplitude of the T-wave according to IEC 60601-2-27 chapter 50.102.17: 4 mV
HR averaging method	The average of the last 16 beats is used, when RR interval corresponds to a HR of < 48 bpm. The average of the last 4 beats is used, when RR interval corresponds to a HR of ≥48 bpm.
HR accuracy	± 5 % or ± 5 bpm (whichever is greater)
HR meter response time	Change from 80 to 120 bpm: 11s Change from 80 to 40 bpm: 11s
Response to Irregular rhythm	A1: 80/min A2: 60/min A3: 120/min A4: 90/min (according to IEC specification 60601-2-27, 6.8.2.bb)
Time to Alarm for tachycardia	B1 and B2: 3 s (according to IEC specification 60601-2-27, 6.8.2.bb)
Sensitivity	According to ANSI/AAMI EC13 / IEC60601-2-27

ECG amplifier	
Sampling frequency	1000 Hz
Pacemaker detection	± 2 to ± 700 mV / 0.1 to 2 ms
Pacemaker rejection	± 2 to ± 700 mV / 0.1 to 2 ms Note: Pacemaker signals can differ from one pacemaker to the next. Rate meters may continue to count the pacemaker rate during occurrences of cardiac arrest or some arrhythmias, mainly with pacemakers generating high amplitudes (> 20 mV) or those generating overshoot. Pacemaker patients should be kept under close or constant observation.
Protection	Fully isolated, defibrillation protected >5 kV
Line frequency filter	50 or 60 Hz sinusoidal interferences filtered by means of adaptive digital filtering.

Respiration

Respiration rate range	0 to 200 breaths / min (pediatric: 0 to 120 breaths per minute)
Connector	Shared with ECG
Signal	28 kHz square wave ± 2.5 V
Patient current	max. 80 µA
Dynamic impedance range	1 k to1.5 kΩ, variation of 0.1 to 3 Ω
Sampling Rate	250 Hz
Respiration rate accuracy	± 1 digit
RR display update interval	max. 2 s

Temperature

Sensor	YSI 401, rectal, skin or ear
Amplifier	Fully isolated, defibrillation protected >5kV
Sampling Frequency	125 Hz
Measurement interval	1x per second
Measurement range	15 °C to 45 °C (59 °F to 113°F)
Resolution	0.1 °C (0.1 °F)
Accuracy	± 0.1° C (± 0.1° F)

NIBP

Measurement	Quick action start / stop button Automatic or manual
Measuring intervals	3 to 60 minutes
Measuring method	Oscillometric
Measurement range	15 to 270mmHg
Deflation rate	3 to 9 mmHg / second
Cuff	Adult, Pediatric and Neonate
Pulse rate measurement range	25 to 250 bpm
Protection	Overpressure protection

IBP

Channels	Two channels
Measurement range	-30 to 300 mmHg
Accuracy	1 mmHg or ± 1% (whichever is greater)
Sampling Frequency	500 Hz
Amplifier	Fully isolated, defibrillation protected >5kV
Calibration	Manual or automatic
Pulse rate measurement range	25 to 250 bpm

SpO_2

Sensors	Nellcor® OxiMax® sensors
Amplifier	Fully isolated, defibrillation protected >5kV
Sampling Frequency	62.5 Hz
Display update interval	1 second
Measurement range	
SpO_2	1 to 100 %
PR	20 to 250 /min
Accuracy (Probe 70%, to 100 %, 28°C to 42°C)	
SpO_2	Adult / pediatric ± 2 digits Neonate ± 3 digits
PR (no motion)	20 to 250 /min ± 3 digits
Calibration range	70 to 100 % (calibration is fixed, no calibration required)
PR Calculation	Averaged over 4 / 8 / 16 beats

$etCO_2$

Module	Mini Medi CO_2
Measuring method	Non dispersive Infrared Spectroscopy
CO_2 range	0 to 99 mmHg (CO_2[mmHg] / Environment pressure) x 100 = CO_2[%])
Curve Resolution	0.1 mmHg
$etCO_2$, $inCO_2$ Resolution	1 mmHg
CO_2 Accuracy	0 to 38 mmHg: ± 2 mmHg 39 to 150 mmHg: ± 5 % of reading and 0.08 % for every 1 mmHg above 38 mmHg
Respiration	0 to 150 Resp/min
Respiration Accuracy	0 to 70: ± 1 Resp/min 71 to 120: ± 2 Resp/min 121 to 150: ± 3 Resp/min
Flow rate	50 ml/min, flow measured by volume
Waveform sampling	20 samples/s
Initialization Time	40 s (typical)
System Response Time	5.6 s (typical combined response time)

Note The capnography component of this product is covered by one or more of the following US patents: 6,428,483;6,997,880; 5,300,859, 6,437,316, 7,488,229 and their foreign equivalents. Additional patent applications pending.

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