IntelliVue MX40

Installation and Service

Release B.0

PHILIPS

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First Edition 2012

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- How the data is stored and the conditions by which it is stored.
- How the data is transmitted and the conditions under which that data is transmitted.

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Printing History

New editions of this document will incorporate all material updated since the previous edition. Update packages may be issued between editions and contain replacement and additional pages to be merged by a revision date at the bottom of the page. Note that pages which are rearranged due to changes on a previous page are not considered revised.

The documentation printing date and part number indicate its current edition. The printing date changes when a new edition is printed. (Minor corrections and updates which are incorporated at reprint do not cause the date to change.) The document part number changes when extensive technical changes are incorporated.

First Edition June 2012

Document Conventions

In this guide:

Warnings

Warning

A Warning alerts you to a potential serious outcome, adverse event or safety hazard. Failure to observe a warning may result in death or serious injury to the user or patient.

Cautions

Caution

A Caution alerts you to where special care is necessary for the safe and effective use of the product. Failure to observe a caution may result in minor or moderate personal injury or damage to the product or other property, and possibly in a remote risk of more serious injury.

Notes

A Note contains additional information on the product's usage.

Contents

1. Introduction

The IntelliVue MX40 is a wearable patient monitor. It is designed to support ambulatory patients for continuous ECG and optionally, SpO_2 and impedance respiration. The short-range radio option allows connection to the IntelliVue Cableless Measurements or an IntelliVue patient monitor for additional parameters. The display on the MX40 also provides immediate access to patient information at the point of care.

Network Connectivity

The MX40 provides a choice of network connectivity options – IntelliVue Smart-hopping or 802.11 a/b/g. Three versions of the MX40 are available:

- 865350 – IntelliVue MX40 1.4 GHz Smart-hopping
- 865352 – IntelliVue MX40 2.4 GHz Smart-hopping
- 865352 – IntelliVue MX40 802.11 a/b/g

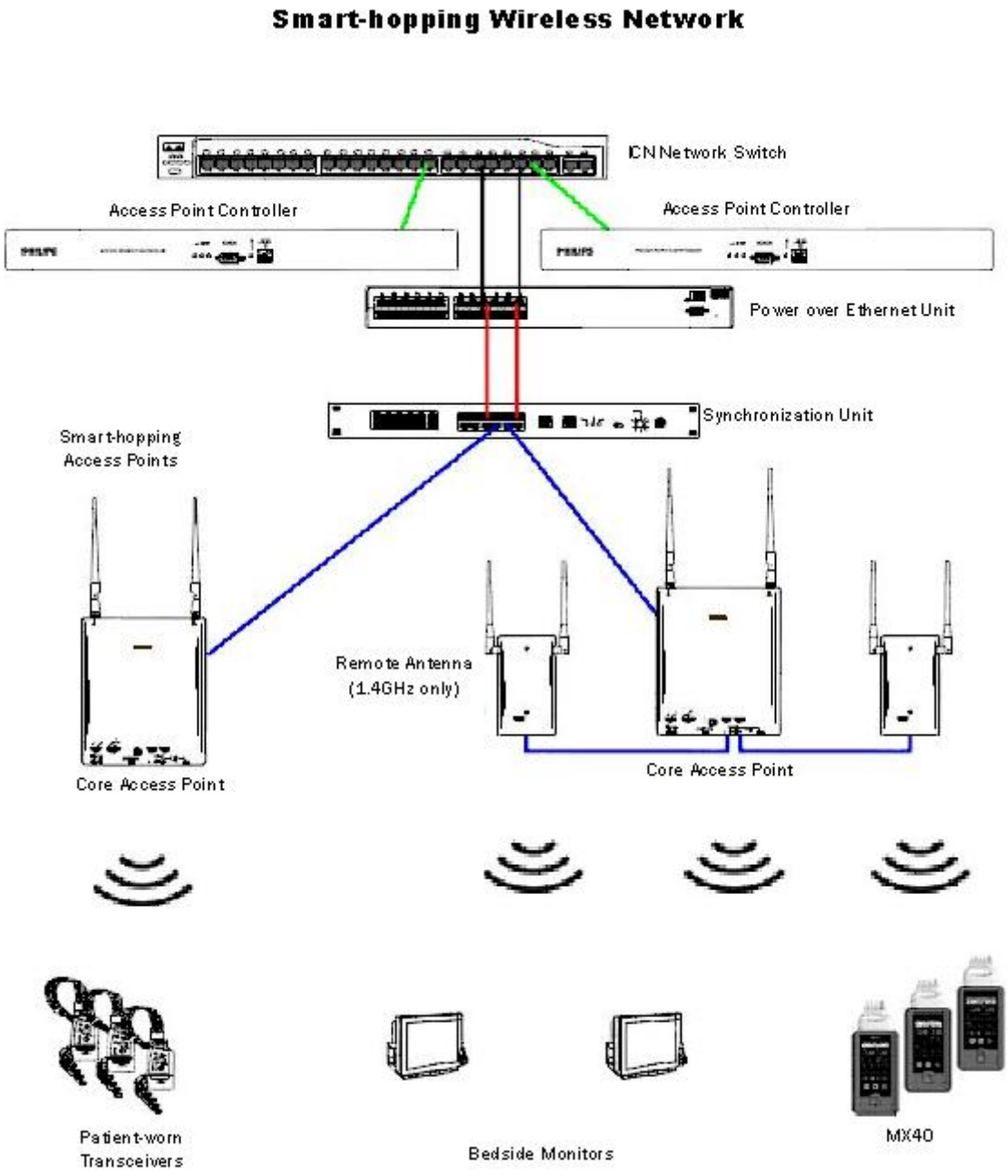
The 865350 and 865351 utilize the IntelliVue Smart-hopping network.

The 865352 supports WLAN networks in the 802.11a 5.6 GHz ISM band or the 802.11b/g 2.4 GHz bands as part of Philips Customer-supplied Clinical Network (CSCN) specification.

Note — For information about the WLAN version of the MX40 and its operation on customer supplied network infrastructure, see Chapter 9.

Network Components

The IntelliVue Smart-hopping wireless network is comprised of the following devices and components:



2. Installation

This section provides compatibility and configuration information for reference during MX40 installation. For clinical configuration information, see the MX40 Configuration Guide, p/n 4535 643 44071.

MX40 Release B.0 Compatibility

The MX40 (865350/865351) is compatible for use with IntelliVue Information Center Release N and IntelliVue Information Center iX Release A.00. Limited compatibility is offered when used with IntelliVue Information Center Release L or M. See the "Operating with Release L or M" chapter for more information.

The MX40 (865352) is compatible with IntelliVue Information Center iX Release A.00. It is not compatible with IntelliVue Information Center Release N or earlier.

The MX40 is compatible for use with IntelliVue Patient Monitors Release G or later when wirelessly connected (IIC Release N).

The MX40 is compatible for use with IntelliVue Patient Monitors Release J or later when wirelessly connected (IIC iX Release A.00).

The MX40 is compatible for use with IntelliVue Cableless Measurements Release A.1.

The MX40 (865350/865351) is compatible for use with Access Point Controller 862147, Release B.00.19 and Access Point Controller 865346, Release C.00.04.

The MX40 Patient Cable is compatible for use with IntelliVue Patient Monitor platforms MP2/X2, MP5/MP5T/MP5SC, MP20/30 with MMS or X2, MP40/50 with MMS or X2, MP60/70 with MMS or X2, MP80/90 with MMS or X2, and MX800/700/600 with MMS or X2.

Wireless Network Configuration

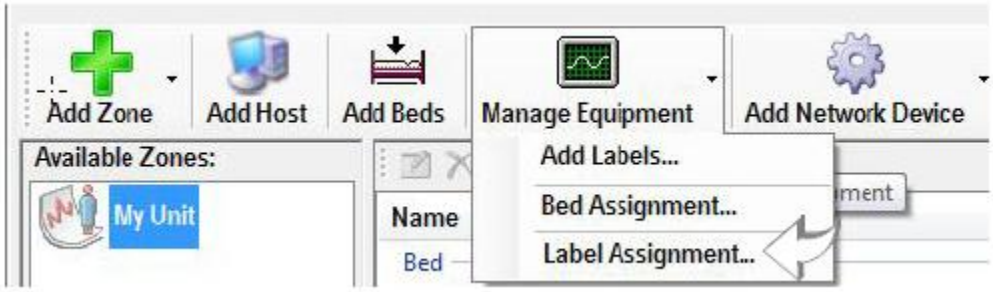
For the Smart-hopping MX40s (865350, 865351), wireless network configuration happens as a part of the equipment label assignment procedure. The MX40s are shipped from the factory with an Equipment Label of "NEW_DEVICE" and an RF Access Code of "0". This allows basic wireless connectivity to any Smart-hopping Access Point. After the MX40 has basic connectivity to the Smart-hopping network, the "Label Assignment" procedure can be performed at the Information Center. The "Label Assignment" procedure configures the RF Access Code and Equipment Label into the MX40 without the need for any additional tools.

For the 802.11 a/b/g MX40s (865350), wireless network configuration must be completed before the equipment label assignment procedure can be performed. The WLAN configuration is done using the IntelliVue Support Tool – Mark2. See Chapter 9 of this document and also the IntelliVue Support Tool Instructions for Use for details.

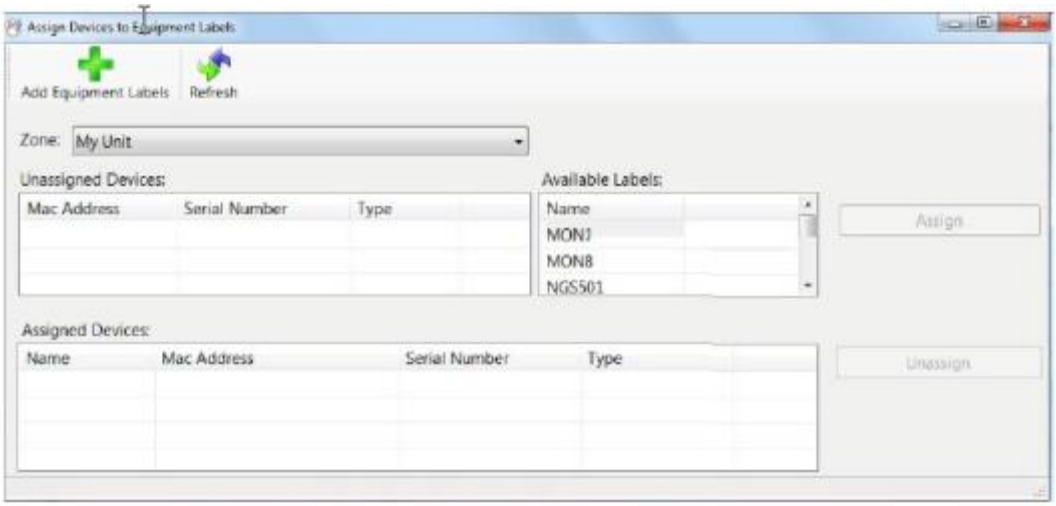
Assigning an Equipment Label - IIC iX

➢ *To assign an equipment label to a device:*

Go to **Manage Equipment** > **Label Assignment**.



The **Assign Devices to Equipment Labels** dialog window opens.



Click the desired label in the **Available Labels** list, then click the desired **Unassigned Device**.

Click the **Assign** button.

Assigning an Equipment Label - IIC

➢ *To assign an equipment label to a device:*

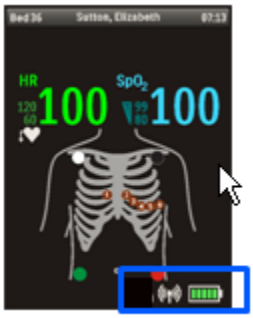
1 Select **All Controls** > **Label Assignment**.

2 Enter password (tele)

3 Insert battery power into the MX40 and if attached, disconnect the patient cable.

4 Select **Refresh**.

5 Confirm the connection to the wireless network as follows:



"System Wireless Connection" Icon

Not connected (Icon grayed out)

Connected

6 Select the MAC address of the device from the **New Devices** list. If the address does not appear, remove battery power and re-insert. Select **Refresh**.

Note — The MAC address appears on the rear label of the MX40.

7 Select the desired equipment label from the **Equipment Label** list.

8 Select **Assign Label** to initiate programming of the equipment label and RF Access Code into the MX40.

9 When prompted, press **Confirm** on the MX40 to accept the assignment. The confirmation must occur within 30 seconds of the prompt.

10 On the MX40, wait for the New_Device label to change to the selected equipment label.

11 Confirm the label assignment by viewing the waveform in the Patient Sector at the Information Center.

Equipment Label Character Limitations

Equipment labels are limited to a maximum of 10 bytes. If the equipment label exceeds the 10 byte maximum, the label assignment process will fail.

- UTF-8 encoded characters may use 1-4 bytes depending on the language. (http://en.wikipedia.org/wiki/UTF-8)
- The first 128 Unicode characters (which corresponds directly to the ASCII character set) take only 1 byte.
  - Example: Tele1 (English) is 5 bytes long.
- If you use special characters, more bytes are required.

Refer to the table below for character limit information:

Language	Bytes per Character	Special Characters Tested
Chinese(Simplified)	3	说汉语
Chinese(Traditional)	3	□□□
Czech	2	ťůýžáčď'éěíň
Danish	2	åæéø
Dutch	2	éëïóöü
English	1	
Finnish	2	äåö
French	2	äåöùûüÿâçéèêëïôœ
German	2	äöüß
Greek	2	ΑαΒβΓγΔδΕεΖζΗηΘθΙιΚκΛλΜμΝνΞξΟοΠπΡρΣσςΤτΥυΦφΧχΨψΩω
Hungarian	2	áéíöóőúű
Italian	2	àèéòóù
Japanese	3	下かうう
Norwegian	2	åæâéèêøóòô
Polish	2	ąćęłńóśźż
Portuguese	2	úüãáâàçéêíõóô
Romania	2	ăâîşşţţ
Russian	2	ёяшертыуиопющъэасдфгчйкльжзхцвбнм
Spanish	2	áéíñóúü¡
Swedish	2	äåéö

Clinical Configuration

Most of the clinical configuration of the MX40 is done in the Information Center; however, several parameters can only be changed through the user interface at the MX40. These parameters are covered in Chapter 4 – Configuration Mode.

It is also possible to copy the clinical configuration from one MX40 to another one using the IntelliVue Support Tool – Mark2. See the IntelliVue Support Tool Instructions for Use for details.

Frequency Management and Channel Selection

Management of the RF environment in a facility is important to the overall performance of any wireless system. Philips cannot control what wireless devices are used in a hospital, but Philips or an authorized service provider will work with the hospital to select the best frequencies to use in order to avoid interference with other wireless devices used within the hospital.

Frequency Management

Frequency management is the selection of frequencies for wireless devices within a facility to prevent interference between devices.

Frequency Management Responsibility

Frequency management is the responsibility of the hospital. Philips has no control over the RF environment in a hospital. If interference exists at the operating frequencies, system performance will be affected. Careful selection of frequencies for all wireless devices used within a hospital is important to prevent interference between them.

Channel Selection

The MX40 has two radios – a wireless network radio (865350–1.4 GHz Smart-hopping, 865351-2.4 GHz Smart-hopping or 865352–802.11 a/b/g) and a short-range radio (optional).

Channel selection for each product (865350, 865351, 865352) is different, therefore they will be discussed separately.

865350 - Channel Selection

WMTS (1.4 GHz) Smart-hopping Channel Selection

The MX40 (865350) operates in the FCC-allocated, protected Wireless Medical Telemetry Service (WMTS) in the 1395-1400 and 1427-1432 MHz bands.

Note — Per U.S. Federal Communications Commission (FCC) rules (Section 95.1111), operation of WMTS equipment requires device registration with an authorized Frequency Coordinator designated by the FCC before the equipment is commissioned. The American Society for Healthcare Engineering (ASHE) is the current designated Frequency Coordinator.

The Smart-hopping channels that can be used, will be determined by this coordination process. A minimum of three Smart-hopping channels is required for proper operation of the system, but using more channels will improve performance. Smart-hopping channels are configured in the Access Point Controller.

Frequency Coordination (USA, WMTS only)

Frequency coordination is a registration and coordination process for wireless medical telemetry devices used in the U.S.A. which operate in the FCC-allocated, protected Wireless Medical Telemetry Service (WMTS) bands (608-614 MHz, 1395-1400 MHz, 1427-1432 MHz).

Registration/Coordination is a two-step process.

Step 1: Registration: The healthcare facility must register with ASHE (http://www.ashe.org/resources/WMTS/onlineregistration.html). Registration confirmation must be received before proceeding to the next step.

Step 2: Frequency Coordination: After confirmation of registration, frequency coordination can begin. This step involves logging the equipment and frequencies used into the FCC's database, so as to identify any existing potential interference and to help prevent potential future interference. Frequency coordination is accomplished via the ASHE website provided above. The way the frequency coordination process is executed as of today, it will need to be repeated twice; once for 1395-1400 MHz band, and then again for the 1427-1432 MHz band, both of which are used concurrently by the Philips product. There is a separate fee for each coordination request.

To fill in the frequency coordination forms, you'll need to know the following:

- County
- Latitude and longitude that represents the center of the area where the transmitting devices will be deployed. Comsearch can help provide this information; www.comsearch.com.
- The name/s of the Clinical Unit/s using the devices (e.g. ICU4, CCU-West, ER1, Step-Down North, etc)
- The radius of deployment, expressed in meters. The radius can be determined by drawing an imaginary circle around the center of the clinical unit that encloses/encompasses the unit.
- The number of the highest floor on which a transmitting device will operate.

- The number of transmitting devices will be used, i.e. the total number of MX40 devices, wireless bedsides, Access Points and Remote Antennas, etc. combined.
- The Effective Radiating Power: 6.3 mW.
- The Equipment Manufacturer: Philips Medical Systems.
- The Equipment Models: MX40, etc.
- The Frequency Range to be used: Two separate coordination submissions are required: For the first one, click on the range of 1395.0 through 1400.0 MHz. For the second one, click on all the frequency ranges listed in the range of 1427.0 through 1432.0 MHz.

1.4GHz Smart-hopping Channel Definition

1.4GHz Smart-hopping Channel Definition - Standard

Primary	Low	Center	High
Channel 1:	1395.0977MHz	1395.8977MHz	1396.6977MHz
Channel 2:	1396.6970MHz	1397.4970MHz	1398.2970MHz
Channel 3:	1398.2963MHz	1399.0963MHz	1399.8963MHz
Channel 4:	1427.0979MHz	1427.8979MHz	1428.6979MHz
Secondary	**Low**	**Center**	**High**
*Channel 5:	1428.6972MHz	1429.4972MHz	1430.2972MHz
*Channel 6:	1430.2965MHz	1431.0965MHz	1431.8965MHz

1.4GHz Smart-hopping Channel Definition - Carved-out Areas*

Primary	Low	Center	High
Channel 1:	1395.0977MHz	1395.8977MHz	1396.6977MHz
Channel 2:	1396.6970MHz	1397.4970MHz	1398.2970MHz
Channel 3:	1398.2963MHz	1399.0963MHz	1399.8963MHz
Channel 4a:	1429.4410MHz	1430.2410MHz	1431.0410MHz
Secondary	**Low**	**Center**	**High**
*Channel 4:	1427.0979MHz	1427.8979MHz	1428.6979MHz

*Carved-out areas apply to:

Location	Counties
Pittsburgh, PA	Allegheny, Beaver, Butler, Washington, Westmoreland

Location	Counties
Washington, DC	Arlington, Fairfax, Loudoun, Prince William, Montgomery, Charles, Prince George's, and Fauquier counties; cities of Alexandria, Fairfax, Falls Church, Manassas, Manassas Park and the District of Columbia
Richmond - Norfolk, VA	Chesterfield, Goochland, Hanover, Henrico, Powhatan, Charles City, Dinwiddie, Isle of Wight, James City, New Kent, Prince George, Southhampton, Surrey, Sussex, and York counties; cities of Richmond, Norfolk, Newport News, Hampton, Virginia Beach, Chesapeake, Portsmouth, Suffolk, Colonial Heights, Franklin, Hopewell, Petersburg, Poquoson, and Williamsburg
Austin - Georgetown, TX	Williamson and Travis
Battle Creek, MI	Calhoun
Detroit, MI	Oakland, Wayne, Washtenaw, Macomb, Livingston
Spokane, WA	Spokane, WA and Kootenia, ID

865350 - Short-range Radio (SRR) Channel Selection

SRR with Cableless Measurements (Telemetry Use Model) – The SRR channels are configured in the Information Center. Configure 2-4 channels as "High" and the rest "Off". The MX40 will select the best channel to use from those channels configured as "High".

SRR with IntelliVue monitor (Bedside Use Model – WTAAP) – One SRR channel is configured in the bedside monitor. This is the channel the bedside will use to communicate with the MX40 and any Cableless Measurement pods. Select the best channel based on the interference level at the location where the bedside will be used.

Warning

The short-range radio operates in the 2.4 GHz band. Short-range radio connections are subject to interruption due to interference from other radio sources in the vicinity, including microwaves, Bluetooth devices, and DECT phones. The most likely interference will come from 802.11b, g wireless LANs.

In order to reduce the chances of interference, the Short Range Radio channels should be chosen to operate at frequencies that avoid any 802.11 b/g channels that are in use in the hospital.

In order to assist with this, recommendations for SRR channels based on possible 802.11 b/g WLAN channel deployments in the 2.4 GHz band are given in the table below.

For example, if the hospital has an 802.11 deployment using 802.11 channels 1, 6, and 11, using the table below, short-range radio channels 25, 26, 15, and 20 are recommended. Using the diagram below to illustrate, SRR channel 15 operates between 802.11 channels 1 and 6, SRR channel 20 operates between 802.11 channels 6 and 11 and SRR channels 25 and 26 operate above 802.11 channel 11, thus minimizing interference with the WLAN that is deployed.

The table below also lists some short-range radio channels that may be used if a frequency survey is performed and a power level check is done to ensure that the frequency is "clear" (has a power level < -80dBm).

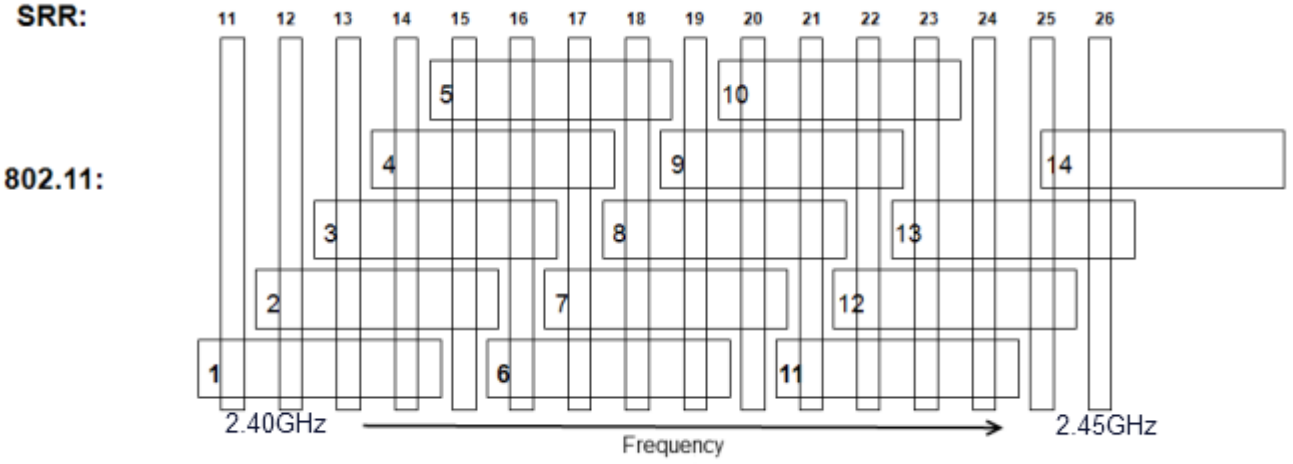
Note — Channel overlap as show in the diagram below is not totally accurate. There is not sufficient resolution to pick channels solely by using this diagram. Use it in conjunction with the table provided.

SRR Channel Recommendations for 865350 Installations.

802.11 b/g Channel Deployment	Short-range Radio Channel Recommendations
1, 6, 11	25, 26, 15, 20
1, 4, 7, 11	25, 26, 11*, 20*, 21*, 24*
1, 4, 8, 11	25, 26, 11*, 17*, 18*, 24*

**Requires RF frequency survey and RF power level check for clear channels. Clear SRR channels have a power level < -80 dBm.*

Channel Comparison - SRR and 802.11 b,g Channels



865351 Channel Selection

For 2.4 GHz Smart-hopping networks, both the Smart-hopping radio and the short-range radio operate in the 2.4 GHz band, and therefore are subject to interference from other devices that operate in this band like 802.11 b/g wireless LANs, microwave ovens, Bluetooth radios, etc. The most likely interference will come from 802.11 b/g wireless LANs.

In order to reduce the chances of interference, the Smart-hopping and short-range radio channels should be chosen to operate at frequencies that avoid any 802.11 b/g channels that are in use in the hospital.

In addition, if the short-range radio will be used, interference between the Smart-hopping radio and short-range radio must be avoided by separating these channels by a minimum of 5 MHz.

In order to assist with this, recommendations for Smart-hopping channels and SRR channels based on possible 802.11 b/g WLAN channel deployments in the 2.4 GHz band are given in the tables that follow.

2.4 GHz Smart-hopping Channel Selection

A minimum of three Smart-hopping channels is required for operation of the system, but Philips strongly recommends selecting the maximum of six channels in order to improve performance.

For example, if a 2.4GHz Smart-hopping network is being deployed without the short-range radio in a hospital with an 802.11 deployment of channels 1, 6 and 11, the best Smart-hopping channels to use would be the channels listed as "Primary" in the table, "802.11 b/g Channel Deployment 1, 6, 11", under "Option 1". This would be Smart-hopping channels 13, 14, 28, 42, 43, 44, 45, 46, 47. The best six of these Smart-hopping channels across the whole coverage area should be selected. A clear Smart-hopping channel is defined as having a power level of < -90dBm.

Using the diagram below to illustrate, Smart-hopping channels 13 and 14 operate between 802.11 channels 1 and 6, Smart-hopping channel 28 operates between 802.11 channels 6 and 11 and Smart-hopping channels 42, 43, 44, 45, 46 and 47 operate above 802.11 channel 11, thus minimizing interference with the WLAN that is deployed.

865351 Short-range Radio (SRR) Channel Selection

SRR with Cableless Measurements (Telemetry Use Model) – The SRR channels are configured in the Information Center. Configure 2-4 channels as "High" and the rest "Off". The MX40 will select the best channel to use from those channels configured as "High".

SRR with IntelliVue monitor (Bedside Use Model – WTAAP) – One SRR channel is configured in the bedside monitor. This is the channel the bedside will use to communicate with the MX40 and any Cableless Measurement pods. Select the best channel based on the interference level at the location where the bedside will be used.

Warning

The Smart-hopping and short-range radios operate in the 2.4 GHz band. Radio connections are subject to interruption due to interference from other radio sources in the vicinity, including microwaves, Bluetooth devices, and DECT phones. The most likely interference will come from 802.11 b/g wireless LANs.

Smart-hopping and SRR Channel Selection for 2.4GHz Smart-hopping Networks

If a 2.4 GHz Smart-hopping network is being deployed with the short-range radio in a hospital with an 802.11 deployment of channels 1, 6 and 11, a number of different deployment options are given in the table. The clearest frequencies should be assigned to the short-range radio, and then the Smart-hopping channels can be assigned.

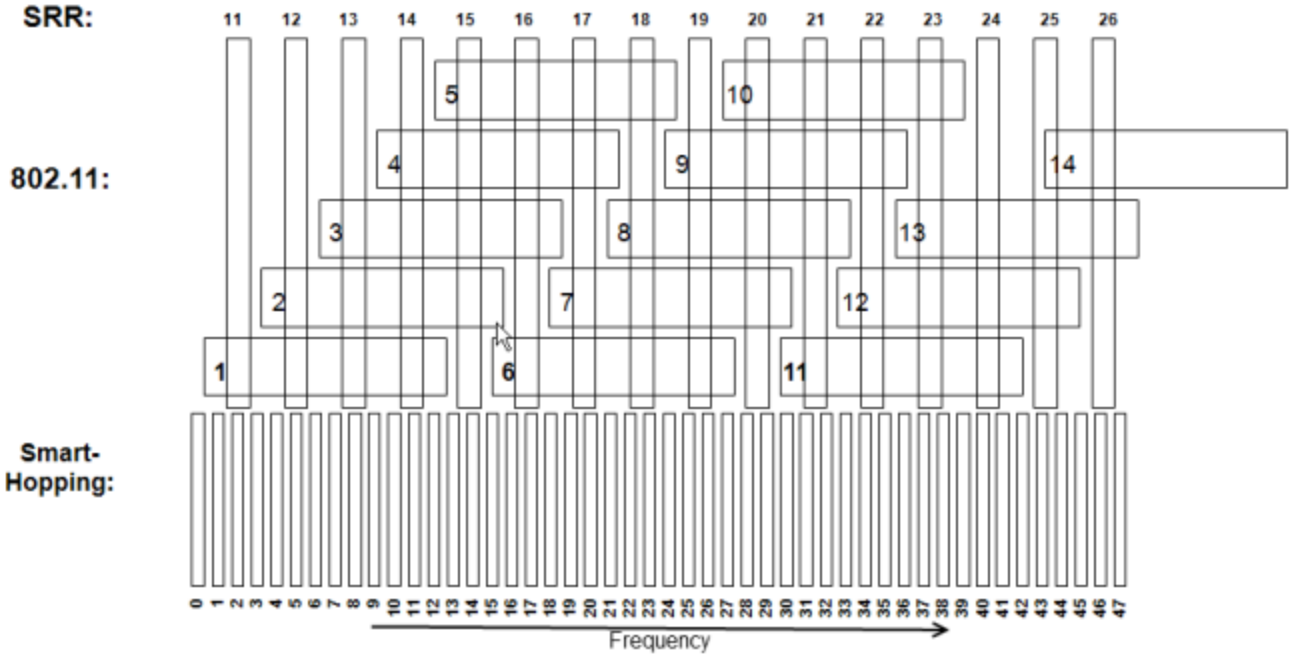
So if short-range radio (SRR) channels 25 and 26 are selected, then the best Smart-hopping channels to use would be the channels listed as "Primary" in the table, "802.11 b/g Channel Deployment 1, 6, 11", under "Option 2". This would be Smart-hopping channels – 13, 14, 28. Channels 42, 43, 44, 45, 46, 47 should not be used because they will interfere with the short-range radio. In addition to these three Smart-hopping channels, the best three channels of the "Secondary" (0 if allowed, 29) and "Tertiary" (12, 15, 27) channels listed should be selected.

Using the diagram again, short-range radio channels 25 and 26 operate above 802.11 channel 11. This leaves the frequencies between 802.11 channels 1 and 6 (Smart-hopping channels 12, 13, 14 and 15) and the frequencies between 802.11 channels 6 and 11 (27, 28 and 29) as possibilities for the Smart-hopping channels.

In these deployments, it is unlikely that all of the channels will be clear throughout the coverage area. A frequency survey is suggested to determine the best channels to use.

- A "clear" short range radio channel is defined as having a power level < -80dBm.
- A "clear" Smart-hopping channel is defined as having a power level < -90dBm.

Channel Comparison - SRR and 802.11 b,g Channels



Note — Channel overlap as shown in the diagram is not totally accurate. There is not sufficient resolution to pick channels solely by using this diagram. Use it in conjunction with the tables provided.

802.11 b/g Channel 1,6,11 Deployment

802.11 b/g Channel Deployment 1, 6, 11					
			FCC, RSS-210 Rules	ARIB Rules	ETSI, AUS/AZ Rules
			Canada, China, Hong Kong , Singapore, Taiwan, USA	Japan	All other countries
OPTION 1		SRR	None	None	None
	Smart-hopping Channels	Primary	13, 14, 28, 42, 43, 44, 45, 46, 47	13, 14, 28, 42, 43, 44, 45, 46, 47	13, 14, 28, 42, 43, 44, 45, 46
		Secondary*	0, 29	29	29
		Tertiary*	12, 15, 27, 41	12, 15, 27, 41	12, 15, 27, 41
OPTION 2		SRR	25, 26	25, 26	25, 26
	Smart-hopping Channels	Primary	13, 14, 28	13, 14, 28	13, 14, 28
		Secondary*	0, 29	29	29
		Tertiary*	12, 15, 27	12, 15, 27	12, 15, 27
OPTION 3		SRR	25, 26, 24*, 11*	25, 26, 24*, 11*	25, 26, 24*, 11*
	Smart-hopping Channels	Primary	13, 14, 28	13, 14, 28	13, 14, 28
		Secondary*	29	29	29
		Tertiary*	**12, 15, 27**	**12, 15, 27**	**12, 15, 27**
OPTION 4		SRR	15, 20	15, 20	15, 20
	Smart-hopping Channels	Primary	42, 43, 44, 45, 46, 47	42, 43, 44, 45, 46, 47	42, 43, 44, 45, 46
		Secondary*	0	None	None
		Tertiary*	1, 41	1, 41	1, 41

**Requires RF Frequency Survey and RF Power Level Check for clear channels. Clear SRR channels have a power level < -80dB. Clear Smart-hopping channels have a power level < -90dBm.*

802.11 b/g Channel 1,4,7,11 Deployment

802.11 b/g Channel Deployment 1, 4, 7, 11					
			FCC, RSS-210 Rules	ARIB Rules	ETSI, AUS/AZ Rules
			Canada, China, Hong Kong , Singapore, Taiwan, USA	Japan	All other countries
OPTION 1		SRR	None	None	None
	Smart-hopping Channels	Primary	0, 42, 43, 44, 45, 46, 47	42, 43, 44, 45, 46, 47	42, 43, 44, 45, 46
		Secondary*	1, 29, 30, 41	1, 29, 30, 41	1, 29, 30, 41
		Tertiary*	10, 11, 19, 20	10, 11, 19, 20	10, 11, 19, 20
OPTION 2		SRR	20*, 21*	20*, 21*	20*, 21*
	Smart-hopping Channels	Primary	0, 42, 43, 44, 45, 46, 47	42, 43, 44, 45, 46, 47	42, 43, 44, 45, 46
		Secondary*	1	1	1
		Tertiary*	10, 11, 19, 20	10, 11, 19, 20	10, 11, 19, 20
OPTION 3		SRR	11*, 20*, 21*	11*, 20*, 21*	11*, 20*, 21*
	Smart-hopping Channels	Primary	42, 43, 44, 45, 46, 47	42, 43, 44, 45, 46, 47	42, 43, 44, 45, 46
		Secondary*	10, 11, 19, 20	10, 11, 19, 20	10, 11, 19, 20
		Tertiary*	None	None	None

**Requires RF Frequency Survey and RF Power Level Check for clear channels. Clear SRR channels have a power level < -80dB. Clear Smart-hopping channels have a power level < -90dBm.*

802.11 b/g Channel 1,4,8,11 Deployment

802.11 b/g Channel Deployment 1, 4, 8, 11					
			FCC, RSS-210 Rules	ARIB Rules	ETSI, AUS/AZ Rules
			Canada, China, Hong Kong , Singapore, Taiwan, USA	Japan	All other countries
OPTION 1		SRR	None	None	None
	Smart-hopping Channels	Primary	0, 42, 43, 44, 45 46, 47	42, 43, 44, 45 46, 47	42, 43, 44, 45 46
		Secondary*	1, 20, 21, 41	1, 20, 21, 41	1, 20, 21, 41
		Tertiary*	10, 11, 30, 31, 32	10, 11, 30, 31, 32	10, 11, 30, 31, 32
OPTION 2		SRR	17*, 18*	17*, 18*	17*, 18*
	Smart-hopping Channels	Primary	0, 42, 43, 44, 45 46, 47	42, 43, 44, 45 46, 47	42, 43, 44, 45 46
		Secondary*	1, 41	1, 41	1, 41
		Tertiary*	10, 11, 30, 31, 32	10, 11, 30, 31, 32	10, 11, 30, 31, 32
OPTION 3		SRR	11*, 17*, 18*	11*, 17*, 18*	11*, 17*, 18*
	Smart-hopping Channels	Primary	42, 43, 44, 45 46, 47	42, 43, 44, 45 46, 47	42, 43, 44, 45 46
		Secondary*	41	41	41
		Tertiary*	10, 11, 30, 31, 32	10, 11, 30, 31, 32	10, 11, 30, 31, 32

**Requires RF Frequency Survey and RF Power Level Check for clear channels. Clear SRR channels have a power level < ˉ80dB. Clear Smart-hopping channels have a power level < ˉ90dBm.*

802.11 b/g Channel 1,7,13 Deployment

802.11 b/g Channel Deployment 1, 7, 13					
			FCC, RSS-210 Rules	ARIB Rules	ETSI, AUS/AZ Rules
			Canada, China, Hong Kong , Singapore, Taiwan, USA	Japan	All other countries
OPTION 1		SRR	Not Applicable	None	None
	Smart-hopping Channels	Primary	Not Applicable	13, 14, 15, 16, 17, 31, 32, 33, 34	13, 14, 15, 16, 17, 31, 32, 33, 34
		Secondary*	Not Applicable	30	30
		Tertiary*	Not Applicable	12, 18, 35, 47	12, 18, 35
OPTION 2		SRR	Not Applicable	15, 16	15, 16
	Smart-hopping Channels	Primary	Not Applicable	31, 32, 33, 34	31, 32, 33, 34
		Secondary*	Not Applicable	30	30
		Tertiary*	Not Applicable	35, 47	35
OPTION 3		SRR	Not Applicable	21, 22	21, 22
	Smart-hopping Channels	Primary	Not Applicable	13, 14, 15, 16, 17	13, 14, 15, 16, 17
		Secondary*	Not Applicable	None	None
		Tertiary*	Not Applicable	12, 18, 47	12, 18

**Requires RF Frequency Survey and RF Power Level Check for clear channels. Clear SRR channels have a power level < -80dB. Clear Smart-hopping channels have a power level < -90dBm.*

802.11 b/g Channel 1,5,9,13 Deployment

802.11 b/g Channel Deployment 1, 5, 9, 13					
			FCC, RSS-210 Rules	ARIB Rules	ETSI, AUS/AZ Rules
			Canada, China, Hong Kong , Singapore, Taiwan, USA	Japan	All other countries
OPTION 1		SRR	Not Applicable	None	None
	Smart-hopping Channels	Primary	Not Applicable	None	None
		Secondary*	Not Applicable	12, 24, 35, 47	12, 24, 35
		Tertiary*	Not Applicable	1, 11, 13, 23, 25, 34, 36, 46	1, 11, 13, 23, 25, 34, 36, 46
OPTION 2		SRR	Not Applicable	11*, 26*	11*, 26*
	Smart-hopping Channels	Primary	Not Applicable	None	None
		Secondary*	Not Applicable	12, 24, 35	12, 24, 35
		Tertiary*	Not Applicable	11, 13, 23, 25, 34, 36	11, 13, 23, 25, 34, 36
OPTION 3		SRR	Not Applicable	11*, 14*, 15*, 26*	11*, 14*, 15*, 26*
	Smart-hopping Channels	Primary	Not Applicable	None	None
		Secondary*	Not Applicable	24, 35	24, 35
		Tertiary*	Not Applicable	23, 25, 34, 36	23, 25, 34, 36
OPTION 4		SRR	Not Applicable	11*, 18*, 19*, 26*	11*, 18*, 19*, 26*
	Smart-hopping Channels	Primary	Not Applicable	None	None
		Secondary*	Not Applicable	12, 35	12, 35
		Tertiary*	Not Applicable	11, 13, 34, 36	11, 13, 34, 36
OPTION 3		SRR	Not Applicable	11*, 22*, 23*, 26*	11*, 22*, 23*, 26*
	Smart-hopping Channels	Primary	Not Applicable	None	None
		Secondary*	Not Applicable	12, 24	12, 24
		Tertiary*	Not Applicable	11, 13, 23, 25	11, 13, 23, 25

**Requires RF Frequency Survey and RF Power Level Check for clear channels. Clear SRR channels have a power level < ˉ80dB. Clear Smart-hopping channels have a power level < ˉ90dBm.*

802.11 b/g Channel 2,7,12 Deployment

802.11 b/g Channel Deployment 2, 7, 12					
			FCC, RSS-210 Rules	ARIB Rules	ETSI, AUS/AZ Rules
			Canada, China, Hong Kong , Singapore, Taiwan, USA	Japan	All other countries
OPTION 1		SRR	Not Applicable	None	None
	Smart-hopping Channels	Primary	Not Applicable	1, 2, 16, 17, 30, 31, 45, 46, 47	1, 2, 16, 17, 30, 31, 45, 46
		Secondary*	Not Applicable	None	None
		Tertiary*	Not Applicable	None	None
OPTION 2		SRR	Not Applicable	11, 21	11, 21
	Smart-hopping Channels	Primary	Not Applicable	16, 17, 45, 46, 47	16, 17, 45, 46
		Secondary*	Not Applicable	None	None
		Tertiary*	Not Applicable	15, 18, 44	15, 18, 44
OPTION 3		SRR	Not Applicable	11, 12*, 20*, 21, 22*	11, 12*, 20*, 21, 22*
	Smart-hopping Channels	Primary	Not Applicable	16, 17, 45, 46, 47	16, 17, 45, 46
		Secondary*	Not Applicable	None	None
		Tertiary*	Not Applicable	15, 18, 44	15, 18, 44

**Requires RF Frequency Survey and RF Power Level Check for clear channels. Clear SRR channels have a power level < -80dB. Clear Smart-hopping channels have a power level < -90dBm.*

802.11 b/g Channel 1,6,11,14 Deployment

802.11 b/g Channel Deployment 1, 6, 11, 14					
			FCC, RSS-210 Rules	ARIB Rules	ETSI, AUS/AZ Rules
			Canada, China, Hong Kong , Singapore, Taiwan, USA	Japan	All other countries
OPTION 1		SRR	Not Applicable	None	Not Applicable
	Smart-hopping Channels	Primary	Not Applicable	13, 14, 28	Not Applicable
		Secondary*	Not Applicable	29	Not Applicable
		Tertiary*	Not Applicable	12, 15, 27, 41, 42	Not Applicable
OPTION 2		SRR	Not Applicable	11*, 20	Not Applicable
	Smart-hopping Channels	Primary	Not Applicable	13, 14	Not Applicable
		Secondary*	Not Applicable	None	Not Applicable
		Tertiary*	Not Applicable	12, 15, 41, 42	Not Applicable
OPTION 3		SRR	Not Applicable	11*, 19*, 20, 21*	Not Applicable
	Smart-hopping Channels	Primary	Not Applicable	13, 14	Not Applicable
		Secondary*	Not Applicable	None	Not Applicable
		Tertiary*	Not Applicable	12, 15, 41, 42	Not Applicable

**Requires RF Frequency Survey and RF Power Level Check for clear channels. Clear SRR channels have a power level < -80dB. Clear Smart-hopping channels have a power level < -90dBm.*

802.11 b/g Channel 3,10,14 Deployment

802.11 b/g Channel Deployment 3, 10, 14					
			FCC, RSS-210 Rules	ARIB Rules	ETSI, AUS/AZ Rules
			Canada, China, Hong Kong , Singapore, Taiwan, USA	Japan	All other countries
OPTION 1		SRR	Not Applicable	None	Not Applicable
	Smart-hopping Channels	Primary	Not Applicable	1, 2, 3, 4, 5, 19, 20, 21, 22, 23, 24, 25, 26, 39, 40, 41	Not Applicable
		Secondary*	Not Applicable	None	Not Applicable
		Tertiary*	Not Applicable	None	Not Applicable
OPTION 2		SRR	Not Applicable	17, 18, 19	Not Applicable
	Smart-hopping Channels	Primary	Not Applicable	1, 2, 3, 4, 5, 39, 40, 41	Not Applicable
		Secondary*	Not Applicable	None	Not Applicable
		Tertiary*	Not Applicable	None	Not Applicable

**Requires RF Frequency Survey and RF Power Level Check for clear channels. Clear SRR channels have a power level < ˉ80dB. Clear Smart-hopping channels have a power level < ˉ90dBm.*

865352 - Channel Selection

802.11 Channel Selection

802.11 channel selection is done by the hospital. Due to the limited number of channels in the 2.4 GHz band, lower capacity, and higher number of native interferers, use of the 802.11a band is highly recommended.

865352 Short-range Radio (SRR) Channel Selection

SRR with Cableless Measurements (Telemetry Use Model) – The SRR channels are configured in the Information Center. Configure 2-4 channels as "High" and the rest "Off". The MX40 will select the best channel to use from those channels configured as "High".

SRR with IntelliVue monitor (Bedside Use Model – WTAAP) – One SRR channel is configured in the bedside monitor. This is the channel the bedside will use to communicate with the MX40 and any Cableless Measurement pods. Select the best channel based on the interference level at the location where the bedside will be used.

Warning

The short-range radio operates in the 2.4 GHz band. Short-range radio connections are subject to interruption due to interference from other radio sources in the vicinity, including microwaves, Bluetooth devices, and DECT phones.

The most likely interference will come from 802.11b, g wireless LANs.

The 802.11 version of the MX40 may only be used with short-range radio when the wireless network radio is operating in the 802.11a (5.6 GHz) band.

In order to reduce the chances of interference, the Short Range Radio channels should be chosen to operate at frequencies that avoid any 802.11 b/g channels that are in use in the hospital.

In order to assist with this, recommendations for SRR channels based on possible 802.11 b/g WLAN channel deployments in the 2.4 GHz band are given in the table below.

For example, if the hospital has an 802.11 deployment using 802.11 channels 1, 6, and 11, using the table below, short-range radio channels 25, 26, 15, and 20 are recommended. Using the diagram below as illustration, SRR channel 15 operates between 802.11 channels 1 and 6, SRR channel 20 operates between 802.11 channels 6 and 11 and SRR channels 25 and 26 operate above 802.11 channel 11, thus minimizing interference with the WLAN that is deployed.

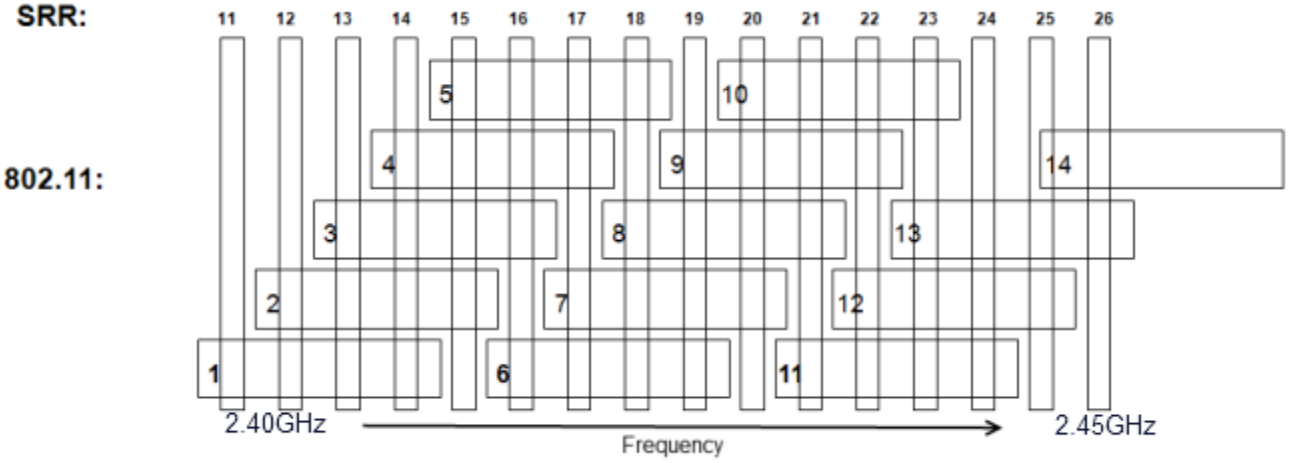
The table below also lists some short-range radio channels that may be used if a frequency survey is performed and a power level check is done to ensure that the frequency is "clear" (has a power level < -80dBm).

SRR Channel Recommendations for 865352 Installations

802.11b/g (2.4 GHz) Channel Deployment	Short-range Radio Channel Recommendations
1,6,11	25, 26, 15, 20
1, 4, 7, 11	25, 26 11*, 20*, 21*, 24*
1, 4, 8, 11	25, 26 11*, 17*, 18*, 24*
1, 7, 13	15, 16, 21, 22
1, 5, 9, 13	12*, 13*, 16*, 17*, 20*, 21*, 24*, 25*
2, 7, 12	11, 16, 21, 26
1, 6, 11, 14	15, 20 25*
3, 10, 14	11, 12, 17, 18, 19, 24

**Requires RF frequency survey and RF power level check for clear channels. Clear SRR channels have a power level < -80 dBm.*

Channel Comparison - SRR and 802.11 b/g Channels

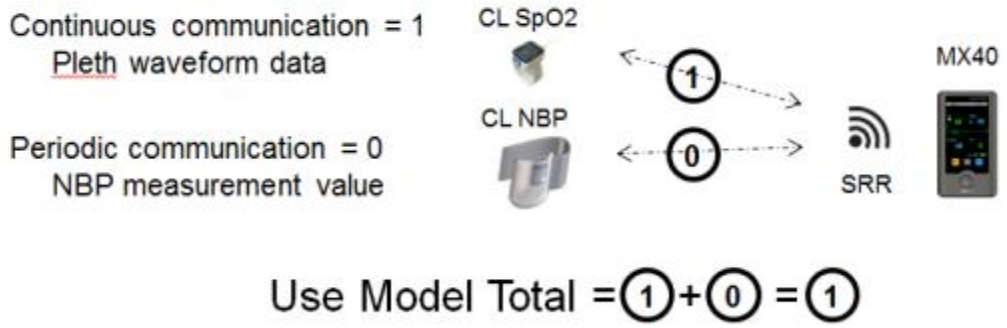


Short-range Radio Density

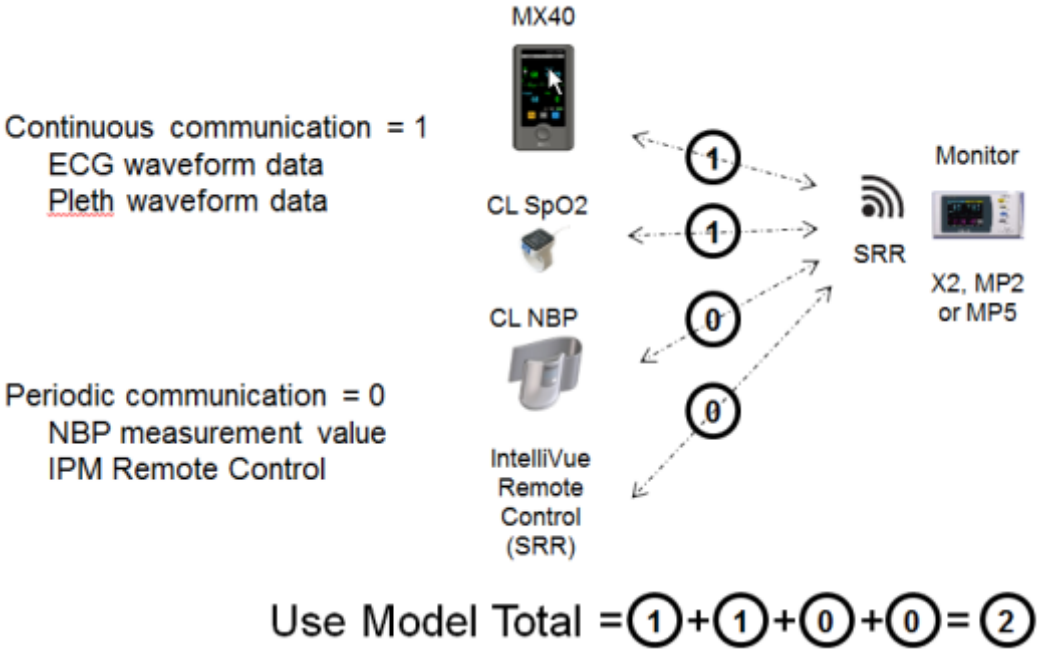
- A Short Range Radio cell is defined as a radius of 15ft (4.6m).
- A "Device Link" is defined by use model.

Device Density per SRR Channel	1.4GHz Smart-hopping Networks	2.4GHz Smart-hopping Networks
Maximum density of SRR Device Links in a single SRR cell	4 Device Links	3 Device Links

SRR with IntelliVue Cableless Measurements (Telemetry Use Model):



SRR with IntelliVue Monitor (Bedside Use Model):



3. Test and Inspection

This section covers Test and Inspection tasks to be performed to ensure the performance of the MX40 after all installation procedures are completed.

MX40 Test & Inspection Matrix

Test Block Name	Test or "Inspection" to Perform	What to Record on Service Record
Visual Test:	Inspect the MX40 (and packing material if applicable) for obvious signs of damage. Also check external leads and accessories. Expected Test Results: The device does not have any obvious signs of damage = Pass	**V:P** or **V:F** where **P**=Pass **F**=Fail
Power On:	Remove patient cable. Insert battery into the MX40. The MX40 will go through its self-test and pass. Make sure that an ECG wave appears on the screen and the battery gauge displays battery status. Check the INOP Area for any equipment malfunctions. The expected test result is pass: the MX40 boots up and displays an ECG wave and the battery gauge displays battery status. The wave will be a flat line if no simulator is attached. Expected Test Results: Expected answer is "yes". If so, Power On test is passed.	**PO:P** or **PO:F** where **P**=Pass **F**=Fail
Performance:	1. Insert battery into the MX40 for the channel being tested. 2. Attach a patient cable to the MX40 and an ECG simulator. 3. At the Information Center assign the MX40 being tested to a Sector. Ensure that the Multi-Function Button is turned "on", and turn on the SpO_2 parameter if the MX40 being tested has the SpO_2 option. Set the mode to Continuous. 4. An ECG waveform should be visible at the Information Center. 5. If the MX40 has the SpO_2 option, connect an SpO_2 sensor and apply the SpO_2 sensor to yourself. Confirm that the MX40 completes a successful measurement. 6 .Set the SpO_2 mode to the customer's desired setting, Continuous or Spot Check/Manual. 7. Place the device in Standby. At the Information Center, resume monitoring. 8. Press the Multi-Function Button on the MX40. The button press should generate one of the following, depending on the configured setting: • Nurse Call & Record - Nurse Call alarm and a recording generated at the Information Center. • Nurse Call Only - Nurse Call alarm at the Information Center. • Record Only - A recording generated at the Information Center. • Disabled - No event at the Information Center.	**P:P** or **P:F** where **P**=Pass **F**=Fail

Test Block Name	Test or "Inspection" to Perform	What to Record on Service Record
	9. If the MX40 has the short-range radio option, establish communication between the MX40 and either the patient monitor or a cableless measurement device, depending on the chosen use model. . If assigned to a patient monitor, an ECG waveform should be visible on the monitor. The display on the MX40 will be:  10. If assigned to a cableless measurement device, initiate a measurement and view it at the Information Center. Expected Test Results: Expected answer to all is "yes". If so, Performance test is passed.	
Revision Check:	Check the revision of the software/firmware in the Device Info. screen. Check the INOP Area for either an "SpO_2 Equip Malf" or "Resp Equip Malf" message which indicates an SpO_2 or Resp upgrade failure.The revision reported should match the revision loaded. You may also check the Status Log at the Information Center. Expected Test Results: Expected answer is "yes". If so, Revision Check test is passed.	**RC:P** or **RC:F** where **P**=Pass **F**=Fail

When to Perform Test Blocks

Service personnel should perform Test Blocks as identified in the following table.

Service Event **When performing...**	**Test Block(s) Required** **Complete these tests**
Installation	Visual, Power On, Performance
Repairs/Replacement	Visual, Power On, Performance
Upgrades	Revision Check
Preventive Maintenance	N/A ***Note —*** There are no preventive maintenance tests required.
All other Service Events	Perform all Test Blocks

4. Operating Modes

This section provides operation information about the MX40 when the device is in Monitoring Mode, Service Mode, Configuration Mode and Demo Mode.

Operating Modes
- Monitoring Mode (no password)
- Configuration Mode
  - Same password as IPM (71034)
  - Monitoring continues
- Service Mode
  - Same password as IPM (1345)
  - No monitoring possible
- Demo Mode
  - Same password as IPM (14432)
  - No monitoring possible

Configuration, Service and Demo mode operation indicated in status area, and on IIC

Monitoring Mode

Monitoring Mode is the normal operating mode of the MX40 and a password is not required.

Controls, Indicators and Connectors

This section describes the clinical controls of the IntelliVue MX40. These controls include buttons, display icons, visual and auditory indicators, ports, and safety labeling located on the front and back of the device.

MX40 Controls and Indicators

1. Patient Cable
2. Patient Information Area
3. Active Alarms Area
4. INOP Area
5. Measurement Area 1
6. Measurement Area 2
7. Waveform 1
8. Waveform 2
9. Radio/Network/Battery Status Area
10. Leads Off Status Area
11. Silence Alarms Button
12. SmartKeys Button
13. Main Screen Button
14. Multi-Function Button

Silence Alarm Button

Button	Function
	• Initiates a local silence/acknowledgment of all active alarms when enabled (IIC). • Initiates a global silence/acknowledgment of all active alarms when enabled (IIC iX). • Silences the "Find Device" sound. ***Note —*** Alarms at the MX40 can be silenced from the Information Center. When silenced from the Information Center, the alarm sound is not silenced at the Information Center until it receives feedback from the MX40. This may take several seconds.

SmartKeys Button

Button	Function
	Displays the SmartKey Menu on the touch screen.

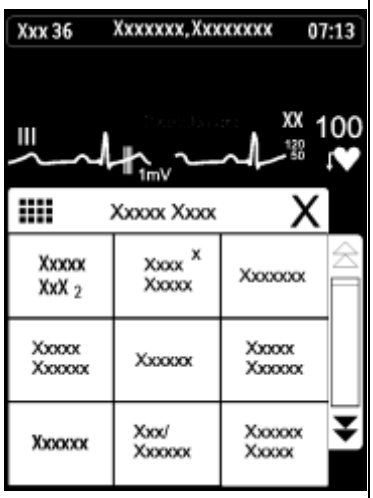
Main Screen Button

Button	Function
	• Activates the Touch Display if touched for two seconds. • Cycles through the display screens if touched repeatedly. • Resumes from Standby. • When pressed from a sub-menu, returns display to the Main Screen.

SmartKeys

The following table lists the SmartKeys available on the display of the MX40.

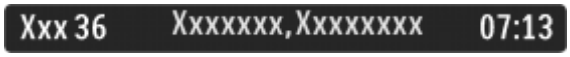
Note—gray text on a SmartKey signifies that the item is unavailable.

	SmartKey	Function
	Start SpO_2 ***Note —*** This SmartKey is unavailable when SpO_2 mode is continuous.	Starts a manual SpO_2 measurement.
	Delay Record	Starts a delayed recording at the Information Center.
	Alarms	Alarm Volume setting. Review of up to 50 previous alarm conditions (entries are stored during power cycle). Pause Alarms for configured time period (if enabled at the Information Center).
	Mode: Telemetry / Mode: Monitor	Toggles between modes. In Telemetry Mode, display and audio are off; in Monitor Mode, display and audio are always on.
	Standby	Puts the device into Standby locally and at the Information Center. Displays purchased/enabled product options. To resume from Standby, touch the Main Screen button.
	Add/Remove	Displays available monitors and IntelliVue Cableless Measurements to assign to via the short-range radio.
	Print Reports	Prints the pre-configured report as designated at the Information Center.
	Vitals Trends	View up to 24 hours of tabular trend data. One hour standard. 24 hours optional.
	Setup Screen	Determines time period that the display remains active after user interaction or whether the display is always On or always Off.
	Lock/Unlock	Locks/Unlocks the display.
	Op Mode	Selects either Monitoring, Demo, Config or Service modes.

Alarms Area

- The Alarm Area of the MX40 displays physiological alarms and technical alarms.
- A multiple alarm indicator (down arrow) is displayed when multiple alarm conditions are present and the alarm message rotates every 3 seconds.
- A check mark in front of the alarm text signifies that the alarm has been acknowledged by touching the Silence Alarms button.
- Alarm Indicators display in the Patient Information Area in place of the time clock when alarm/INOP conditions are present but have not been acknowledged.
- Touching the Alarms Area displays a list of all active alarms.
- The alarms paused icon communicates whether the alarm system is on/off.
- Local Alarm Audio is off when the alarm volume symbol is present next to the time..

Patient Information Area



The Patient Information Area displays the following information:

- Bed Label
- Patient Name (up to 15 characters will display)
- Time

Touching the Patient Information Area displays the **Patient Demogr.** menu which lists the following:

- Patient Name (Last, First, Middle)
- Lifetime ID
- Encounter ID
- Patient Category
- Paced Mode
- Height
- Weight
- Date of Birth
- Gender

Note — If you use an alternative ID, it will display at the Information Center and on printed reports. It will not display at the MX40.

Paced Status

	1. Pacing algorithm is on. 2. Pacing algorithm is off. 3. Pacing algorithm is on. Patient's paced status is unknown.

Display Lock

	The Lock symbol appears in the lower left of the display when the MX40 is in a locked state after five minutes of non-use. Locking the display provides additional protection against accidental patient access. The display is unlocked using the SmartKeys menu.

Status Area

	The status area of the MX40 displays short-range radio connection (optional) and system wireless connection status. You can also view battery strength for the type of battery used in the device, AA or rechargeable Li-on.

Multi-Function Button

Button	Function
	Depending on configuration at the Information Center: • generates a Nurse Call; • Initiates a Delayed Recording; • Both, or; • None ***Note —*** the Multi-Function Button does not operate when paired with an IntelliVue Patient Monitor via the short-range radio connection.

Operating and Navigating

The principle method of operating your MX40 is via the Touch Display. Almost every element on the display is interactive. Display elements include measurement numerics, information fields, alarm fields, waveforms, SmartKeys and menus.

Power-On Self Test

Once battery power is supplied, the MX40 performs a power-on self test to check operational status prior to start-up. Should a failure be detected, an INOP tone will sound and if possible, the appropriate INOP message for the failure will be communicated to the Information Center and displayed locally.

A successful power-on self test will then transition the MX40 to the start-up screen. Selectable background colors can be configured and display on the screen for assistance with device identification. This can be helpful when devices are in a pooled use setting.

If the MX40 enters a continuous "boot-up" cycle or the main display does not appear or update, ensure that you are using a freshly charged lithium-ion battery or new disposable batteries. If the batteries are fresh and the device reboots or does not update, remove the device from service and contact your service personnel.

You must visually check that a waveform is present on the display. You can access further status information is by touching the status area on the display.

Navigating

Touching the Navigation Bar on the right of the display will scroll through additional display items. Solid downward arrows indicate there are additional elements that are not currently displayed. The arrows briefly illuminate when touched. Your selection from the menu also illuminates when touched.

Selecting Display Elements

Touch a display element to get to the actions linked to that element. For example, touch the Patient Information element to call up the Patient Info window, or touch the HR numeric to call up the Setup ECG menu. Touch the ECG waveform to call up the wave selection menu.

Locking the Display

To provide additional protection against accidental patient access to the MX40, the display can be locked using the **Lock SmartKey**. When **Lock** is selected, the **SmartKey** menu automatically changes to the **Main Screen**. When **Unlock** is selected, you must close the **SmartKey** menu to return to the **Main Screen**.

The display automatically locks when there is no interaction for the configured time period (1-30 minutes with a default of 5 minutes).

Function	Display Locked / Active	Display Locked / Inactive	Display Unlocked / Active	Display Unlocked / Inactive
Display Touch	No	No	Yes	No
Main Screen Button	No	Yes	Yes	Yes
SmartKeys Button	Yes	No	Yes	No
Silence Button	No	No	Yes	No

Measurement Area

The measurement area of the MX40 display is optimized to show available parameter numerics, waveforms, and alarm limits. Each element is a touch object and when you select it, further controls and menus become available.

Measurement Area Display Configurations

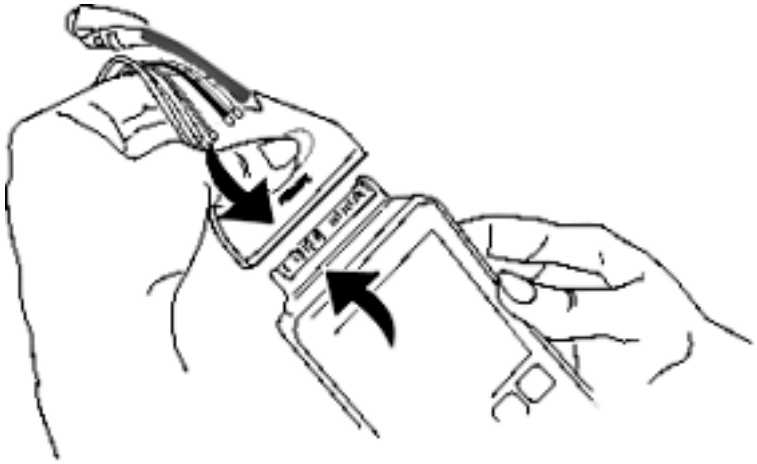
The display of your MX40 is configured/can operate in one of four available orientations:

- Portrait - No Waveforms and six Numerics (IIC iX only)
- Portrait - One Waveform and four Numerics

- Portrait - Two Waveforms and two Numerics (IIC Release N and IIC iX only)
- Landscape - Two Waveforms and three Numerics (IIC Release N and IIC iX only)
- Portrait - Viewable Chest Diagram and two Numerics

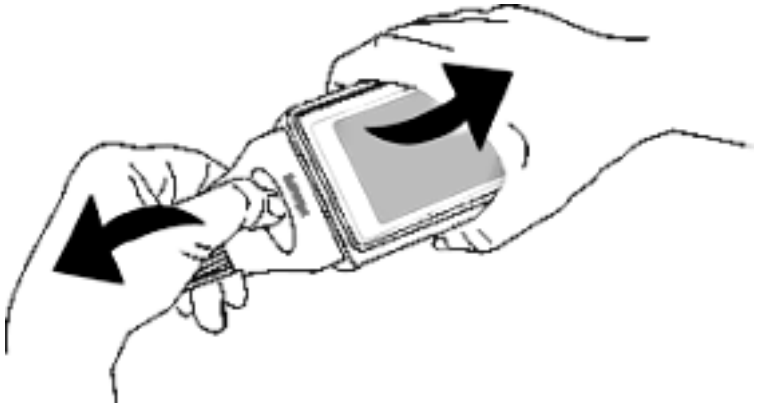
Connecting/Disconnecting the Patient Cable

The patient cable is connected to the MX40 as shown in the illustration below.

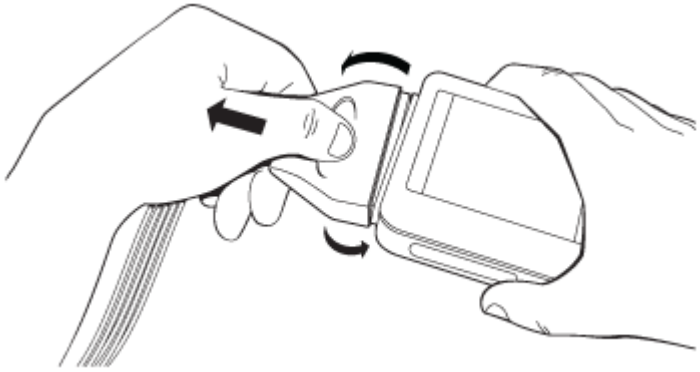


When connecting to the MX40, there is a slight clicking sound that signifies that the cable is securely connected.

Typically, the patient cable may be disconnected as shown below.



During initial use of the MX40, the secure connection between the patient cable and the device may be difficult to disconnect. Should this occur, use the alternative procedure shown below.



Caution

Never disconnect the patient cable by pulling on the leadwires, as this may damage wires over time.

Understanding Settings

Each aspect of how the MX40 works and looks is defined by a setting. There are a number of different categories of settings, including:

- Screen Settings - to define the selection and appearance of elements on each individual display screen.
- Measurement Settings - to define setting unique to each measurement, e.g. high and low alarm limits.
- Monitor Settings -including settings that affect more than one measurement or display screen, for example alarm volume and alarm pause time.

You must be aware that, although many settings can be changed during use, permanent changes to settings can only be done in Configuration Mode. All settings are restored to their default setting when the patient is discharged or the MX40 is powered off.

Changing Measurement Settings

Each measurement has a setup menu in which you can adjust its settings. You enter the setup menu by selecting the measurement numeric.

ECG Settings at the MX40

Setting	Description
Alarm Limits	Heart Rate alarm limits can be viewed locally at the MX40. Limits set at the Information Center (Release N or later or iX) are reflected at the MX40 when connected on the network.
Primary (used for arrhythmia analysis only) (Set at IIC Release N or IIC iX. View only.)	I, II, III, aVR, aVL, aVF, V1-V9, MCL, V3R, V4R, V5R. Available waveforms are based on lead set type. Lead II is the default.
Secondary (used for arrhythmia analysis only) (Set at IIC Release N or IIC iX. View only.)	I, II, III, aVR, aVL, aVF, V1-V9, MCL, V3R, V4R, V5R. Available waveforms are based on lead set type. Lead V is the default.
Paced Mode (Set at IIC Release N or IIC iX)	On, Off
Adjust Size	Set ECG gain to x1/2, x1, x2, x4
Arrhythmia	Initiate an Arrhythmia Relearn; View Arrhythmia Alarm Limits; Turn Arrhythmia Annotation On/Off.
Lead Placement	Set EASI, Standard
ECG	Set ECG On/Off
New Lead Setup	When IntelliVue Patient Monitor lead sets are in use, select 3-wire, or 5-wire.
Va Lead	Shows position of Va, or C1, electrodes. Choices are V1-V9, v3R, V4R, V5R.
Vb Lead	Shows position of Vb, or C2, electrodes. Choices are V1-V9, v3R, V4R, V5R.
Change Numeric	Selects parameter numeric to display in place of current HR numeric.

Waveform Settings at the MX40

Setting	Description
Wave 1	Primary, Secondary, I, II, III, aVR, aVL, aVF, V1-V9, MCL, V3R, V4R, V5R, Pleth (if SpO_2 is available), Resp (if Resp is available). Available waveforms are based on patient cable type. Lead II is the default. If Primary or Secondary are selected, then the waveform displayed is the waveform configured as primary or secondary for arrhythmia analysis.

Setting	Description
Wave 2	Primary, Secondary, I,II, III, aVR, aVL, aVF, V1-V9, MCL, V3R, V4R, V5R, Pleth (if SpO_2 is available), Resp (if Resp is available). Available waveforms are based on patient cable type. Lead V is the default. If Primary or Secondary are selected, then the waveform displayed is the waveform configured as primary or secondary for arrhythmia analysis.

Primary or secondary waveform configuration changes made at the Information Center change the MX40.

Battery Information

Battery Safety Information

Warnings

- The battery compartment door must be closed during defibrillation.
- Use the Philips Rechargeable Lithium-ion Battery or 3 Duracell Alkaline batteries, size AA, MN 1500, 1.5V, to ensure specified performance and correct battery gauge reporting. Outdated, mismatched, or poor-quality batteries can give unacceptable performance (e.g., insufficient Battery-Low warning time). If you are using disposable batteries, the use of fresh high-quality alkaline batteries is strongly recommended.
- Certain failure conditions, such as short circuits, can cause a battery to overheat during use. High temperatures can cause burns to the patient and/or user. If the MX40 becomes hot to the touch, remove it from the patient and place it aside until it cools. Then remove the batteries and discard them. Have the MX40 checked by your service provider to identify the cause of overheating.
- If you receive a TELE BATTERY LOW, TELE BATTERY EMPTY, REPLACE BATTERY T, or TELE BATTERY TEMP alarm, the batteries must be promptly replaced. If these conditions are not corrected, they will result in a device shutdown and cessation of monitoring.
- Disposable batteries should be removed from the MX40 at the end of the battery's useful life to prevent leakage.

  If battery leakage should occur, use caution in removing the battery. The leaked substance may cause eye or skin irritation. Avoid contact with skin. Clean the battery compartment according to the instructions in the Maintenance section. Wash hands.
- To eliminate the risk of electrical shock or burn, do not carry loose batteries on your person, e.g. in clothing pockets.

Cautions

- Use of AA Lithium batteries or batteries with terminal voltage >1.6V may cause damage to the device.
- When monitoring with the WLAN version of the MX40 (Model 865352), the lithium-ion rechargeable battery is the only approved power source. Use of AA disposable batteries is not supported.

Lithium-ion Rechargeable Battery Care

Care of the rechargeable battery begins when you receive a new battery for use and continues throughout the life of the battery. The table below lists battery care activities and when they should be performed.

Activity	When to Perform
Perform a visual inspection.	Before inserting a battery in the MX40.
Charge the battery.	Upon receipt, after use, or if a low battery state is indicated. To optimize performance, a fully (or almost fully) discharged battery should be charged as soon as possible.
Clean the battery	At each patient discharge, or in cases when the battery is exposed to contaminants.
Charge stored batteries to at least 90% of their capacity every six months.	When not in use for an extended period of time.
Decommission the battery	When any of the following INOPs are displayed on the MX40: **TELE SERVICE BATTERY** **TELE BATTERY TEMP**

Rechargeable batteries are charged using the IntelliVue CL Charging Station. For information on charging station use, see Charging Li-ion Rechargeable Batteries p. 5-8 .

Note — The battery capacity of rechargeable batteries degrades over time and number of recharge cycles. Toward the end of its useful life, the battery capacity may be reduced by 25-30%. If this reduced battery life is unacceptable based on your use model, Philips recommends replacing the rechargeable battery sooner.

Lithium-ion Rechargeable Battery Storage

When storing rechargeable batteries, make sure that the battery terminals do not come into contact with metallic objects or other conductive materials.

If batteries are stored for an extended period of time, they should be stored in a cool, dry place, ideally at 15°C (60°F), with a state of charge of 20% to 90%. Storing batteries in a cool place slows the aging process.

The batteries should not be stored at a temperature outside the range of -20°C (-4°F) to 50°C (122°F).

Stored batteries should be should be charged to at least 90% of their capacity every 6 months. They should be charged to full capacity prior to use.

Note — Storing batteries at temperatures above 38°C (100°F) for extended periods of time could significantly reduce the batteries' life expectancy.

Lithium-ion Rechargeable Battery Handling Precautions

Lithium-ion batteries store a large amount of energy in a small package. Use caution when handling the batteries; misuse or abuse could cause bodily injury and/or equipment damage.

- Do not short circuit - take care that the terminals do not contact metal (e.g. coins) or other conductive materials during transport and storage.
- Do not crush, drop or puncture - mechanical abuse can lead to internal damage and internal short circuits that may not be visible externally.
- Do not apply reverse polarity.
- Do not incinerate batteries or expose them to temperatures above 60°C (140°F).

If a battery has been dropped or banged against a hard surface, whether damage is visible externally or not:

- discontinue use.
- dispose of the battery in accordance with the disposal instructions.

Inserting/Removing Batteries

Warning

Arrhythmia relearning is initiated whenever the MX40's batteries are removed for one minute or longer. Be sure to check your patient's arrhythmia annotation for accuracy whenever relearn has occurred.

Caution

Remove the batteries before storing the MX40 for an extended period of time.

The battery compartment is located on the back of the MX40, accessible by opening the compartment door from the bottom. It accommodates three AA 1.5V Alkaline batteries or the Philips Rechargeable Lithium-ion battery. Only these batteries should be used.

Note— Lithium-ion batteries should be fully charged prior to first use.

Important— Do not use other rechargeable batteries. Use of this type of battery will adversely affect:

- Battery gauge performance
- Battery low warnings
- Battery life performance

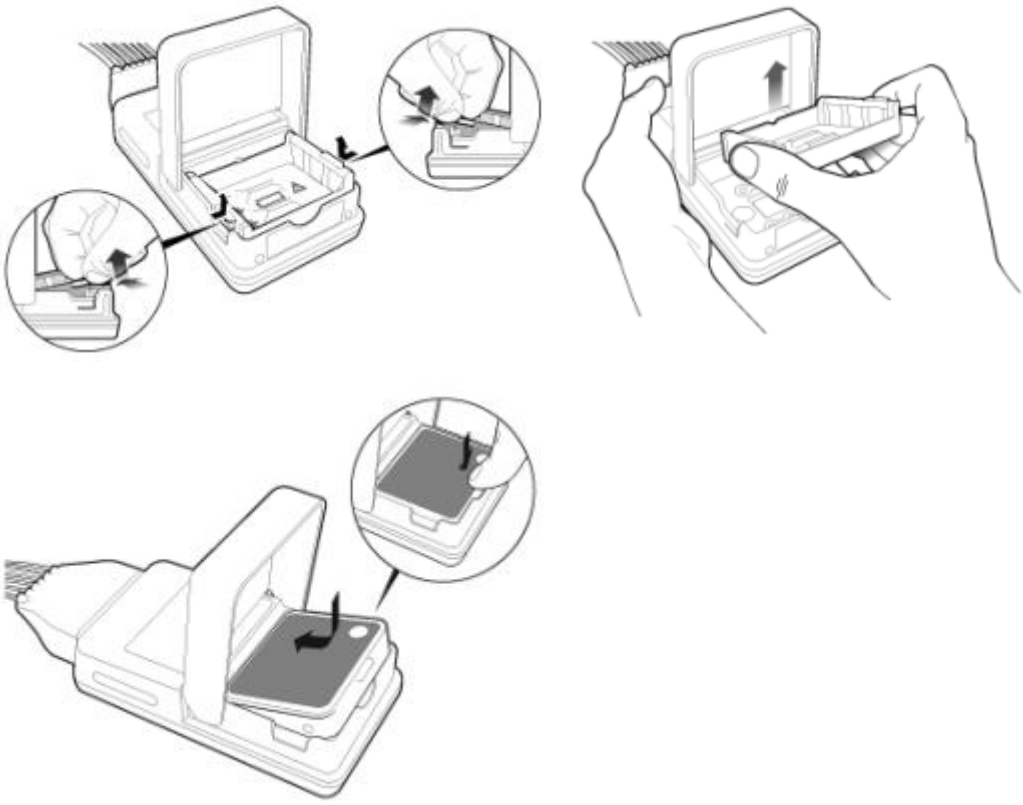
Inserting Batteries

➢ ***Insert the rechargeable lithium-ion battery using the following procedure:***

1 Open the battery compartment by lifting up on both bottom sides of the compartment door.

2 Remove the AA battery tray if present.

3 Insert the battery pack so that the raised tab is aligned with the cutout in the base of the battery compartment.



4 Close the battery compartment door.

5 Watch for the start-up screen on the front of the MX40 to illuminate briefly.

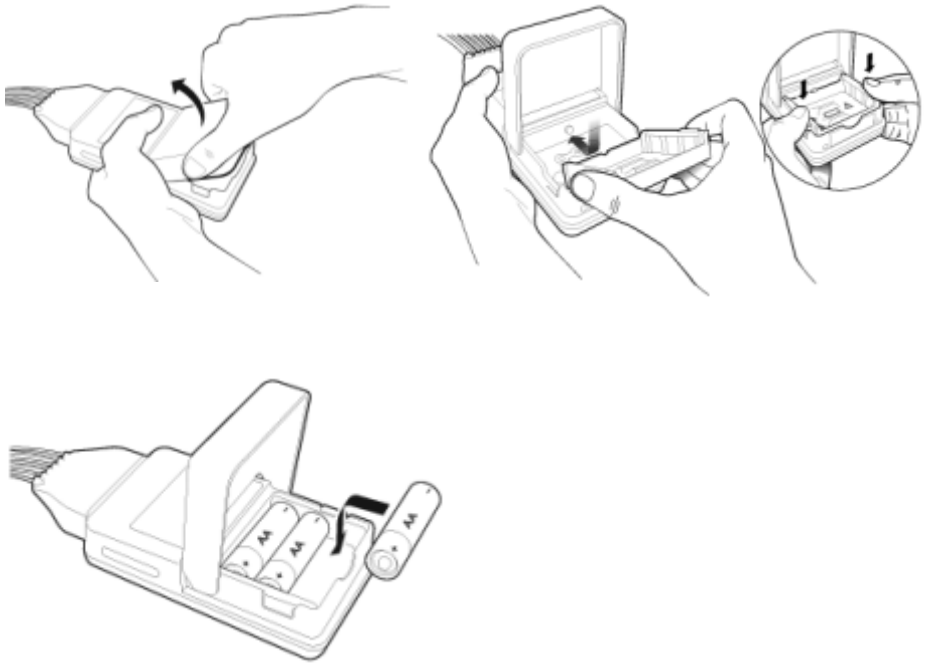
➢ *Insert AA batteries into the MX40 using the following procedure:*

1 Open the battery compartment by lifting up on both bottom sides of the compartment door.

2 Insert the AA battery tray if not already present.

3 Insert three Duracell AA 1.5V Alkaline batteries, matching the polarity with the + indications inside the compartment.

Note—all batteries are inserted with the + polarity in the same direction. Use of AA batteries is not supported with the WLAN MX40 (Model Number 865352). Use only the rechargeable lithium-ion battery.



4 Close the battery compartment door.

5 Watch for the start-up screen on the front of the MX40 to illuminate briefly.

Removing the Batteries

Batteries should be removed when the MX40 is not in use or is being stored.

To remove the batteries, open the battery compartment door and push from the opening at the bottom of the compartment to pop the batteries out. Device settings (patient cable type, SpO_2 mode, volume, etc.) are retained when the batteries are removed.

Do not use AA batteries that have different energy levels remaining. Fresh AA batteries are recommended for each new application.

Important— Do not "store" disposable AA batteries by leaving them in the incorrect polarity position in the MX40.

Be careful not to short circuit the batteries. Batteries can get hot when shorted. Short circuits are caused when a piece of metal touches both the positive and negative terminals simultaneously. More than a momentary short circuit will generally reduce the battery life. In case of a short circuit, discard the batteries, or just the shorted one if the batteries are new.

Disposal of Batteries

When disposing of batteries, follow local laws for proper disposal. Dispose of batteries in approved containers. If local regulations require you to recycle batteries, recycle batteries in accordance with those regulations.

Battery Charge Status

The battery charge indicator displays in the Status Area and communicates the remaining battery charge time when using both AA batteries or the rechargeable lithium-ion battery.

When the MX40 is initially powered-on, it takes approximately 25 seconds for the indicator to populate. During this time, the indicator displays a ? in the battery icon.

In order to guarantee overall device performance, certain functionality is disabled when the battery charge reaches critical levels. See the tables below for additional information about battery status.

AA Battery Charge Status

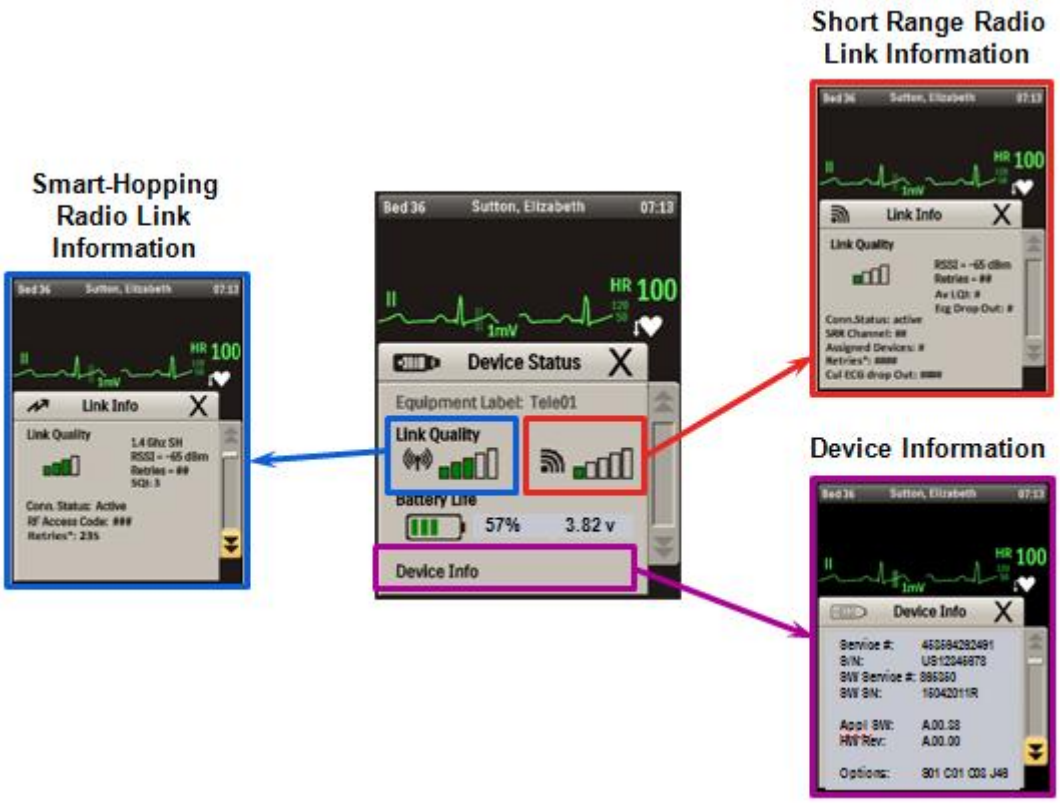
Approximate Battery Life Remaining	Approximate Time Remaining (ECG only)	Approximate Time Remaining (ECG & Spo2 Continuous)	Functionality Disabled	Battery Indicator LCD Segments
100%	~ 24 hours	~ 9 hours	None	5 Green
75%	< 18 hours	< 7 hours	None	4 Green
50%	< 12 hours	< 5 hours	None	3 Green
25%	< 6 hours	< 2 hours	None	2 Green
10%	< 2 hours	< 1 hours	None	1 Green
Low battery level to replace/charge battery level	< 30 minutes	< 30 minutes	SpO_2 and short-range radio are disabled. Display is at half brightness.	1 Red Red Battery Icon Audio
Replace/charge battery level	< 10 minutes	< 10 minutes	Device shutdown	1 Red Red Battery Icon

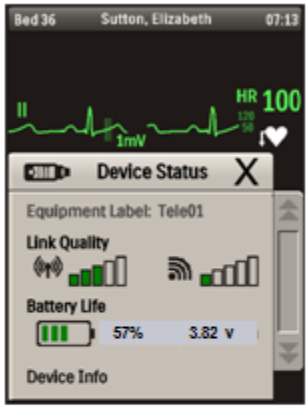
Lithium-ion Rechargeable Battery Charge Status

Approximate Battery Life Remaining	Approximate Time Remaining (ECG only)	Approximate Time Remaining (ECG & Spo2 Continuous)	Functionality Disabled	Battery Indicator LCD Segments
100%	~ 25 hours	~ 14 hours	None	5 Green
75%	< 19 hours	< 10.5 hours <10 hours (865352)	None	4 Green
50%	< 13 hours	< 7 hours	None	3 Green
25%	< 6 hours	< 3.5 hours	None	2 Green
10%	< 3 hours < 2 hours (865352)	< 1.5 hours	None	1 Green
Low battery level to replace/charge battery level	< 30 minutes	< 30 minutes	SpO_2 and short-range radio are disabled. Display is at half brightness	1 Red Red Battery Icon Audio
Replace/charge battery level	< 10 minutes	< 10 minutes	Device shutdown	1 Red Red Battery Icon

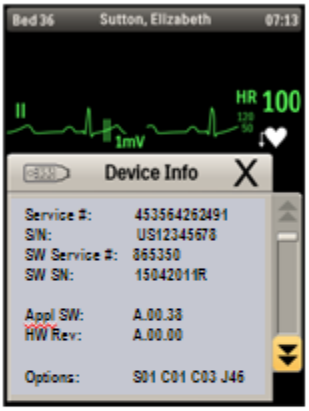
Service Information Available in Monitoring Mode

While the MX40 is operating in Monitoring Mode, important Service information is available by touching the Status Area. You can view radio signal strength and device specific information, such as serial number and software and hardware revisions.





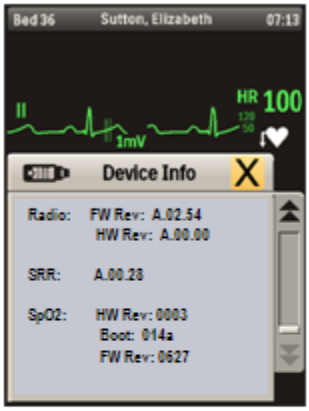
Device Info – Page 1



Hardware Service Number
Hardware Serial Number
Software Service Number
Software Serial Number

Application Software Revision and Options

Device Info – Page 2



Detailed Revision Information

Configuration Mode

This section describes settings that are configured using the user interface on the MX40. For information on configuration settings that are entered at the Information Center, see the *IntelliVue Information Center Configuration Guide* contained on the MX40 Documentation CD, p/n 4535 643 15931.

Configuration Mode is password protected. The password to enter is "71034".

Clinical Configuration

The table below lists the settings that are configured using the **Configuration** menu:

Setting	Description	MX40 with IIC N	MX40 with IIC L/M	MX40 with IIC iX
Touch Tone Volume:	Audio feedback for button touch events. Mute (0) or allow sound feedback	0 -10 **4**	0-10 **4**	0-10 **4**
Default Screen:	Screen displayed after power on	1 wave - P(ortrait) **2 waves - P(ortrait)** 2 waves - L(andscape) Chest Diagram All numerics	**1 wave - P(ortrait)** Chest Diagram	Set at IIC iX
Screen Color:	The color of the Standby screen can be changed. This can be used to distinguish devices between different units, e.g. Blue for CCU, Green for ED	**Blue**, Gray, Green, Pink, Purple, Yellow ***Note —*** Blue, Gray, and Green apply to both Startup and Standby screens. Pink, Purple and Yellow apply to Standby screen only.	**Blue**, Gray, Green, Pink, Purple, Yellow	**Blue**, Gray, Green, Pink, Purple, Yellow
ECG Cable Color:	These are the colors that will be displayed on the chest diagram if a patient cable type cannot be determined.	**AAMI**, IEC	**AAMI**, IEC	**AAMI**, IEC
Alarm Sounds:	Sets MX40 alarm sound type to Traditional (Carenet) or ISO.	**Traditional**, ISO	**Traditional**, ISO	**Traditional**, ISO
Alarms On:	Enable: All MX40/IIC Release N features available. Disable: MX40 operates as if connected to IIC Release L/M.	Disable, **Enable** ***Note —*** This configuration item is not available when operating with IIC iX.	**Disable**	**Enable** (cannot disable - MX40 is the alarm manager)

Setting	Description	MX40 with IIC N	MX40 with IIC L/M	MX40 with IIC iX
Lock	Sets the default automatic lock time (minutes).	1, 2, **5**, 15, 30	1, 2, 5, 15, 30	1, 2, **5**, 15, 30
Unit Defaults:				

The table below lists the settings that are configured using the **SmartKeys** menu:

Setting	Description	MX40 with IIC N	MX40 with IIC L/M	MX40 with IIC iX
Alarm Volume for Off Network:	Sets the default alarm volume when the device goes off network	10 only	10 only	10 only
Inop Reminder:	Inop reminders on or of	Set at IIC	**On**, Off	Set at IIC iX
Inop Severity: • ECG Leads Off • Replace Battery	Sets the severity of the "ECG Leads Off" and/or "Replace Battery" INOP conditions	Set at IIC	Red, Yellow, **Cyan**	Set at IIC iX
• Screen On Time	Sets default screen on time (minutes)	**1**, 2, 5, 15, 30	**1**, 2, 5, 15, 30	Set at IIC iX
• Trend Group	Sets default trend group type: Standard (no ST/QT) or Cardiac (includes ST/QT)	Standard (Cardiac not available)	Standard (Cardiac not available)	**Standard**, Cardiac
• Trend Interval	Sets default trend interval time	**1**, 5, 10, 15, 30, 1 hour, 2 hours	**1**, 5, 10, 15, 30, 1 hour, 2 hours	**1**, 5, 10, 15, 30, 1 hour, 2 hours

The table below lists the settings that are configured using the individual parameter Setup menus for ECG, SpO_2 and Resp:

Setting	Description	MX40 with IIC N	MX40 with IIC L/M	MX40 with IIC iX
Lead Placement:	Sets the default lead placement to either Standard or EASI ECG. This impacts the leads that are selectable and the location of the electrodes displayed on the Chest Diagram.	**Standard**, EASI	**Standard**, EASI	Set at IIC iX
SpO_2 Mode:	Sets the default SpO_2 mode to either Manual or Continuous.	**Manua**l, Continuous	**Manua**l, Continuous	Set at IIC iX (Auto also available)
Change Wave 1 / 2	The following choices are available if the waveform displayed is:			
	ECG	Primary Lead, Secondary Lead, Pleth	Primary Lead, Secondary Lead, Pleth	Primary Lead, Secondary Lead, Pleth
	Pleth	Any ECG Lead, Any Pleth	Any ECG Lead, Any Pleth	Any ECG Lead, Any Pleth, Any Resp
	Resp	n/a	n/a	

Setting	Description	MX40 with IIC N	MX40 with IIC L/M	MX40 with IIC iX
	Note — Wave 1 on MX40 defaults to ECG Wave - Primary Lead. Wave 2 on MX40 defaults to PlethT.			
ECG Wave Adjust Size	Sets default ECG wave size on MX40.	x1/2, **x1**, x2, x4	x1/2, **x1**, x2, x4	x1/2, **x1**, x2, x4
RESP Wave Adjust Size	Sets the default Respiration size (MX40 and IIC iX)	n/a	n/a	x1/2, x1, **x2**, x4

Default Settings = **Bold**.

Note — The IntelliVue Support Tool - Mark 2 can be used to copy the configuration of one MX40 to another MX40.

Service Mode

This section describes the menus and settings accessed from the Service Operating Mode. Service Mode is password protected. The password to enter is "1345".

Setup Network

The **Setup Network** menu allows you to set the RF Access Code for the MX40.

Revisions

The **Revisions** menu displays the **Device Info** menu:

- Service #: This is the Service Identification Number located on the back label and used to identify the device.
- S/N: This is the Hardware Serial Number for the device located on the back label and used to identify the device.
- SW Service #: This is the Service Identification Number for the software version on the device. It can be found on the Software License Certificate that shipped with the Device.
- SW SN: This is the Software License Number. It can be found on the Software License Certificate that shipped with the device.

  Note — Customers should save the Software License Certificate for future reference.
- Appl SW: This is the revision of the software installed and running on the MX40.
- HW Rev: This is the Revision Number for the device hardware.
- Options: List of enabled product options on the device.

Enabled Product Option #	Product Option
S01	ECG only
S02	ECG and SpO_2
S03	ECG and SpO_2 Ready (for future upgrade)
C01	Enhanced Arrhythmia
C03	24 hours of Vitals Trends
J46	Short-Range Radio
M02	Impedance Respiration

Rechargeable Battery Information

The **Batt Info** menu displays information about the rechargeable battery. Touch the Device Status area and then the battery area to display:

- Rechargeable: The battery type.
- Percent Remaining: Remaining battery capacity.
- Voltage: Current voltage measurement.
- Av. Current: Average current measurement.
- Av. Power: Average current power measurement.
- Temp: Current operating temperature.
- Ch Cycle: The number of charge cycles the battery has undergone.

Demo Mode

The MX40 has a Demo Operating Mode available for assistance in sales and training situations. Demo Mode is password protected. The password to enter is "14432".

In Demo Mode, all menus are accessible, and all buttons and SmartKeys are operational. There is a simulated ECG wave on the display, and the alarm system is functional. Data is transmitted to the Information Center and is labeled "Demo" in the patient sector and on the MX40 in the Leads Off Status Area.

5. Maintenance

This section provides procedures for maintaining the MX40 after installation, including equipment label assignment, cleaning and battery care.

Cleaning

The procedure in this section keeps the MX40 and its accompanying patient cable clean and provides protection against infectious agents and bloodborne pathogens. Both the outside and the inside of the MX40 battery compartment and the patient cable must be kept free of dirt, dust, and debris.

Note — Single-Patient-Use leadsets are intended to be disposed of when use is complete. They are not to be re-used and are not designed to be cleaned using any of the materials listed below.

Important — After exposure, the MX40 and the patient cable must be cleaned as per the instructions contained herein. Sterilization of the MX40 has been qualified using the STERRAD 100NX System. For more information and instruction on sterilizing the MX40, refer to the instuctions provided by the manufacturer. The alternative Steris V-pro process using hydrogen peroxide vapor is also acceptable.

➢ *Perform the following steps to clean the MX40 and the patient cable of visible surface contamination.*

Note — when cleaning, the use of protective gloves is encouraged.

1 Remove the batteries and disconnect the patient cable.

2 If using disposable AA batteries, remove the battery tray and clean separately.

3 Wipe the MX40 and the patient cable clean by using a cloth dampened modestly with one of the approved cleaning agents listed in the table below.

4 Follow the manufacturer's instructions with regard to application duration.

5 Wipe the M40 and inside the patient cable housing with distilled water or alcohol to prevent residue build-up.

6 Allow to air-dry, or dry with a non-lint producing cloth.

Cleaning Materials for the MX40

Caution

- Use of abrasive cleaning materials, or disinfectants or cleaning agents not listed herein, on any part or component of the MX40 may damage the components.
- The Gore-tex patch in the battery compartment of the MX40 can be damaged by the use of glutaraldehyde and anti-bacterial soap.
- Sharp or pointed instruments should not be used to remove soil from recessed areas on the MX40.

Approved Cleaners

Cleaner	Active Ingredient
Isopropyl Alcohol based	Isopropyl Alcohol (≥70%)
Hydrogen Peroxide	Hydrogen Peroxide (3%)
Chlorine Bleach	Sodium Hypochlorite (1:10 concentration, mixed < 24 hours)
Metrex CaviWipes	Isopropyl alcohol (15-18%) Sodium hydroxide (0.1%) 2-butoxyethanol (1-5%)
Viraguard	Isopropanol (70%)
Resert XL HLD	Hydrogen peroxide (1.4-2-3%) 2-Fumic Acid (<2.5%)
Sporox II Sterilizing & Disinfection Solution	Hydrogen peroxide (7.5%) Phosphoric acid (0.85%)
Sanicloth Plus Germicidal Cloths	Isopropyl alcohol (55%) Quaternary ammonium (0.5%)
WipesPlus Disinfecting Wipes	Phenylphenol (0.28%), Benzyl-p-chlorophenol (0.03%)
TechSpray General Purpose Cleaner	Isopropyl alcohol (70%)
Oxivir Tb Cleaner Disinfectant	Hydrogen peroxide (2.5-3.5%)
Oxivir Tb Wipes	Hydrogen peroxide (3%)
Sanicloth HB	Quaternary ammonium (1%)

Cleaner	Active Ingredient
Sanicloth Plus	Quaternary ammonium (0.25%) 2-Butoxyethol (1-4%) Isopropyl alcohol (14.85%)
Super Sanicloth	Quaternary ammonium (<1%) Isopropyl alcohol (55%)
Sanicloth Bleach Germicidal Disposable Wipes	Sodium Hypochlorite (0.6%)
Bacillol 25	Ethanol (100 mg/g g) Propane-2-ol (90 mg/g) Propane-1-ol (60 mg/g)
Bacillol AF	Propane-1-ol (450 mg/g) Propane-2-ol (250 mg/g) Ethanol (47 mg/g)
Hydrogen Peroxide	Hydrogen peroxide (5%)
Meliseptol	Propane-1-ol, (50 g) Glyoxal (0.08 g)

Note —The cleaners listed above are also suitable for cleaning the patient cable and the lithium-ion battery.

Unsupported Cleaners

The following cleaners have been tested and failed. They should not be used to clean the MX40.

- Caltech-Dispatch 5200
- Cidex OPA
- Gluteraldehyde
- Liquid Soap (antibacterial soap)
- Omnicide
- Sanicloth AF
- Wavicide
- Cidex Formula 7
- Cidex Activated Dialdehyde
- Incidin
- Metricide
- Procide 14
- Virex Tb

Disposing of the MX40

Warning

To avoid contaminating or infecting personnel, the environment or other equipment, make sure you disinfect and decontaminate the MX40 appropriately before disposing of it in accordance with your country's laws for equipment containing electrical and electronic parts. For disposal of parts and accessories where not otherwise specified, follow local regulations regarding disposal of hospital waste.

You will find detailed disposal information on the following web page:

http://www.healthcare.philips.com/main/about/Sustainability/Recycling/pm.wpd

The Recycling Passports located there contain information on the material content of the equipment, including potentially dangerous materials which must be removed before recycling (for example, batteries and parts containing mercury or magnesium).

Do not dispose of waste electrical and electronic equipment as unsorted municipal waste. Collect it separately, so that it can be safely and properly reused, treated, recycled, or recovered.

Label Assignment for Replacement MX40

During installation, an equipment label is assigned to each MX40 in a clinical unit so that the device can be identified during operation within the wireless system. If an MX40 is lost, the Assign Label function at the Information Center enables you to unassign the label from a lost device, and re-assign its label to a replacement device. Labels are limited to those available in an individual clinical unit.

Re-assigning an Equipment Label at the IntelliVue Information Center

➢ *To re-assign an equipment label to a replacement device:*

1 At the Information Center, clear the sector that the original equipment label was assigned to (**Patient Window -> Sector Setup -> Clear Sector -> OK**).

Note — Before clearing the sector, ensure that the equipment label of the lost device is not actively assigned to a patient being monitored.

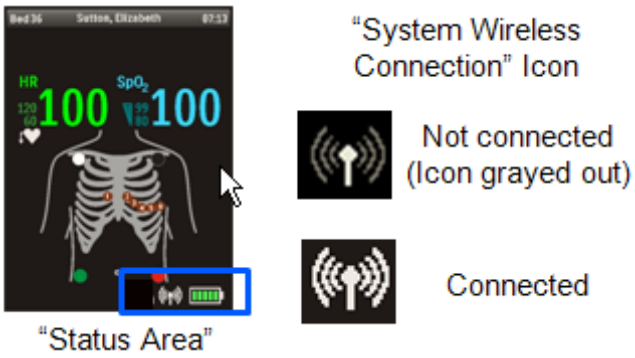
2 Select **All Controls -> Label Assignment**.

3 Enter password (tele).

Note — The remaining screens will be in English only.

4 Insert battery power into the MX40 and if attached, disconnect the patient cable.

5 Select **Refresh**.



6 Select the MAC address of the replacement device from the **New Devices** list. If the address does not appear, remove battery power and re-insert. Select **Refresh**.

Note — The MAC address appears on the rear label of the MX40.

7 Select the equipment label that was assigned to the previous device from the **Equipment Label** list.

8 Select **Assign Label** to initiate programming of the equipment label into the replacement MX40.

9 When prompted, press **Confirm** on the MX40 to accept the assignment. The confirmation must occur within 30 seconds of the prompt.

10 Wait for the new_device label to change to the selected equipment label.

11 In **Sector Setup**, select the **Bed Label** and **Equipment Label** and then press **OK**.

Re-assigning an Equipment Label at the IntelliVue Information Center iX

➢ *To re-assign an equipment label to a replacement device:*

1 Enter the **Manage Unit** application (scroll down if necessary).

2 Select **Label Assignment**.

3 Select the entry for both the previously assigned device (on the left) and the entry for the available device (on the right).

4 Select **Replace**.

5 At the MX40, select **Confirm**.

6 At the Information Center iX, select **OK**.

7 Select Refresh to confirm that the device now appears in the **Assigned Devices** column.

8 Confirm that the Equipment Label is now displayed on the MX40.

Charging Lithium-ion Rechargeable Batteries

The li-ion rechargeable battery is recharged using the IntelliVue CL Charging Station. In order to meet the published battery life specifications, the battery should be fully charge before use.

Battery management is very important to ensure that when a fully charged battery is needed, one is available. Recharging a discharged battery can take up to 6.5 hours.

To charge a battery, place it onto a charger slot on the charging station. The battery power indicators will supply information about the charge status.

Warning

- Always use the supplied power cord with the grounded mains plug to connect the charging station to a grounded AC mains socket. Never adapt the mains plug from the power supply to fit an ungrounded AC mains socket.
- Do not use AC mains extension cords or multiple socket outlets. If a multiple portable socket outlet without an approved isolation transformer is used, the interruption of its protective grounding may result in leakage currents equal to the sum of the individual ground leakage currents, so exceeding allowable limits.
- Do not connect any devices that are not supported as part of the system.

Battery Power Indicators

There are various indications which help you keep track of the battery power status.

- LEDs on the charging station slots
- battery status information on both the MX40 and the charging station's display
- INOP messages

The indicators always show the remaining capacity in relation to the battery's actual maximum capacity which may lessen as the battery ages.

Charging Station LEDs

The **AC Power / Error LED** is

- cyan during startup or to indicate a general charging station error
- green when the charging station is connected to AC power

The nine **Charger Slot LEDs** show the battery status of the device in their slot and are switched off if a battery is not inserted.

When a battery is put on a charging station slot, confirm that the corresponding LED flashes yellow until the battery's current state has been identified. Then a beep is issued and the LED reflects the battery status as described in the table below.

Status	LED
no battery on charger slot or battery inserted upside down.	off
battery put on charger slot and recognized	flashing yellow
battery not properly recognized, error	cyan
battery recognized, battery charging	yellow
battery recognized, battery full (≥90%)	green

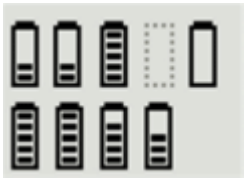
The **AC Power / Error LED** is

- cyan during startup or to indicate a general charging station error
- green when the charging station is connected to AC power

Note — Wiping of battery contacts with an alcohol solution after cleaning is recommended.

Battery Status on the Charging Station Display

The IntelliVue CL Charging Station display provides a quick overview of all the connected devices and their battery status. The screen is arranged in the same layout as the charger slots.



Battery Lifetime Management

The lifetime of a li-ion battery depends on the frequency and duration of use. When properly cared for, the useful life is approximately 4 years or 500 complete charge-discharge cycles, whichever comes first. In addition, experience indicates that the incidence of failure may increase with battery service life due to the accumulated stresses of daily use. We therefore strongly recommend that li-ion batteries be replaced after 2 years or 500 complete charge-discharge cycles.

The age of a li-ion battery begins at the date of manufacture. The date of manufacture is listed on the side of the battery.

Battery Disposal

Discharge the battery and insulate the terminals with tape before disposal. Dispose of used batteries promptly and in accordance with local recycling regulations.

6. Part and Option Ordering Information

This section provides specific part number, option number, support part number, and descriptive information associated with the MX40.

MX40 Release B.0 Product Structure

The tables below provide part part and option ordering information.

	INTELLIVUE MX40 DEVICES	865350	865351	865352
	Feature comparison			
	WMTS Smart-hopping (1.4 GHz) network	●	n/a	n/a
	2.4 GHz Smart-hopping network	n/a	●	n/a
	802.11a/b/g Philips Customer-supplied Clinical Network	n/a	n/a	●
	Rechargeable battery[1] (*must purchase separately*)	●	●	●
	AA batteries (*must purchase batteries separately*)	●	●	n/a
	Base functionality[2]			
S01	ECG only	●	●	●
S02	Fast SpO2 enabled[3]	●	●	●
S03	Fast SpO2 ready[4]	●	●	●
	Add-on options			
	Clinical applications			
C01	Enhanced Arrhythmia[5]	●	●	●
C03	Vitals Trend	●	●	●
M02	Impedance Respiration	●	●	●
	Interfaces			●
J46	Short Range Radio	●	●	●

IntelliVue MX40 Upgrad options	
865348	**Upgrade for 865350 IntelliVue MX40 1.4 GHz Smart-hopping**
S02	Enable Fast SpO2[3] (*for an existing –S02 device*)
C01	Add Enhanced Arrhythmia
C03	Add Vitals Trend
M02	Impedance Respiration
J46	Add Short Range Radio
SUB	MX40 Release B Software
866089	**Upgrade for 865351 IntelliVue MX40 2.4 GHz Smart-hopping**
S02	Enable Fast SpO2[3] (*for an existing –S02 device*)
C01	Add Enhanced Arrhythmia
C03	Add Vitals Trend
M02	Impedance Respiration
J46	Add Short Range Radio
SUB	MX40 Release B Software
866129	**Upgrade for 865352 IntelliVue MX40 802.11 a/b/g[8]**
S02	Enable Fast SpO2[3] (*for an existing –S02 device*)
C01	Add Enhanced Arrhythmia
C03	Add Vitals Trend
M02	Impedance Respiration
J46	Add Short Range Radio

1. Requires purchase of
2. Must choose one /S0x option in this category.
3. Requires purchase of pulse oximetry accessories.
4. Requires purchase of appropriate /S02 to enable feature.
5. Not applicable for IntelliVue Information Center release L or M.
6. Consult Philips about appropriate network configurations and requirements.
7. Supports fiber cabling. Must order 865223 when supporting fiber.
8. 865352 ships with Release B

MX40 Support Parts

Description	Part Number	86530	86531	865352
TELE MX40, 1.4 GHz, ECG Only, Exchange	453564262491	S01	n/a	n/a
TELE MX40, 1.4 GHz, ECG and Sp02, Exchange	453564262511	S02 or S03	n/a	n/a
TELE MX40, 2.4 GHz, ECG only, Exchange	453564262531	n/a	S01	n/a
TELE MX40, 2.4 GHz, ECG &Sp02, Exchange	453564262551	n/a	S02 or S03	n/a
TELE MX40, WLAN, ECG only, Exchange	453564262571	n/a	n/a	S01
TELE MX40, WLAN, ECG and SpO_2, Exchange	453564262591	n/a	n/a	S02 or S03
ASSY - AA Battery Adapter, Tele PWM	453564132721	All	All	All
PLAST - Battery Door w/Gasket	453564205271	All	All	All
MX40 Rechargeable Battery, Pkg 1	989803176201	All	All	All
MX40 Service Adapter + Cable (tool for service)	453564270071	All	All	All

Note — The software license transfer process expects the same hardware number as original device.For example:

- A SW license for S01 can only be transferred to 453564262491, 453564262531, or 453564262571.
- A SW license for S02 or S03 can only be transferred to 453564262511, 453564262551, or 453564262591.

Service personnel can find the following information on the label on the back of the MX40:

Hardware Service Number: "Service #"

Hardware Serial Number: SN

MAC address: MAC

7. MX40 Repair Strategy

The MX40 Repair Strategy is Unit Exchange worldwide through Philips part centers.

Tools Required

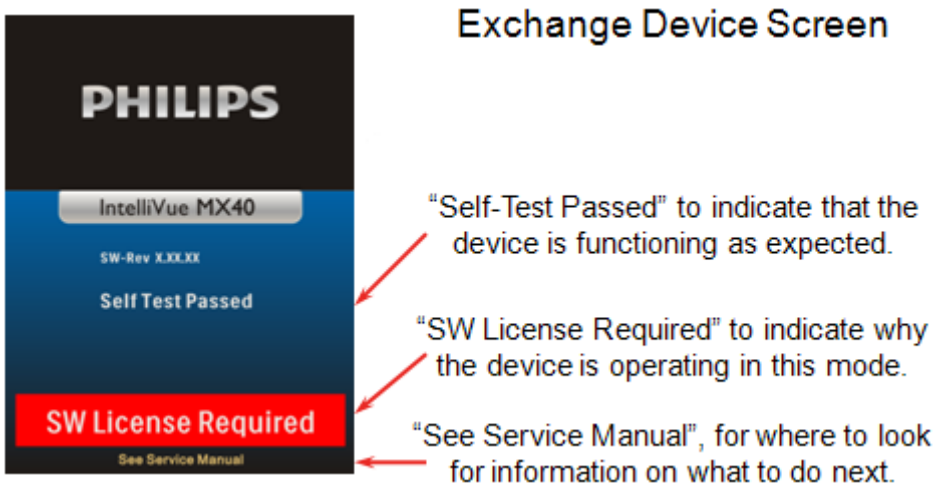
Repair of the MX40 requires the following tools:

- MX40 Service Adapter Cable
- PC running the IntelliVue Support Tool - Mark2
- Internet Connection to the Philips Software License Server

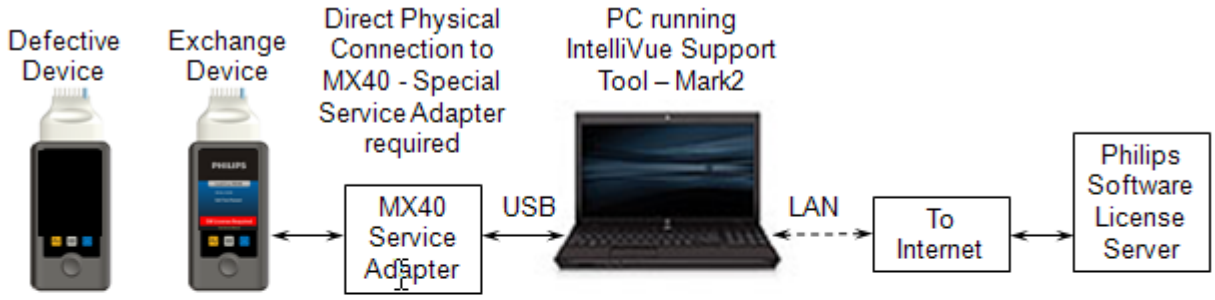
Software License Transfer

The MX40 uses software licensing functionality to track customer information, software revisions, and features enabled. Software Licensing allows Philips personnel to easily determine what products, features, and revisions are installed at a particular customer site.

Exchange devices will arrive without a software license.



The software license from the defective device needs to be transferred to the exchange device using the IntelliVue Support Tool - Mark2. For more information, see the Support Tool Instructions for Use that accompanied the Support Tool software..



Required information from defective device:

- SW Serial Number
  OR
- HW Service Number and HW Serial Number

Notes on the MX40 Service Adapter and cable:

- The service adapter is for service and demo use only.
- It is not to be used in the patient vicinity.
- It is not to be used to power the device when it is connected to a patient!
- The service adapter is installed in the battery compartment.
- The MX40 connects to the PC via a USB port, and uses a USB cable - but the MX40 does not operate as a standard USB device.
- Maximum cable length = 3ft (1m)

Note — The MX40 connects to a PC via a USB port and uses a USB cable, but the MX40 does not operate as a standard USB device. The MX40 does not support the use of a cable longer than 3 ft. Longer cables may result in an unacceptable drop in voltage.

8. Troubleshooting

This section provides information about the technical alarms generated by the MX40 and associated troubleshooting suggestions. Also provided are troubleshooting suggestions for user interface issues and information regarding the patient cables used with the MX40.

Technical Alarms (INOPs)

Technical Alarms, or INOPs (inoperative conditions), are sourced at the MX40, the ST/AR algorithm running at the Information Center, or the IntelliVue Patient Monitor. They identify inoperative conditions (that is conditions where the system is not operating properly and therefore cannot measure or detect alarm conditions reliably). There are four levels of Technical Alarms:

- **Severe** - Monitoring and alarm generation are disabled. Visual alarm indicator on the MX40. Audible tone at the Information Center. Must be acknowledged by a clinician.
- **Hard** - Monitoring and alarm generation are disabled. Visual alarm indicator on the MX40. Audible tone at the Information Center.
  If the hard INOP is "latched", the sound will be silenced, but the message will remain on the display until resolution of the offending condition.
- **Soft** - Monitoring and alarms remain active. Visual alarm indicator on the MX40 and at the Information Center. No audible tones are generated at the Information Center
- **Red/Yellow** - Replace Battery and ECG Leads Off INOPs may be configured to display as either Red or Yellow Technical Alarms.
  Note - The ECG Leads Off INOP will initially display as a cyan technical alarm until a valid ECG signal is obtained.

In the following table, technical alarms are listed alphabetically.

Alarm Text	Priority	Condition	What to do
BATTERY LOW T **Source - MX40**	Soft	• There is less than 15 minutes of monitoring time remaining (AA batteries). • Lithium-ion battery level is ≤ 10% or has ≤30 minutes remaining time.	• Replace batteries promptly to avoid shutdown and cessation of monitoring. • Insert a charged lithium-ion battery pack.
CANNOT ANALYZE ECG **Source - MX40 (IIC iX only) and Information Center**	Hard	Arrhythmia algorithm cannot reliably analyze the ECG data on any monitored leads.	Assess the lead selections, initiate relearn, and validate analyzed rhythm. Check other INOPs for possible source of problem.

Alarm Text	Priority	Condition	What to do
CHECK PAIRING **Source - MX40**	Yellow Technical Alarm	• There is a problem with device pairing. • When the MX40 is wirelessly paired with an X2 patient monitor (no label) docked with a larger networked MP series monitor, and the network connection is lost.	• Check that the bedside monitor or cableless measurement device is correctly paired. • Select the correct device to be paired.
cl NBP Batt Low **Source - Cableless Measurement Device**	Hard	CL NBP Pod weak battery condition.	Charge CL NBP Pod.
cl NBP Batt Empty **Source - Cableless Measurement Device**	Severe	CL NBP Pod empty battery condition. Monitoring is not possible.	• Replace CL NBP Pod. • Recharge depleted CL NBP Pod.
cl NBP DISCONNECT **Source - Cableless Measurement Device**	Hard	CL NBP Pod is not connected with the MX40.	• Resolve interference condition. • Reduce range between CL NBP Pod and MX40.
cl SpO_2 Batt Low **Source - Cableless Measurement Device**	Hard	CL SpO_2 Pod weak battery condition.	Charge CL SpO_2 Pod.
cl SpO_2 Batt Empty **Source - Cableless Measurement Device**	Severe	CL SpO_2 Pod empty battery condition. Monitoring is not possible.	• Replace CL SpO_2 Pod. • Recharge depleted SpO_2 Pod.
cl SpO_2 DISCONNECT **Source - Cableless Measurement Device**	Hard	CL SpO_2 Pod is not connected with the MX40.	• Resolve interference condition. • Reduce range between CL SpO_2 Pod and MX40.
!!!/!! CUFF NOT DEFLATED **Source - Cableless Measurement Device**	Severe	Cuff pressure has exceeded the specified safety limit.	Remove cuff and tubing and expel air.
!!!/!! CUFF OVERPRESS **Source - Cableless Measurement Device**	Severe	Cuff pressure has increased above overpressure safety limits.	Remove cuff and tubing and expel air.

Alarm Text	Priority	Condition	What to do
ECG/ARRH ALARM(S) OFF **Source - MX40**	Soft	ECG is turned off.	Turn on ECG.
ECG LEADS OFF Note This INOP may also be configured to display as a Red or Yellow Technical Alarm. **Source - MX40**	Red or Yellow or Hard Technical Alarm	• Multiple leads are off.	Re-attach ECG leads to patient..
<electrode> LEAD OFF **Source - MX40**	Hard	Single lead is off. If primary lead is MCL, lead will be identified as V/C in INOP text.	Re-attach ECG leads to patient.
LEADSET UNPLUGGED **Source - MX40**	Hard	• Patient cable has been unplugged from the MX40. • Incompatible leadset attached to patient cable.	• Re-attach the patient cable. • Replace the leadset.
LEADSET LIFE **Source - MX40**	Soft	The single-patient use leadset has exceeded its limit of 25 cycles.	Replace with new leadset.
LOCAL AUDIO OFF **Source - MX40** ***Note —*** This is normal operation in Telemetry Mode.	Soft	There is no alarm audio notification when operating in Telemetry Mode.	Change to Monitor Mode.
NBP INTERRUPTED **Source - Cableless Measurement Device**	Hard	The preset maximum time for the total measurement has been exceeded.	Reduce patient movement and avoid interaction with the cuff and tubing.
NBP MEASURE FAILED **Source - Cableless Measurement Device**	Hard	Measurement values cannot be derived.	• Attach cuff to new location on patient. • Replace cuff.

Alarm Text	Priority	Condition	What to do
NBP EQUIP MALF **Source - Cableless Measurement Device**	Hard	• Tubing may be obstructed or kinked. • Hardware malfunction.	• Check tubing. • If condition persists, contact Service.
NO ALARM DISPLAY **Source - MX40**	Soft	When operating with Information Center Release L Or M, there is no local alarming at the MX40, networked or non-networked.	Condition is not present when operating with Information Center Release N or later (unless specifically configured to operate in this way).
NO CENTRAL MONITOR (appears at MX40 only) **Source - MX40**	Hard	• The MX40 is out of range of the network. • Patient Sector at the Information Center is in Standby.	• Return the MX40 to the coverage area. • Select Resume at the Information Center.
NO HOST MONITOR **Source - MX40**	Hard	The paired MX40/bedside monitor is out of short-range radio range or there is excessive radio interference.	• Reduce the distance between the devices. • Identify and remove interference source.
NO SIGNAL (appears at the Information Center only) ***Note —*** When operating with IIC iX, the INOP will display as NO DATA PWM. **Source - Information Center**	Hard, Latched	• The MX40 is outside the coverage area, or • No batteries in the MX40, or • The MX40 has failed.	• Make sure that the MX40 is within the coverage area and has good batteries. • Replace the MX40 if Power On Self Test fails. • Put bed in Standby. • Contact Service
REPLACE BATTERY T **Source - MX40** ***Note —*** This INOP may also be configured to display as a Red or Yellow Technical Alarm.	Red or Yellow or Hard Technical Alarm, Latched	Dead battery. No monitoring is occurring.	Replace batteries.
RESP EQUIP MALF **Source - MX40**	Hard	• Malfunction in the Resp equipment. • MX40 requires calibration.	Contact Service.
RESP LEAD OFF ***Note —*** OR leadsets cannot be used to monitor Resp with the MX40. **Source - MX40**	Hard	Resp lead off.	Re-attach lead to patient.

Alarm Text	Priority	Condition	What to do
SOME ECG ALARMS OFF	Soft	Some ECG alarms have been turned off at the Information Center.	For information only.
SpO_2T EQUIP MALF **Source - MX40**	Hard	Malfunction in the SpO_2 equipment	Contact Service.
SpO_2T ERRATIC **Source - MX40**	Hard	Erratic SpO_2 measurements, often due to a faulty sensor or invalid SpO_2 measurements, or incorrect transducer position	Repeat measurement, reposition sensor on patient, or finally, replace sensor.
SpO_2T EXTD UPDATE Numeric is replaced by a -?-. **Source - MX40**	Soft	The update period of displayed values is extended due to an NBP measurement on the same limb or an excessively noisy signal.	If NBP is not active, check the sensor placement. Reposition the sensor on patient, or replace sensor.
SpO_2T LOW PERF **Source - Monitor**	Soft	Accuracy may be reduced due to low perfusion. Data displayed with ?.	Increase perfusion. Change sensor site. Avoid site distal to BP cuff or intra-arterial line. Warm the site.
SpO_2T INTERFERENCE **Source - MX40**	Hard	Level of ambient light or level of electrical interference are so high that the SpO_2 sensor cannot measure SpO_2 and pulse rate.	Reduce ambient light to sensor or electrical noise sources.
SpO_2T NO SENSOR ***Note —*** Silencing this technical alarm turns off the SpO_2 measurement on the MX40 and at the Information Center. **Source - MX40**	Hard	No sensor attached to SpO_2 device.	Attach SpO_2 sensor.
%SpO_2T NOISY SIGN **Source - MX40**	Hard	Excessive patient movements or electrical interference are causing irregular pulse patterns	Reduce movement or electrical noise sources.
SpO_2T NO PULSE **Source - MX40** ***Note —*** When paired directly with an IntelliVue MP5 Patient Monitor, the INOP will display as SpO_2T SENSOR OFF.	Hard	• Pulse is too weak or not detectable • Sensor has fallen off at patient.	• Check connection to patient. • Change sensor site. Avoid site distal to BP cuff or intra-arterial line.

Alarm Text	Priority	Condition	What to do
SpO_2 POOR SIGNAL **Source - MX40**	Soft	Although a measurement may be possible, its accuracy may be reduced due to poor signal quality.	• Apply the sensor according to the manufacturer's instructions. • Relocate the sensor to a different site on the patient.
SpO_2T SEARCHING **Source - MX40**	Soft	The patient signal is analyzed, but a valid numeric is not available yet.	Wait for the measurement to complete.
SpO_2T SENSOR OFF ***Note —*** The ability of the algorithm to detect this condition depends on the sensor type in use.	Hard	The algorithm has determined that a sensor is connected, but not properly applied to the patient.	• Apply the sensor according to the manufacturer's instructions. • If the condition persists, relocate the sensor to a different site on the patient.
SpO_2T SENSOR MALF **Source - MX40**	Hard	Malfunction of the SpO_2 sensor/adapter cable	Replace sensor.
SpO_2 UNKN SENSOR **Source - MX40**	Hard	The connected SpO_2 sensor and/or adapter cable is not supported by the hardware version.	Use specified sensor and/or adapter cable.
SpO_2T UPGRADE **Source - MX40**	Soft	SpO_2 hardware is in upgrade process. Monitoring is not possible.	Wait for the upgrade process to complete.
TELE BATT EMPTY ***Note —*** This INOP may also be configured to display as a Red or Yellow Technical Alarm. **Source - MX40** ***Note —*** For Information Center Release L or M, this INOP will appear as "REPLACE BATTERY T".	Hard, Latched	Lithium-ion battery level is critically low. A 10-minute countdown begins. The MX40 will shut down if the condition is not cleared.	Insert a charged lithium-ion battery pack.
TELE BATTERY TEMP **Source - MX40** ***Note —*** For Information Center Release L or M, this INOP will appear as "REPLACE BATTERY T"	Hard	The temperature of the lithium-ion battery is above 55^{o} C or below -5^{o} C.	Replace the lithium-ion battery.
TELE CHECK BATT **Source - MX40**	Soft	Lithium-ion battery has $\leq$ 25 charge cycles remaining before reaching the charge cycle maximum limit.	Be aware that the Lithium-ion battery pack will soon need replacement.

Alarm Text	Priority	Condition	What to do
TELE MALFUNCTION **Source - MX40**	Hard	MX40 malfunction or self-test failure.	Contact Service to replace the MX40.
TELE REMOVE BATT **Source - MX40** ***Note —*** For Information Center Release L or M, this INOP will appear as "REPLACE BATTERY T".	Hard, Latched	The temperature of the lithium-ion battery is >60° C and the battery must be removed.	• Replace the lithium-ion battery. • Dispose of old battery properly.
TELE SERVICE BATT **Source - MX40**	Hard	The lithium-ion battery has exceeded the maximum charge cycle limit and reached the end of its useful life.	• Replace the lithium-ion battery. • Dispose of old battery properly.
TELE WEAK SIGNAL **Source - MX40**	Soft	• Patient is at outer range of the radio coverage area. • The MX40 is receiving a weak signal with high data loss from the AP. • Condition exists for multiple devices in a specific area	• Return patient to the coverage area. • If patient is in close proximity to AP, replace the MX40. Contact service. • The AP covering the specific area is suspect. Contact Service
TRANSMITTER OFF **Source - MX40**	Hard	RF Auto Shutoff after 10 minutes of all leads off and no SpO_2 sensor connected.	• Reattach ECG leads to patient. • Reattach SpO_2 sensor.
UNSUPPORTED LAN **Source - MX40**	Hard	The MX40 (WLAN) is connected to the Access Point, but cannot obtain an IP address.	Correct the IP address issue.
WIFI OUT OF RANGE **Source - MX40**	Hard	The MX40 (WLAN) is out of range of an access point.	Correct the RF coverage issue.

Informational Messages

The following table lists the Informational Text messages that may appear in the Status Area of the MX40 display.

Informational Text	Condition	What to do.
Setting sync'd	The MX40 is returned to use and settings are synchronized to reflect any changes that may have occurred at the Information Center.	Cleared after setting synchronization is complete. The message displays for a minimum of 30 seconds, depending on the number of settings changes.
Check Versions	The revision of the Information Center that the MX40 is trying to connect to is not supported.	Connect only to supported revisions of the Information Center.
DEMO (flashing text)	The MX40 is operating in Demo Mode.	Cleared when the MX40 is changed to a different operating mode.
CONFIG (flashing text)	The MX40 is operating in Configuration Mode.	Cleared when the MX40 is changed to a different operating mode.
SERVICE (flashing text)	The MX40 is operating in Service Mode.	Cleared when the MX40 is changed to a different operating mode.
SRR Started	Short-range radio is powered on (used with Cableless Measurement Devices and when paired to a patient monitor).	Cleared automatically.
SRR Ntwk Scan	Short-range radio channel scan in progress.	Cleared automatically when complete.
SRR Chan <chan num>	Short-range radio channel scan is complete and best channel is selected.	Cleared automatically after selection.
SRR Searching Sensor	Short-range radio is attempting to associate with Cableless Measurement Devices.	Cleared automatically.
SRR Stopped	Short-range radio is in power saving mode and no longer searching for Cableless Measurement Device until the Add/Remove SmartKey is touched again	Cleared automatically or when the Add/Remove SmartKey is touched.
cLNBP Assigned	Short-range radio is assigned to an NBP Cableless Measurement Device.	Cleared automatically after one minute.
cLSpO_2 Assigned	Short-range radio is assigned to an SpO_2 Cableless Measurement Device.	Cleared automatically after one minute.
SRR Searching Monitor	Short-range radio is attempting to associate with a patient monitor.	Cleared automatically.
SRR Assoc Monitor	Short-range radio is connected to a patient monitor.	Cleared automatically.
SRR Link Test	Short-range radio link testing is in progress before final association.	Cleared automatically. Icon replaces message.

Informational Text	Condition	What to do.
SRR unavailable with Resp	Respiration monitoring is enabled, therefore the short-range radio is disabled.	Turn the Resp parameter off at the Information Center.

Possible User Interface Issues

- The MX40 display does not turn on.
  - The AA Battery Tray may be inserted backwards.
  - The user may not understand that they need to touch the blue Main Screen button for two seconds.

Main Screen Button

- The MX40 display does not react to touch.
  - The screen is locked and needs to be unlocked using the Unlock SmartKey.

The user is not using their finger to touch the screen. The MX40 does not react to touches by a fingernail, pen, etc.

Fingertip | Fingertip through pouch and 2 pairs of gloves (this will work) | Finger nail | Pen, etc.

- The MX40 does not not recognize the patient cable type.
  - The IntelliVue style leadset adapter cable is being used, therefore, detection of the cable type is not possible. Configure the MX40 for the desired settings:
  - ECG Cable Color, using the **Configuration** Menu in Configuration Mode.
  - Lead Placement, using the **HR** Menu in Configuration Mode.
  - If using a 3-wire IntelliVue leadset, it must be selected using the **Setup ECG** menu and then selecting the **New Lead Setup** entry. This will remove the INOP message.

WLAN Coverage Assessment (MX40 P/N 865352)

For MX40 WLAN devices, use the following procedure to confirm that the RF coverage of the wireless network meets the requirements of the MX40 for the performance level for clinically safe operation.

Measurements are focused in patient care areas where patients spend the majority of their time (patient room, patient bathroom). Additional measurements are suggested for traditionally difficult coverage locations where monitored patients will be (in procedure areas, patient transport corridors (frequent roaming) and elevators, etc.).

During the procedure, the MX40 is worn on the body to more closely simulate the normal use model. The RF signal strength will be impacted by the body. Use the "Link Info" screen on the MX40 to monitor both signal strength and link quality while moving through the specified coverage area. If the test criteria are not met, remediation is required.

Signal strength remediation may include:

- moving access points
- adding access points

Interference remediation may include:

- removing the source of the interference
- changing the frequency of operation

Equipment Setup

1 Attach the patient cable to the MX40.

2 If the system is set for RF auto-shutoff (default configuration), the MX40 will turn off the radio after 10 minutes with no monitoring. To avoid this, connect the patient cable to a simulator, short the ECG lead wires together or attach a SpO_2 sensor and begin a continuous SpO_2 measurement.

Note — Shorting the lead wires will result in a continuous asystole alarm.

3 On the MX40, set the screen on time to always on. (SmartKeys > Screen Setup > Always On).

4 Navigate to the "Link Info" screen by touching the Device Status area  and then the network Link Quality area 

.

Note — When holding the MX40 in your hand, hold it near the battery door and keep it physically close to the body. If the MX40 is held near the display, it will result in excessive RF absorption from the body that will have a negative effect on the measurement technique.

Note — The device screen will "Lock" after the configured period of time unless there is some interaction with the touch screen. This will close the "Link Info" window. If the device locks, touch the SmartKeys button, navigate to the second screen, and touch the lock icon  to unlock.

Coverage Test Procedure

1 Set up the MX40 as described above.

2 Perform each of the two tests described below:

   a "With Body Blocking" - placing your body between the MX40 and the access point the MX40 is connected to, (for Smart-hopping and 802.11a/b/g MX40s) and

   b "No Body Blocking - there is there is no physical body between the MX40 and the access point the MX40 is connected to (for 802.11a/b/g MX40s).

3 Observe the Link Info screen for a period of 15-30 seconds and determine if the tests passed all the criteria using the appropriate table shown below.

4 Record the typical RSSI range for future reference.

5 Perform the tests at the in these locations:

- All patient rooms (near the bed, in the bathroom and near the window)
- Locations where patients may gather (lounges, smoking areas, chapel, etc.)
- Procedure rooms
- Patient transport corridors
- Elevators

6 If any of the locations fail any of the criteria, retest once or twice to confirm a persistent problem.

	Smart-hopping Pass / Fail Criteria		
Location	**RSSI - with Body Blocking RSSI ≥ -69dBm Record Typical RSSI Range**	**Link Quality Indicator 4 Green Bars with an Occasional 3 Yellow Bars**	**No WEAK SIGNAL inops on MX40 and No Lost Associations with IIC**
Example: Room 436	Pass -67 to -58dBm	Pass	Pass

	802.11 Pass / Fail Criteria			
Location	**RSSI - No Body Blocking RSSI ≥ -67dBm Record Typical RSSI Range**	**RSSI - with Body Blocking RSSI ≥ -75dBm Record Typical RSSI Range**	**Link Quality Indicator 4 Green Bars with an Occasional 3 Yellow Bars**	**No WEAK SIGNAL inops on MX40 and No Lost Associations with IIC**
Example: Room 436	Pass -62 to -57dBm	Pass -70 to -65dBm	Pass	Pass

The table below lists the WLAN Status Parameters and their associated definitions/settings. Access is through Service Mode or by touching the wireless icon in the Status Area while in Monitoring mode. The Status Parameters can then be viewed by touching the Link Quality area on the Device Status menu. Use the Status Parameter information to determine connection quality. Coverage must be at an RSSI value of ≥ -69 dBm (three green bars on the Link Quality Indicator.

a The defined Radius of Coverage ((RoC) for 1.4GHz Smart-hopping Networks is 32 ft.

b The defined Radius of Coverage (RoC) for 2.4GHz Smart-hopping Networks is 32 ft. in ETSI mode and 60 ft. in FCC mode.

Note — Interference is indicated by a poor Link Quality Indicator reading and an excessive number of Retries while RSSI is at an adequate value.

Link Information	Definition/Setting
RSSI	Received Signal Strength Indicator (moving average over 3 seconds)
Rate	Currently selected transmit rate (adapts dynamically based on wireless signal propagation behavior)
	Radio link quality relates to RSSI and Retries
Retries	Retries over last 3 seconds.
SQI	Signal Quality Indicator (SQI) = 0-4
Wireless LAN	On, Off
Conn. Status	Current wireless LAN connection status (None, Scanning, Authenticating, Associating, Connected, Link Problem)
Retries*	Retries since last reboot.
Mode	802.11ah, 802.11bg, 802.11g
WMM Mode	Wireless Multi-Media - Enable, Disable - support Quality of Signal (QoS) over WLAN
SSID	The Service Set Identifier in use - Network Name
Security Mode	Display selected security mode
Active Channel	Current radio channel
MAC AP WLAN	The MAC address of the access point to which a connection has been established
MAC Address	The MAC address of the MX40 WLAN radio
Network Info	IPAddress, Subnet Mask, Default Gateway, Server IP (Server IP - IP address of the PC server. If not entered (0.0.0.0) the address of the DHCP server, if any, is substituted)

WLAN Troubleshooting

Problem	Possible Cause	Solution
The MX40 fails to connect to Surveillance PIIC iX. MX40 displays inop '**No Central Monitor**' and Connection Status is in state '**None**.'	Status indicates that the MX40 does not have a network connection, or a radio "association" to the Access Point. There are several possible causes for this including: AP not turned on, or not connected to customer-supplied infrastructure properly.	Verify the AP is powered on and connected to the customer-supplied infrastructure properly.
	MX40 is not configured for the correct 802.11 radio modality (for the SSID setup (802.11a, 802.11bg, 802.11abg).	Check the configuration of the MX40 and verify radio modality is configured (refer to the MX40 service documentation). After the MX40 settings have been set via the IntelliVue Support Tool, make sure setting are Confirmed to ensure the settings are retained.
	MX40 not configured for the correct SSID. It must be the same as configured on the WLAN Controller.	Check the configuration of the MX40 and verify that the correct, case sensitive SSID is configured. Also, check the configuration of the SSID on the WLAN Controller. See "Step 1: Configure the ICN WLAN." on page 4-15 for the procedure. After the MX40 settings have been set via the Support Tool, make sure setting are Confirmed to ensure the settings are retained.
	MX40 not configured for the correct WPA/WPA2 pre-shared key, must be the same as configured on the WLAN Controller.	Check the configuration of the MX40 and verify that the correct WPA or WPA2 pre-shared key is configured. Check the configuration of the WPA/WPA2 key on the WLAN Controller. The default pre-shared key must not be used. See "Step 1: Configure the ICN WLAN." On page 4-15 for the procedure.
	MX40 is not seeing strong enough signals (-67 dBm or higher **when not body blocked**).	Deploy additional APs or adjust AP power levels to accommodate the required signal strength.
	MX40 was cloned and wireless settings were lost.	Configure the MX40 with the correct settings: SSID, WPA key, radio modality.
	MX40 not configured for the correct Country Code.	Do not change the MX40 country code from its default setting (1000). The default setting causes the monitor to use the country code provided by the AP to which it associates.
	Defective MX40.	If MX40 self test fails: 1. Verify issue persists with other MX40s. If so, verify CSCN WLAN settings. 2. If all settings are correct, replace MX40.

Problem	Possible Cause	Solution
MX40 fails to connect to Surveillance PIIC iX.	MX40 has a radio connection to the wireless infrastructure but has not been recognized by the Surveillance PIIC iX. Possible causes include:	
	MX40 not assigned to Surveillance PIIC iX. No Monitor label assigned to MX40 from Surveillance PIIC iX.	Assign patient monitor in to the Surveillance PIIC iX. Assign the Monitor Label to MX40 from Surveillance PIIC iX.
	Configuration problem using WEP, WPA(PSK), WPA2(PSK), or 802.1x. Authentication.	Verify the Mode, SSID, Country and Security settings in the MX40 match your installation.
	Configuration problem using WPA Enterprise or WPA2 Enterprise including 802.1x Authentication.	1. Check the connection Status. (Status message ... Conn.Status). If the state only shows "Scanning," make sure that the Mode, SSID, Country and Security settings in the MX40 Status screen are accurate. If not correct, correct the configuration using the IntelliVue Support Tool.
		2. Check the connection status. If the MX40 shows the state "Authenticating," the SSID, Mode, Country and Security settings are correct. If a WLAN connection to the Access Point is established, but the MX40 fails to authenticate, check the authentication server and WLAN controller error logs.
		3. As an investigation step, disable the CertificateCheck via the IntelliVue Support Tool (Configuration -> Hardware -> Network -> WLAN). If authentication is now possible, proceed with step 4. Otherwise, verify the authentication server configuration, WLAN controller configuration and the user credentials (User Name, Password, Anonymous Identity). If the previously used credential settings were incorrect, the MX40 is perhaps on the exclude list of the WLAN Controller. Resolve this issue on the WLAN controller. Note: Do not forget to re- enable the certificate check.
		4. Check the installed CA certificate using the support tool. - Task -> Clone from Medical Device - Open the cloned file using Configuration -> Configuration Editor - In Configuration Editor check Configuration -> Hardware -> Network -> WLAN -> Certificate 1 for validity (Valid from, Valid until).
		5. Make sure that the installed CA certificate is the root certificate of the authentication server certificate chain.

Smart-hopping Troubleshooting

Normal Start-up Process

1 MX40 performs self-test.

2 MX40 begins local monitoring.

3 MX40 establishes connection to Smart-hopping network.

4 MX40 establishes connection with IntelliVue Information Center.

General Troubleshooting:

1 Check status at the Information Center.

- Ensure MX40 equipment is assigned to a sector.
- Check for INOP messages in the sector.

2 Check status of MX40.

- Check for INOP messages.
- Check Device Status area icons for basic status.
- Navigate to **Link Info** screen for more detailed information if necessary.

Link Information	Definition/Setting
RSSI	Received Signal Strength Indicator (moving average over 5 seconds). Reported in dBm (decibel-milliwatts). See Signal Strength table below
	Link Quality Indicator Radio link quality relates to RSSI and Retries
Retries	This retry number represents the number of retries over the last second.
SQI	Signal Quality Indicator (SQI) = 0-4
Conn. Status	Current wireless network connection status Seeking: MX40 has Smart-hopping radio on and is looking for an Access Point Locked: MX40 has located an Access Point Active: MX40 has an active connection to an Access Point Inactive: MX40 has Smart-hopping radio turned off
RF Access Code	RF Access Code the MX40 is currently programmed for.
Retries*	Retries since last reboot.
MAC Info	The MAC address of the MX40 Smart-hopping radio.
Network Info	IP Address, Subnet Mask, Default Gateway, Server IP

Bars (LQI)	Average Retries (5 seconds)	Link Quality
4	0-1	Excellent
3	2-4	Good
2	5-9	Marginal
1	10-19	Insufficient
0	> 20	No Connection

SQI	RSSI - Received Signal Strength Indicator	Coverage
1.4 GHz		
4	> -60 dBm	Excellent
3	-68 to -60 dBm	Good
2	-77 to -69 dBm	Marginal
1	-83 to -79 dBm	
0	< or = to -84 dBm	Insufficient
2.4 GHz		
4	. -60 dBm	Excellent
3	-68 to -60 dBm	Good
2	-68 to -60 dBm	Marginal
1	-83 to -78 dBm	
0	< or = to -87 dBm	Insufficient

9. MX40 WLAN (P/N 865352)

This section provides information specific to the operation of the WLAN version of the MX40.

Important — MX40 WLAN (865352) requires compliance with Phillips Customer-supplied Clinical Network Specifications.

Short-range Radio and WLAN

Because at least 20 MHz separation is needed between the SRR channels and 802.11b/g (2.4 GHz ISM band) channels in order to source real-time waves over the SRR link, the MX40 WLAN device should only be used with Short-range radio when operating on the 802.11a (5.6 GHz) band. See Smart-hopping and SRR Channel Selection for 2.4GHz Smart-hopping Networks p. 2-15.

WLAN Configuration Parameters

The MX40 WLAN configuration is loaded into the MX40 using the IntelliVue Support Tool - Mark2 (IVST Mark2). The parameter values are changed using the IntelliVue Support Tool Configuration Editor which is accessed from the IVST Mark2 "Configuration/Reports" table. The WLAN parameters can be found under **Hardware** > **Network**. There are two menu pages, **Network** and **WLAN**.

Network

Many of the configuration parameters on the **Network** menu page do not apply to the MX40. See the table below.

Parameter	Applicable to MX40?	Available Selections	Comments
LAN IP Config			
Enabled	No	No	
Mode	No	No	
IP Address	No	No	
Subnet Mask	No	No	
Default Gateway	No	No	
WLAN IP Config			
Enabled	Yes	Off, On	Must be "On" for WLAN connection to function.
Mode	Yes	Off, DHCP, Manual, Bootp	The MX40 only supports "DHCP".
IP Address	No	No	
Subnet Mask	No	No	
Default Gateway	No	No	
DNS Config 1			
DNS Mode	No	No	
DNS Server 1	No	No	
DNS Server 2	No	No	
DNS Server 3	No	No	
IGS Server 1			
CI Mode	No	No	
CI Address	No	No	
CI TTL	No	No	

Parameter	Applicable to MX40?	Available Selections	Comments
IGS Server 2			
CI Mode	No	No	
CI Address	No	No	
CI TTL	No	No	
IGS Server 3	No	No	
CI Mode	No	No	
CI Address	No	No	
CI TTL	No	No	
IP Address Configuration			
IGMP	No	No	
CI Mode	No	No	
CI Address	No	No	
CI TTL	No	No	
QoS State	Yes	On, Off	To enable QoS, this must be configured "On", and WMM Mode on the WLAN page must be set to "Enabled".
QoS Level	Yes	0-7	A level of 6 is recommended.
Directory Mode	No	No	
Directory Address	No	No	

WLAN

Here are the parameters listed on the **WLAN** menu page.

Parameter	Applicable to MX40	Available Selections	Comments
General			
Country	Yes	1000	Not modifiable. A country code of 1000 allows the MX40 to adapt to the country code of the access point.
IP Address	Yes	0.0.0.0	Not modifiable. Uses DHCP for IP address.
WMM Mode	Yes	Disabled, Enabled	To enable QoS, this must be set to "Enabled", and QoS State on the Network menu page must be set to "On".

Parameter	Applicable to MX40	Available Selections	Comments
Security Mode	Yes	NotConfigrd, WEP, WPA (PSK), WPA2 (PSK), WPAEnterpr, WPA2Enterpr	WPA2-Enterprise is not recommended due to increased handover times.
Mode	Yes	None, Auto, 802.11ah, 802.11bg, 802.11g	
SSID	Yes	****	1-32 characters
WEP			
WEP Key Index	Yes	1, 2, 3, 4	This selects which WEP Key will be used.
WEP Key Size 1	Yes	104 Bit, 40 Bit	
WEP Key 1	Yes	****	10 or 26 hex characters based on Key Size 1,2,3,4,5,6,7,8,9,A,B,C,D,E,F
WEP Key Size 2	Yes	104 Bit, 40 Bit	
WEP Key 2	Yes	****	10 or 26 hex characters based on Key Size 1,2,3,4,5,6,7,8,9,A,B,C,D,E,F
WEP Key Size 3	Yes	104 Bit, 40 Bit	
WEP Key 3	Yes	****	10 or 26 hex characters based on Key Size 1,2,3,4,5,6,7,8,9,A,B,C,D,E,F
WEP Key Size 4	Yes	104 Bit, 40 Bit	
WEP Key 4	Yes	****	10 or 26 hex characters based on Key Size 1,2,3,4,5,6,7,8,9,A,B,C,D,E,F
WPA (PSK) / WPA2 (PSK)			
WPA Password	Yes	****	8-63 characters
WPA Enterprise / WPA2 Enterprise			
Authentication	Yes	NotConfigrd, PEAP, TTLS	If WPA / WPA2 Enterprise is selected, must select PEAP or TTLS.
Inner Authentication	Yes	NotConfigrd, PAP, CHAP, MSCHAP, MSCHAPv2	The MX40 only supports MSCHAPv2.
PEAP Version	Yes	Default, Version 0, Version 1	
PEAP Label	Yes	Default, EAP, PEAP	

Parameter	Applicable to MX40	Available Selections	Comments
Certificate Check	Yes	Disabled, Enabled	Should be "Enabled" is using a certificate. "Disabled" is provided for troubleshooting purposes.
User Name	Yes	****	0-63 characters
Password	Yes	****	0-63 characters
Anonymous Identity	Yes	****	0-63 characters
Certificate 1			
Friendly Name	Yes	****	0-32 characters
File	Yes	Add, Delete	
File Size	Yes		Not modifiable, reflects file chosen
Valid from	Yes		Not modifiable, reflects file chosen
Valid until	Yes		Not modifiable, reflects file chosen
PEAP Version	Default, Version 1, Version 2		
User name, Password	Yes	****	In EAP, PEAP mode this entry needs a User name and Password with 0-63 alpha-numeric characters. This identity is optionally used for the first authentication phase to hide the real user identity and four routing purposes. If the length is 0, "Not configured" is shown.
IGMP Mode (no user config required)	Yes	On	Enables IGMP support. No use of streaming multicast. IGMP is required to support IP Multicasting. Set to On with CI configured to Multicast. No user control.

WLAN Configuration Parameter Definitions

Network Parameter Definitions

These definitions are for the parameters that apply to the MX40.

WLAN IP Config – these are parameters that apply specifically to the wireless network adapter.

- "Enabled" under the WLAN IP Config section refers to the wireless network adapter in the MX40. When "Enabled" is configured "on" the wireless network adapter is on and active. When configured "Off", the wireless network adapter is in a low power sleep state.

- "Mode" under the WLAN IP Config section refers to the network configuration protocol the device uses when communicating over the 802.11 link. Although other selections may be available on the IntelliVue Support Tool Configuration Editor, the only network configuration protocol that the MX40 supports is DHCP.

IP Address Configuration – these parameters apply to the MX40 once the data reaches the wired network

- IGMP: IGMP (Internet Group Management Protocol) must be "On" to allow basic communication between the MX40 and the Information Center iX.
- QoS State: In order to enable Quality of Service for the MX40 data once it reaches the wired network, the "QoS State" parameter must be configured "On", and the "QoS Level" must be configured for a value greater than "0". Note: "WMM Mode" on the "WLAN" page must be configured for "Enabled" otherwise this setting will be ignored by the MX40.
- QoS Level: "QoS Level" sets the network QoS priority that the MX40 will use to tag packets. The QoS Level is used for both the wired and the wireless link. "0" is the lowest priority, "7" is the highest priority. A QoS Level of "6" is recommended for the MX40.

WLAN Parameter Definitions

General

- **Country**

  Not modifiable. A country code of 1000 allows the MX40 to adapt to the country code of the access point
- **IP Address**

  Not modifiable. The MX40 uses DHCP to obtain an IP address.
- **WMM Mode**

  This parameter enables or disables WMM (Wireless Multimedia Mode). Used for basic wireless quality of service. Note: "QoS State" on the "Network" page must be configured "On" and the "QoS Level" must be configured for a value greater than "0" otherwise this setting will be ignored by the MX40.
- **Security Mode**

  WEP, WPA(PSK) or WPA2(PSK), WPA-Enterprise and WPA2-Enterprise with either Protected EAP (PEAP) or Tunneled TLS (TTLS) as authentication methods. WEP is not recommended due to general security issues.
- **SSID**

  Service Set Identifier: Logical WLAN Network Name.

WEP

- **WEP Key Index**

  Defines the transmit WEP Key Index. This entry must match the WEP Key Index configured at the infrastructure device, i.e. on a WLAN Access Point, and ranges from 1 to 4.
- **WEP Key Size**

  The WEP Key Size 40 bit or 104 bit
- **WEP Key**

  The number of hex characters for the WEP key depends on the WEP key size chosen. For a 40 bit WEP key size the WEP key must be 10 hexadecimal characters long, for a 104 bit key the WEP key must be 26 hexadecimal characters long.

WPA

- **WPA Password**

  In WPA(PSK) or WPA2(PSK) mode this entry defines the Pre-Shared-Secret or Password with 8 to 63 alpha-numeric characters.

WPA Enterprise / WPA2 Enterprise

In WPA-Enterprise or WPA2-Enterprise mode the following parameters are used:

- **Authentication**

  The authentication method can be either Protected EAP (PEAP) or Tunneled TLS (TTLS).
- **Inner Authentication**

  For the MX40, PEAP and TTLS can only be used with MSCHAPv2 as the Inner Authentication method.
- **PEAP Version**

  This setting describes the PEAP protocol version to be used while authenticating against the authentication server. Valid values are Default, Version 0 and Version 1. If set to Default the decision is up to the wireless adapter. Version 0 or 1 forces the wireless adapter to use the protocol version required for a certain authentication server. This setting is intended for experts only.
- **PEAP Label**

  The PEAP label setting defines the string to be used to signal EAP-PEAP encryption to the authentication server. Valid values are Default, EAP or PEAP. Default leaves the decision up to wireless adapter. Both EAP and PEAP force the wireless adapter to use this setting. This setting is intended for experts only.
- **Certificate Check**

As long the Certificate Check is set to Enabled, the CA Certificate is used to verify the authenticity of the certificate chain delivered by the authentication server. The verification involves also the system time to check the validity period of every certificate in the chain. This item can only be set to Enabled, if an CA Certificate has been installed. Valid values are Disabled or Enabled.

- **Username**

  The username used in the encrypted tunnel with 1-63 alpha-numeric characters. It is also used as outer identity as long as the Anonymous Identity is not set.

- **Password**

  The password used in the encrypted tunnel with 8-63 alpha-numeric characters. Will be shown as four stars "****" after the user entered the password.

- **Anonymous Identity**

  The identity used for the outer PEAP or TTLS authentication, which may be "unprotected". Thus, the identity should be different to the Username for enhanced security. The Anonymous Identity contains

  1-63 characters. It can be set to NotConfigured by clearing it.

Certificate 1

- **Friendly Name**

  A certificate can be installed on the MX40, and when doing so, a "Friendly Name" of up to 32 characters can be assigned to it.

10. Safety Standards & Specifications

This section describes the regulatory standards that the IntelliVue MX40 complies with, along with product and measurement specifications.

Regulatory Information

Software Hazard Prevention

Potential hazards arising from errors in the software program have been identified. Mitigations applied to reduce the associated risk of such hazards are included as part of the Risk Management, Clinical Evaluation, and Verification and Validation phases of the product's development.

AC Power Source

The system is not intended for connection to the public mains as defined in CISPR-11.

Industrie Canada Compliance (Canada)

This Class B ISM device complies with Canadian ICES-001.

Cet ISM de la classe B est conforme à la norme NMB-001 du Canada.

Safety Standards

The device complies with the following safety requirements for medical electrical equipment:

- EN 60601-1:1990 + A1:1993 + A2:1995 +A11:1993 +A12:1993 + A13:1996 General Requirements for Safety (with worldwide deviations, including U.S. deviations)
- CSA C22.2 #601.1:1992 Medical Electrical Equipment - General Safety
- UL 60601-1 Medical Electrical Equipment - General Safety
- UL 2054 Standards for Household and Commercial Batteries
- EN 60601-1-1:2006 System Requirements
- EN 60601-1-4:2000 Safety Requirements for Programmable Electronic Medical Systems
- EN 50371:2005 Low Power Electronic and Electronic Apparatus Electromagnetic Exposure
- EN ISO 9919:2005 Requirements for SpO_2 Pulse Oximeters
- EN ISO 10993-1:2003 Biocompatibility
- EN ISO 10993-1:2003 Biocompatibility (for leadwires and pouch)
- EN ISO 9919:2005 Pulse Oximeters

- IEC 60601-1-2:2001 Electromagnetic Compliance
- IEC 60601-1-4:1999 +A1 Requirements for Programmable Electrical Medical Systems
- IEC 60601-1-6:2006 General requirements for basic safety and essential performance - Collateral standard: Usability
- IEC 60601-1-8:2006 General Requirements for Safety for Alarm Systems
- IEC 60601-2-49:2001 Particular Requirements for Safety for Patient Monitoring Equipment
- IEC 60601-2-27:2005 Particular Requirements for Safety for Electrocardiograph Monitoring Equipment
- IEC 62133:2002 Safety Requirements for Portable Sealed Secondary Cells (alkaline, lithium-ion)
- AAMI EC 13:2007 Performance Standard, Cardiac Monitors
- AAMI EC 53:1995 (R) 2001 ECG Cables/Leadwires (excluding 4.2.1)

Intended Use Statement

Intended for monitoring and recording of and to generate alarms for, multiple physiological parameters of adults and pediatrics in a hospital environment and during patient transport inside hospitals. Not intended for home use. Intended for use by health care professionals.

Indications for Use

Indicated for use by health care professionals whenever there is a need for monitoring the physiological parameters of patients. Intended for monitoring and recording of, and to generate alarms for, multiple physiological parameters of adults and pediatrics in hospital environments and during transport inside hospitals.

Intended Uses of MX40

The MX40 is to be used primarily as a traditional telemetry medical device. It connects to the IntelliVue Information Center by way of a wireless network. When the MX40 is connected the IntelliVue Information Center the IntelliVue Information Center provides the primary patient monitoring and alarming function. The MX40 does not automatically provide local monitoring or alarming when connected to the Information Center.

The MX40 can provide time-limited local monitoring when it is not connected to the wireless network.

Unlike a traditional bedside monitor which operates on AC power, the MX40 is powered by battery and cannot provide continuous monitoring.

Authorized EU Representative

Philips Medizin Systeme Deutschland
Hewlett-Packard-Strasse 2
D 71034, Boeblingen
Germany

Patient Population

This device is not for use with infant or neonatal patients.

Clinical judgment must be used to determine when the MX40 should be used on a specific pediatric patient, as it is not possible to assign a precise weight or age to ECG performance.

Use of the device is restricted to one patient at a time.

The components/accessories which come into contact with the patient's skin are in compliance with the relevant requirements of EN ISO 10993-1 for Biocompatibility. The device is not designed for direct contact with the patient's skin. The accompanying pouch is the appropriate means for holding the device.

Rx

Federal Law restricts this device to sale by or on the order of a physician.

Essential Performance

The IntelliVue MX40 provides Essential Performance (EP) under normal operating conditions (includes EMC exposure) only as a complete Medical Electrical System, consisting of the MX40, MPx companion monitor (Optional), IntelliVue CL SpO_2 and NBP Cableless Measurement devices(Optional), IntelliVue Telemetry Network Infrastructure, and the Information Center.

The System achieves its Essential Performance exclusively through alarm generation at the IntelliVue Information Center and locally at the MX40, based on configuration.

The IntelliVue MX40 protects the patient from unacceptable immediate clinical risk by generating specific Physiological Alarms when appropriate. If the system cannot generate Physiological Alarms, then relevant Severe or Hard-Level Technical Alarms (Inops) are created.

Risk Management Considerations

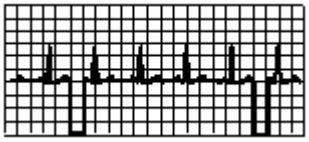
Warning

The MX40 operates exclusively via a wireless network connection, therefore, it should not be used for primary monitoring in applications where momentary loss of the ECG is unacceptable at the Information Center. It sends ECG and optionally pulse oximetry and respiration data to the Information Center, where the Information Center displays real-time patient data, provides alarm annunciation, data storage and review applications. The ECG waveform data, alarms and optionally SpO_2 and Resp can always be viewed on the MX40 regardless of the connection to the Information Center.

Smart Hopping technology alleviates most of the problems associated with legacy telemetry technologies. Reception problems are less frequent, because Smart Hopping avoids interference and moves to a different access point if the signal strength is too low. The level of radio frequency activity is always fluctuating in the environment. If the level becomes high enough to significantly interfere with transceiver operation, the system responds by moving to another "cleaner" area where there is less activity.

Dropouts

Because the MX40 operates exclusively via a wireless network connection, under certain frequency conditions dropouts can occur. Dropouts result from a weak signal or RF interference, and appear on the waveform when the signal "drops" to the bottom of the channel for a minimum of 200 ms. If dropouts are frequent enough to affect the heart rate count, the "Cannot Analyze ECG" or "Cannot Analyze ST" technical alarm occurs. If there are enough dropouts to cause disassociation/reassociation with the Information Center, events in the Clinical Review application can reflect loss of data for up to 1 minute in the worst case.

Problem	Cause	Remedy
Dropouts 	Low signal strength RF interference	See "Signal Strength" below. See "Radio Frequency Interference" below.

Monitoring Considerations

- Patient should be restricted to the designated coverage area. Monitoring performance will degrade if patients go outside the radius of coverage of the receiving wireless network.
- A patient location strategy is critical to a telemetry system. If a life-threatening event occurs, the clinician must be able to locate the patient quickly. The importance of this increases as the coverage area increases.
- Frequency management is the responsibility of the hospital. Philips Healthcare has no control over the RF environment in the hospital. If interference exists at the operating frequencies of the telemetry equipment, telemetry performance will be affected. Careful selection of frequencies for all wireless devices used within a facility (transceivers, other wireless medical devices, etc.) is important to prevent interference between them.

Caution

IEC/ANSI/AAMI 80001-1:2010

Philips recognizes the importance of a safe and effective network that meets both the business needs of a healthcare facility, IT networking requirements, and the clinical functionality. Philips supports the IEC 80001-1 standard in regards to working as a partner with a healthcare organization in the design, implementation, and management of the Medical IT-Network to properly provision and support not only Philips devices, but all the devices using the network. Applying the principles of risk management to hospital frameworks is highly encouraged.

When operating the MX40 on a Customer Supplied Clinical Network, Philips strongly encourages our customers to perform risk management of their Medical IT-Network infrastructure in accordance with IEC 80001.

If the MX40 experiences loss of network connectivity, technical alerts at the Information Center ("No Signal" or "No Data Tele") and at the MX40 ("No Central Monitor") will occur. The MX40 will also automatically revert to local monitor mode which activates display of patient data on the MX40 – however, when in this state, battery life will be shortened.

Electromagnetic Compatibility

Medical electrical equipment can either generate or receive electromagnetic interference. This product has been evaluated for electromagnetic compatibility (EMC) with the appropriate accessories according to IEC 60601-1-2:2001, the international standard for EMC for medical electrical equipment. This IEC standard has been adopted in the European Union as the European Norm, EN 60601-1-2:2001.

Radio frequency (RF) interference from nearby transmitting devices can degrade performance of the product. Electromagnetic compatibility with surrounding devices should be assessed prior to using the product.

Fixed, portable, and mobile radio frequency communications equipment can also affect the performance of medical equipment. See your service provider for assistance with the minimum recommended separation distance between RF communications equipment and the product.

The cables, sensors/transducers, and other accessories for which compliance is claimed are listed in the Service and User documentation accompanying the product.

Warnings

- The use of accessories, transducers and cables other than those specified in the product service and user documentation can result in increased electromagnetic emissions or decreased immunity of the product.
- Short-range radio connections are subject to interruption due to interference from other radio sources in the vicinity, including microwaves, bluetooth devices, and DECT phones. Outside the frequency band and 5% above and below, i.e. the exclusion band according to IEC 60601-1-2, the short-range radio connection is immune up to 3V/m in the frequency range from 80MHz to 2.5 GHz. Depending on the strength and duration of the interference, the interruption may occur for an extended period. Any interruption of the signal due to interference, moving out of range, or for other reasons is indicated with a Tele Disconnected INOP message.
- The product should not be used next to or stacked with other equipment. If you must stack the product, you must check that normal operation is possible in the necessary configuration before the product is used on patients.

Reducing Electromagnetic Interference

The MX40 and associated accessories can be susceptible to interference from other RF energy sources and continuous, repetitive, power line bursts. Examples of other sources of RF interference are other medical electrical devices, cellular products, information technology equipment, and radio/television transmission. If interference is encountered, as demonstrated by artifact on the ECG or dramatic variations in physiological parameter measurement values, attempt to locate the source. Assess the following:

- Is the interference due to misplaced or poorly applied electrodes or sensors? If so, re-apply electrodes and sensors correctly according to directions in Chapter 6.
- Is the interference intermittent or constant?
- Does the interference occur only in certain locations?
- Does the interference occur only when in close proximity to certain medical electrical equipment?

Once the source is located, attempt to attenuate the interference by distancing the MX40 from the source as much as possible. If assistance is needed, contact your local service representative.

Restrictions for Use

Artifact on ECG and other physiological waveforms caused by electromagnetic interference should be evaluated by a physician or physician authorized personnel to determine if it will negatively impact patient diagnosis or treatment.

Electromagnetic Compatibility (EMC) Specifications

Take special precautions regarding electromagnetic compatibility (EMC) when using medical electrical equipment. You must operate your monitoring equipment according to the EMC information provided in this book. Portable and mobile radiofrequency (RF) communications equipment can affect medical electrical equipment.

Accessories Compliant with EMC Standards

All accessories listed in the accessories section comply, in combination with the MX40, with the requirements of IEC 60601-1-2:2001 + A1:2004.

Warning

Using accessories other than those specified may result in increased electromagnetic emission or decreased electromagnetic immunity of the monitoring equipment.

Electromagnetic Emissions

Emissions Test	Compliance	Avoiding Electromagnetic Interference
Radio Frequency (RF) emissions	Group 1	TheMX40 uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class B	The MX40 is suitable for use in all establishments.
Harmonized emissions	Not Applicable	Device is battery powered only
Voltage fluctuations/Flicker emissions IEC 61000-3-3	Not Applicable	

Electromagnetic Immunity

The MX40 is suitable for use in the specified electromagnetic environment. The user must ensure that it is used in the appropriate environment as described below.

Immunity Test	IEC 60601-1-2 Test Level	Compliance Level	Electromagnetic Environment Guidance
Electrostatic discharge (ESD) IEC 61000-4-2	±6 kV contact ±8 kV air	±6 kV contact ±8 kV air	Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be a t levels characteristic of a typical location in a typical commercial and/or hospital environment

Recommended Separation Distance

Warning

The MX40, equipped with a wireless network interface, intentionally receives RF electromagnetic energy for the purpose of its operation. Therefore, other equipment may cause interference, even if that other equipment complies with CISPR emission requirements.

In the following table, P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m).

Portable and mobile RF communications equipment should be used no closer to any part of the MX40, including cables, than the recommended separation distance calculated from the equation appropriate for the frequency of the transmitter.

Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, should be less than the compliance level in each frequency range.

Interference may occur in the vicinity of equipment marked with this symbol: 

Immunity Test	IEC 60601-1-2 Test Level	Compliance Level	Electromagnetic Environment Guidance
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	3 VRMS	Recommended separation distance: $d = 1.2\sqrt{P}$
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	Recommended separation distance: 80 MHz to 800 MHz $d = 1.2\sqrt{P}$ 800 MHz to 2.5 GHz $d = 2.3\sqrt{P}$

Field strengths from fixed transmitters, such as base stations for radio (cellular, cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the monitor is used exceeds the applicable RF compliance level above, the MX40 should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the monitor.

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

The MX40 is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or user of the monitor can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment and the monitor as recommended below, according to the maximum output power of the communications equipment.

In the following table, P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m).

Frequency of Transmitter	**150 kHz to 80 MHz**	**80 MHz to 800 MHz**	**800 MHz to 2.5 GHz**
Equation	$d = 1.2\sqrt{P}$	$d = 1.2\sqrt{P}$	$d = 2.3\sqrt{P}$
Rated max. output power of transmitter	Separation distance	Separation distance	Separation distance
0.01 W	0.1 m	0.1 m	0.2 m
0.1 W	0.4 m	0.4 m	0.7 m
1 W	1.2 m	1.3 m	2.3 m
10 W	3.8 m	3.8 m	7.3 m
100 W	12.0 m	12.0 m	23.0 m

Electrosurgery Interference/Defibrillation/Electrostatic Discharge

The equipment returns to the previous operating mode within 10 seconds without loss of any stored data. Measurement accuracy may be temporarily decreased while performing defibrillation. This does not affect patient or equipment safety. Do not expose the equipment to x-ray or strong magnetic fields (MRI). The MX40 is not for use during electrosurgery.

Restart Time

After power interruption, an ECG wave will be shown on the display after 30 seconds maximum.

Battery Specifications

Battery Life

The battery life specifications listed below are based on the use of three Duracell MN 1500 batteries. Battery life for other brands may differ.

Telemetry Mode Networked (Display Off)	Battery Life (1.4GHz p/n 865350)	Battery Life (2.4GHz p/n 865351)
ECG Only (only one radio active)	24.9 hours	24.7 hours
ECG/SpO_2 Continuous (using legacy SpO_2 cable/sensors. Only one radio active.)	11.2 hours	8.9 hours
ECG/SpO_2 Manual	In this mode battery life is dependent on the usage rate and will range between the ECG Only battery life and the ECG/SpO_2 Continuous battery life.	

Monitor Mode Networked (Display On)	Battery Life (1.4GHz p/n 865350)	Battery Life (2.4GHz p/n 865351)
ECG Only (only one radio active)	11 hours	7.7 hours
ECG/SpO_2 Continuous (using legacy SpO_2 cable/sensors. Only one radio active.)	5.3 hours	2.9 hours
ECG/SpO_2 Manual	In this mode battery life is dependent on the usage rate and will range between the ECG Only battery life and the ECG/SpO_2 Continuous battery life.	

Monitor Mode Non-networked (Display On)	Battery Life (1.4GHz p/n 865350)	Battery Life (2.4GHz p/n 865351)
ECG Only (only one radio active)	6.8 hours	7.3 hours
ECG/SpO_2 Continuous (using legacy SpO_2 cable/sensors. Only one radio active.)	4.7 hours	4.6 hours

Monitor Mode Non-networked (Display On)	Battery Life (1.4GHz p/n 865350)	Battery Life (2.4GHz p/n 865351)
ECG/SpO_2 Manual	In this mode battery life is dependent on the usage rate and will range between the ECG Only battery life and the ECG/SpO_2 Continuous battery life.	

The battery life specifications listed below are based on the use of the Philips Rechargeable Lithium-ion battery.

Telemetry Mode Networked (Display Off)	Battery Life (1.4GHz p/n 865350)	Battery Life (2.4GHz p/n 865351)	Battery Life (WLAN p/n 865352)
ECG Only (only one radio active)	26.1 hours	25.1	25 hours
ECG/SpO_2 Continuous (using legacy SpO_2 cable/sensors. Only one radio active.)	15.6 hours	14.1	15 hours
ECG/SpO_2 Manual	In this mode battery life is dependent on the usage rate and will range between the ECG Only battery life and the ECG/SpO_2 Continuous battery life.		

Monitor Mode Networked (Display On)	Battery Life (1.4GHz p/n 865350)	Battery Life (2.4GHz p/n 865351)	Battery Life (WLAN p/n 865352)
ECG Only (only one radio active)	11 hours	10.4 hours	11 hours
ECG/SpO_2 Continuous (using legacy SpO_2 cable/sensors. Only one radio active.)	8 hours	7.8 hours	8 hours
ECG/SpO_2 Manual	In this mode battery life is dependent on the usage rate and will range between the ECG Only battery life and the ECG/SpO_2 Continuous battery life.		

Monitor Mode Non-networked (Display On)	Battery Life (1.4GHz p/n 865350)	Battery Life (2.4GHz p/n 865351)	Battery Life (WLAN p/n 865352)
ECG Only (only one radio active)	13 hours	10.4 hours	12 hours
ECG/SpO_2 Continuous (using legacy SpO_2 cable/sensors. Only one radio active.)	8.8 hours	7.8 hours	8.5 hours

Monitor Mode Non-networked (Display On)	Battery Life (1.4GHz p/n 865350)	Battery Life (2.4GHz p/n 865351)	Battery Life (WLAN p/n 865352)
ECG/SpO_2 Manual	In this mode battery life is dependent on the usage rate and will range between the ECG Only battery life and the ECG/SpO_2 Continuous battery life.		

Note — Use of the short-range radio can reduce battery life by 25%.

Note — The battery capacity of re-chargeable batteries degrades over time and number of recharge cycles. Toward the end of its useful life, the battery capacity may be reduced by 25-30%. If this reduced battery life is unacceptable based on your use model, Philips recommends replacing the rechargeable battery sooner.

Nominal Current

Operating Mode	Nominal Current (p/n 865350)	Nominal Current (p/n 865351)	Nominal Current (p/n 865352)
ECG Only (Display inactive)	67 mA @ 3.6V	67 mA @ 3.6V	70 mA @ 3.6V
ECG/SpO_2 Continuous (Display inactive)	136 mA @ 3.6V	136 mA @ 3.6V	140 mA @ 3.6V

Lithium-ion Battery Charge Time

Definition	Charging Method	Charge Time
Battery pack charge time from 90% depletion state	The Lithium-ion Battery Pack is charged on a separate external charging station. It must be removed from the MX40 to charge.	6.5 hours

Physical Specifications

Parameter	Specification
Height	126.8 mm (4.99 in)
Width	69.9 mm (2.75 in)
Depth	31.5 mm (1.24 in)
Weight • Without batteries, includes SpO_2 and short-range radio • With 3 AA batteries, includes SpO_2 and short-range radio • With lithium-ion battery, includes SpO_2 and short -range radio	 1.4 GHz - 240 g (8.5 oz) 2.4 GHz - 215 g (7.6 oz) WLAN - 206 g (7.3 oz) 1.4 GHz - 324 g (11.4 oz) 2.4 GHz - 298 g (10.5 oz) WLAN - 292 g (10.3 oz) 1.4 GHz - 314 g (11.1 oz) 2.4 GHz - 289 g (10.2 oz) WLAN - 274 g (9.7 oz)
Display • Type • View Area • Resolution • Backlight • ECG Display Sector Size (height) • ECG Display Sweep Speed • Resp Display Sweep Speed	 • 2.8" QVGA Color LCD • 43.2mm x 57.6 mm (1.70" x 2.26") • 240 x 320 • White LED • 13.5mm (portrait), 9.9mm (landscape) • 10mm/s with 4.32 sec of viewable ecg data (portrait), 10mm/s with 5.76 sec of viewable ecg data (landscape) • 2.5mm/s with 17.28 sec of viewable resp data (portrait) 2.5mm/s with 23.04 sec of viewable resp data (landscape).
Alarm Signal Sound Pressure Level	40dB(A) - 70dB(A)

MX40 1.4 GHz Smart-Hopping Radio

Parameter	Specification
Frequency Ranges	Bands: 1395-1400 MHz and 1427-1432 MHz Channel Spacing: 1.6 MHz
RF Output Power (existing systems)	8 dBm +2/-1.5 dB (4.5 mW to 10 mW), into antenna load
Radio Frequency Accuracy during normal operation	<+60/-100 KHz relative to channel frequency, includes temperature compensation and aging effects
Modulation Type	GFSK (1M40Q7D)
Out of Band Spurious Emission Levels: <= 1394 MHz, >= 1401 MHz <= 1428 MHz, >= 1433 MHz	<-41 dBm in 1 MHz bandwidth for FCC limit
Occupied bandwidth as defined by power in 99% BW	< +/- 800 KHz

1.4GHz WMTS (US only)

This device complies with Part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference. Operation of this equipment requires the prior coordination with a frequency coordinator designated by the FCC for the Wireless Medical Telemetry Service.

MX40 2.4 GHz Smart-Hopping Radio

Parameter	Specification
Frequency Range	ISM Band: 2400 - 2483.5 MHz
Channel Assignment	48 radio channels assigned from 2401.056 MHz - 2482.272 MHz Channel Spacing: 1.728 MHz
RF Output Power	FCC: Channels 0-46 -17 dBm +/- 1 dB (40 mW to 63 mW, nominal 50 mW), into antenna load. Channel 47 only - 15 dBm +/- 1 dB. ETSI: 12 dBm +/- 1 dB (13 mW to 20 mW, nominal 16 mW), into antenna load ARIB: 13.5 dBm +/- 1 dB (18 mW to 28 mW, nominal 22 mW), into antenna load
Radio Frequency Accuracy during normal operation	<+ 60 /- 100 KHz relative to channel frequency, includes temperature compensation and aging effects
Modulation Type	GFSK, Gaussian Frequency Shift keying (1M40Q7D)
Modulation Bandwidth	Typically 1.4 MHz (20 dB Bandwidth) Typically 980 KHz (6 dB Bandwidth)
Out of Band Spurious Emission Levels	Meets ETSI, RSS-210, FCC, ARIB standards

2.4 GHz ISM

FCC and Industry Canada Radio Compliance: This device complies with Part 15 of the FCC Rules and RSS-210 of Industry Canada. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Any changes or modifications to this equipment not expressly approved by Philips Healthcare may cause harmful radio frequency interference and void your authority to operate this equipment.

The radio device used in this product is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC (Radio Equipment and Telecommunications Terminal Equipment Directive). Class 2 radio equipment. Member states may apply restrictions on putting this device into service or placing it on the market. This product is intended to be connected to the Publicly Available Interfaces (PAI) and used throughout the EEA.

This ISM device complies with Canadian ICES-001. Cet appareil ISM est conforme a la norme NMB-001 du Canada.

MX40 Short-Range Radio

Parameter	Specification
Frequency Ranges	ISM Band: 2400-2483.5MHz
Radio Channel assignment	16 Radio Channel assigned, Fc= 2405 +5*(k-11)MHz, k=11,12,…,26
Frequency Control	Configured via the bedside monitor or the Information Center depending on use model.
RF Output Power	-1.5 to -4.5 dBm +2/-3dB (0.7 mW to 0.3 mW), into Antenna load.
MX40 Frequency Accuracy during normal operation	<+/-40ppm, includes temperature compensation & aging effects
Modulation Type	Direct Sequence Spread Spectrum (DSSS), O-QPSK with half sine pulse shaping modulation (1M40Q7D)
Modulation Bandwidth	>500KHz, typically +/-950KHz (6dB Bandwidth), typically +/-1.4MHz (20dB Bandwidth)

MX40 2.4GHz WLAN Radio

The MX40 2.4GHz/5.6GHz WLAN Radio conforms to the 802.11 a/b/g standard operating in the 2.4GHz and 5.6GHz ISM bands.

Note — For the MX40 WLAN device, Part Number 865352, use of the MX40's short-range Radio is only supported when operating with 802.11a (5.6GHz band).

The Radio characteristics are defined below.

WLAN Radio RF Specs	Specification
802.11b	
Technology	IEEE 802.11 b
Frequency Range	2.4 to 2.4835GHz
Transmitter Power	14 to 17 dBm into antenna load (RMS power)
Modulation	CCK (Complementary Code Keying)
Occupied Bandwidth, 99%	<-22 MHz
802.11g	
Technology	IEEE 802.11 g
Frequency Range	2.4 to 2.4835GHz
Transmitter Power	12 to 15 dBm into antenna load (RMS power)
Occupied Bandwidth, 99%	<-22 MHz
Modulation Type	OFDM (Orthogonal Frequency Division Multiplex)
Frequency Bands (802.11 b/g)	FCC, RSS-210, ETSI Japan{ARIB},China, AS/NZS: 2.400 – 2.4835GHz
Out of Band Emissions (802.11 b/g)	Meets ETSI, RSS-210, FCC, ARIB, AS/NZS standards
802.11a	
Technology	IEEE 802.11 a
Frequency Power	5.15 to 5.825GHz
Transmitter Power	12 to 14 dBm into Antenna load (RMS power)
Occupied Bandwidth	≤ 18 MHz
Modulation	DSSS : OFDM (Orthogonal Frequency Division Multiplex)

WLAN Radio RF Specs	Specification
Frequency Bands (802.11a)	FCC, RSS-210: 5.15 ~ 5.25Ghz, 5.25 ~ 5.35Ghz, 5.42 ~ 5.725Ghz, 5.725 ~ 5.825Ghz (excluding 5.6 ~5.65GH ETSI, AS/NZS: 5.15~ 5.35Ghz, 5.47 ~ 5.725Ghz Japan, ARIB: 5.150 – 5.250GHz, 5.25 – 5.35GHz, 5.470 – 5.725GHz, China: 5.725 ~5.825Ghz
Out of Band Emissions (802.11a)	Meets ETSI, RSS-210, FCC, ARIB, AS/NZS standards

FCC and Industry Canada Radio Compliance

This device complies with Part 15 of the FCC Rules and RSS-210 of Industry Canada. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Any changes or modifications to this equipment not expressly approved by Philips Healthcare may cause harmful radio frequency interference and void your authority to operate this equipment.

- The maximum antenna gain permitted (for devices in the 5250-5350 MHz and 5470-5725 MHz bands) complies with the e.i.r.p. limits as stated in RSS-210.
- The maximum antenna gain permitted (for devices in the 5725-5825 MHz bands) complies with the e.i.r.p. limits specified for point-to-point operation as stated in RSS-210.
- The device for band 5150-5250 MHz is only for indoor usage to reduce potential for harmful interference to co-channel mobile satellite systems.

Caution

High power radars are allocated as primary users of 5250-5350 MHz and 5650-5850 MHz. These radars could cause interference and/or damage to LE-LAN devices.

Environmental Specifications

Parameter	Specification
Temperature	
Operating	0 to 37° C (32 to 99° F)
Storage	-30° C to 50° C (-22° F to 122° F) without batteries 12° C to 35° C (53.6° F to 95°F) with Single-Patient-Use leadsets
Humidity	
Operating	< 95% RH at 37° C (98.6° F) non-condensing
Storage	< 90% RH at 50° C (122° F) without batteries
Altitude	
Operating & Non-operating	3,000 m (9,842 ft)
Barometric Pressure	72kPa (537 mmHg)

Measurement Specifications

ECG

Parameter	Specification
ECG channel transmitted Leads	
3 electrodes	Channel #1 = I, II, or III
5 electrodes	Channel #1 = II Channel #2 = III Channel #3 = MCL
5 electrodes, EASI	Channel #1 = Va-i Channel #2 = Va-s Channel #3 = Ve-s
6 electrodes	Channel #1= II Channel #2 = III Channel #3 = MCLa Channel #4 = MCLb
Resolution	5 μV
ECG Input	Differential, defibrillator protected against 360 joules discharge into a 100 ohm load
Input Impedance	> 5 megohms (@ 10 Hz
Input Dynamic Range	+/- 9 mV
DC Offset Range	+/- 320 mV
CMRR	≥ 90 dB @ 50, 60 Hz
Bandwidth +/- 3 dB	0.05 to 40 Hz
Gain Accuracy	+/- 5% at 25 °C (77 °F)
Noise Referred to ECG Input (Peak-to-Peak)	AAMI: 30 μV (as per AAMI EC 13)
Lead Wires	3, 5 or 6-wire patient cable compatible with IntelliVue Patient Monitor, AAMI/IEC color codes
Time to baseline recovery from Defibrillator	AAMI: 5 s max (until ECG wave is on display but not yet centered, monitoring bandwidth)

Parameter	Specification
Pacer Rejection Performance (Pace pulses with no tails).	Positive pacers[1] Amplitude — Width +2 to +700 mV — 0.1, 0.2, 0.5 and 1.0 ms +2 to +500 mV — 1.5 ms +2 to +400 mV — 2 ms Negative pacers[1] Amplitude — Width -2 to -700 mV — 0.1, 0.2, 0.5 and 1.0 ms -2 to -500 mV — 1.5 ms -2 to -400 mV — 2 ms [1] Philips does not claim, verify, or validate support for all available pacemakers.
EMC Performance Limits, radiated immunity	Meets Essential Performance.
ECG Patient Cable Disconnection Safety	All ECG connections are patient safe within 750 msec of patient cable removal, with patient leakage current <10 μA. Exception: Leadset detection pins are protected mechanically to prevent patient contact.

ECG Performance Disclosure/Specifications

Characteristic	Performance Disclosure/Specification (in italics)
Heart Rate Averaging Method	Two different methods are used: • Normally, heart rate is computed by averaging the 12 most recent RR intervals. • If each of 3 consecutive RR intervals are greater than 1200 milliseconds (i.e. rate less than 50 b/min) for adult and pediatric patients, then the 4 most recent RR intervals are averaged to compute the HR.
Heart Rate Meter Accuracy and Response to Irregular Rhythm	Provides correct heart rates (80, 60, 120, 90 b/min) using test waveforms as indicated in ANSI/AAMI EC13 Sec. 4. 1. 2. 1 (e).
Response Time of Heart Rate Meter to Change in Heart Rate	For a rate increase, the average time to reach the specified heart rate using test waveforms as indicated in ANSI/AAMI EC13 Sec. 4. 1. 2. 1 (f) is 10 seconds. For a rate drop, the average time is 7 seconds.

Characteristic	Performance Disclosure/Specification (in italics)
Time to Alarm for Tachycardia	The ranges of time to alarm using test waveforms as indicated in ANSI/AAMI EC13 Sec. 4 1. 2. 1 (g) are 4 to 5 seconds.
Pacemaker Pulse Rejection Capability	Rejects pace pulses using test waveforms as indicated in ANSI/AAMI EC13 Sec. 4. 1. 4.1 (with amplitude from +/- 2 to +/- 700 mV, width from 0.1 to 2.0 ms).
Range and Accuracy of Heart Rate Meter	Meets the ANSI/AAMI EC13 Section 4.2.7 recommended minimum range and accuracy. Heart rate range is 15 - 300 b/min for adults patients and 15-350 b/min for pediatric patients with accuracy of ± 1% of the range. (Note: for rates equal to or less than 15, the displayed heart rate is 0).
Alarm Limit Range	Meets the ANSI/AAMI EC13 Section 4.2.8.1 standard. Lower alarm limit is 15 -295. Upper alarm limit is 20 - 300.
Resolution of Alarm Limit Settings	Meets the ANSI/AAMI EC13 Section 4.2.8.2 standard. The resolution is ± 5 b/min.
Alarm Limit Accuracy	Meets the ANSI/AAMI EC13 Section 4.2.8.3 standard. Error less than ± 10% or ± 5b/min
Time to Alarm for Cardiac Standstill	Meets the ANSI/AAMI EC13 Section 4.2.8.4 standard: maximum alarm time <10 seconds, using the test waveforms as indicated.
Time to Alarm for Low Heart Rate	Meets the ANSI/AAMI EC13 Section 4.2.8.5 standard: maximum alarm time <10 seconds, using the test waveforms as indicated.
Time to Alarm for High Heart Rate	Meets the ANSI/AAMI EC13 Section 4.2.8.6 standard: maximum alarm time <10 seconds, using the test waveforms as indicated.
Alarm Silencing	The time required for reactivation of a latched, silenced alarm is 3 minutes
ECG Waveform Display Time Base Accuracy	*Meets the ANSI/AAMI EC13 Section 4.2.9.6 standard: maximum error = +/-10%.*
Channel Width	*Meets the ANSI/AAMI EC13 Section 4.2.9.7(a) standard: minimum = 30mm.*
Trace Width	*Meets the ANSI/AAMI EC13 Section 4.2.9.7(b) standard: maximum = 1.0mm.*
Aspect Ratio	*Meets the ANSI/AAMI EC13 Section 4.2.9.7(f) standard: 0.4 ± 0.08 s/mV.*
Input Signal Reproduction Accuracy: Overall Error	*Meets the ANSI/AAMI EC13 Section 4.2.9.8(a) standard: maximum = +/- 20%.*
Frequency Response: Sinusoidal	*Meets the ANSI/AAMI EC13 Section 4.2.9.8(b) standard: 0.67 to 40 Hz* *(3 db down).*

Characteristic	Performance Disclosure/Specification (in italics)
Frequency Response: Triangular	*Meets the ANSI/AAMI EC13 Section 4.2.9.8(b) standard: 0 to 25% reduction.*
Impulse Response: (for waves marked with ST bandwidth)	*Meets the ANSI/AAMI EC13 Section 4.2.9.8(c) standard: displacement maximum = 0.1 mV; slope* *maximum = 0.30 mV/s.*
Pacemaker Pulse Display Capability	*Meets the ANSI/AAMI EC13 Section 4.2.9. 12 standard: minimum = 0.2 mV RTI.*
Tall T-Wave Rejection Capability	Meets AAMI standard: 0.5 – 40 BW: HR of 80bpm at all T-wave amplitudes 0.05 – 40 BW: HR of 80bpm at all T-wave amplitudes

Respiration

Parameter	Specification
Leads Used for Measurement	RA, LL (standard) or I, A (EASI)
Range	Adult/Pedi: 0 to 120 rpm
Bandwidth	0.3Hz to 2.5Hz (-6dB)
Noise	Less than 25 mOhm (rms) referred to the input
Calibration Signal	Signal: 1 Ohm p-p; Accuracy: +/- 20%
Respiration Rate Resolution	1 rpm
Respiration Accuracy	+/- 1 rpm for 0-120 rmp
Auxiliary Current, Respiration Excitation Signal	< 470 uA rms @48KHz, sinusoidal waveform

Respiration Alarm

Alarm	Range	Delay
High	Adult/Pediatric: 10 to 100 rpm	≤ 15 seconds
Low	Adult/Pediatric: 0 to 95 rpm	for limits from 0 to 20 rpm: max. 4 seconds for limits above 20 rpm: max. 15 seconds
Apnea Alarm	10 to 40 seconds	Incremental delay 5 seconds max.

FAST SpO_2

Parameter	Specification
SpO_2 Measurement Range (Calibration and Display)	0 to 100%
SpO_2 Accuracy	See table following.
SpO_2 Resolution	1%
SpO_2 Numerics - Averaging	5 - 20 seconds (default = 10 seconds) ***Note—***The update rate for the SpO_2 pulse oximetry value and pulse rate is typically 1 second. This can be extended to a max. 60 s when NBP is measured on the same limb, with a corresponding INOP message after a max. of 30 s, indicating that the displayed values are not current values. The effect of SpO_2 pulse oximetry on data averaging is internally controllable by the patient worn monitorMX40, with no user controls.
SpO_2 & Pulse Numerics - Update Rate	Transmitted once per second. ***Note—***The update rate for the SpO_2 pulse oximetry value and pulse rate is typically 1 second. This can be extended to a max. 60 s when NBP is measured on the same limb, with a corresponding INOP message after a max. of 30 s, indicating that the displayed values are not current values.
Pleth Wave- Sampling Rate	125 sps
Technical Alarms (INOPs)	Triggered if the sensor is disconnected, if a pulse is not detected, if the signal is noisy, if light interference is detected, if the sensor is defective, if the measurement is erratic, or if the module is malfunctioning
Wavelength Range	500 to 1000 nm ***Note—***Information about wavelength range can be especially useful to clinicians (e.g., clinicians performing photodynamic therapy).
Pulse Rate Measurement (available only with Continuous SpO_2)	Range: 30 to 300 bpm Accuracy: +/- 2% Resolution: 1 bpm

Parameter	Specification
Display of SpO_2 numerics	SpO_2 values are displayed as xxx % SpO_2 to meet ISO 9919.
Emitted Light Energy	$\leq$ 15 mW

SpO_2 Sensor Accuracy

Type	Description	Model Number	Accuracy % [A]rms (70-100% Range)
Reusable Sensors			
	Adult Finger, 2m cable	M1191B	2.0
	Adult Finger, 3m cable	M1191BL	2.0
	Adult Finger, 0.45m cable	M1191T	3.0
	Pediatric, Small Adult Finger, 1.5m cable	M1192A	2.0
	Pediatric, Small Adult Finger, 0.45m cable	M1192T	3.0
	Adult &Pediatric Ear Clip, 1.5m cable	M1194A	3.0
	Adult Finger Clip, 3m cable	M1196A	3.0
	Adult Finger Clip, 2m cable	M1196S	3.0
	Adult Finger Clip, 0.9m cable	M1196T	3.0
	LNCS Adult Reusable Sensor	Masimo LNCS DC-I	2.0
	LNCS Pediatric Reusable Sensor	Masimo LNCS DC-IP	2.0
	LNCS Tip-Clip Ear Reusable Sensor	Masimo LNCS TC-I	3.5
	LNOP Adult Reusable Sensor	Masimo LNOP-DC-I	2.0
	LNOP Pediatric Reusable Sensor	Masimo LNOP DC-IP	2.0
	LNOP Tip-Clip Reusable Sensor	Masimo LNOP TC-I	3.5

Type	Description	Model Number	Accuracy % [A]rms (70-100% Range)
Single Patient Use Sensors			

Type	Description	Model Number	Accuracy % [A]rms (70-100% Range)
	Adult Finger, > 40kg	M1901B	3.0
	Pediatric 3-20kg	M1902B	3.0
	Pediatric Finger, 10-50kg	M1903B	3.0
	Adult Finger, >30kg	M1904B	3.0
	Adult, Pediatric > 20kg	M1131A	3.0
	Adult Finger, > 30kg	Nellcor OxiMax Max-A	3.0
	Adult Finger, > 30kg	Nellcor OxiMax Max-AL	3.0
	Adult Finger > 40kg	Nellcor OxiMax Max-N	3.0
	Pediatric	Nellcor OxiMax Max-P	3.0
	Pediatric	Nellcor OxiMax Max-I	3.0
	Adult Finger > 30kg	Nellcor Oxisensor II D-25	3.0
	Adult Finger > 40kg	Nellcor Oxisensor II N-25	3.0
	Pediatric Finger 10-50kg	Nellcor Oxisensor II D-20	3.0
	Adult Finger	Nellcor OxiCliq A	3.0
	Pediatric Finger	Nellcor OxiCliq P	3.0
	Pediatric	Nellcor OxiCliq I	3.0
	Adult Finger > 40kg	Nellcor OxiCliq N	3.0
	Pediatric Adhesive	Masimo LNOP PDT	2.0
	Pediatric Adhesive	Masimo LNOP PDTx	2.0
	Adult Adhesive	Masimo LNOP ADT	2.0
	Adult Adhesive	Masimo LNOP ADTx	2.0
	Adult Adhesive	Masimo LNCS ADTx	2.0
	Pediatric Adhesive	Masimo LNCS PDTx	2.0
	Adult Adhesive	Masimo LNCS Neo-3	2.0

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