Flexible Fetal & Maternal Monitoring FM20/30

Philips M2702A/M2703A Technical Data Sheet Release L.3

The Philips Avalon FM20/FM30 fetal monitor offers a reliable, cost-effective, high-performance solution for fetal monitoring needs in clinics and hospitals, doctors' practices, and private households. This ranges from prenatal check-ups to antepartum monitoring of high-risk pregnancies, and monitoring during labor and delivery.

With a cutting-edge feature set, including advanced transducers, **triplets** monitoring, high-quality signal processing, and a **touchscreen** interface, the Avalon FM20/FM30 sets new standards for performance, flexibility, convenience, and ease of use.

The unique **Smart Pulse** measurement integrated into the Toco transducer simplifies monitoring. Without an additional sensor, the maternal pulse rate is monitored and continuously compared with the heart rate from the fetal sensor (cross-channel verification).

In combination with an **Avalon CL Transducer System**, all fetal and maternal measurements can be monitored cablelessly, including twins, triplets, and Smart Pulse.

The **battery option** gives monitoring flexibility for in-house transport, or bridging a mains power outage

Features

Transducers and Measurements

- Smart transducers are waterproof, comfortable to wear, and easy to clean
- **Ultrasound** (US) fetal heart rate monitoring of singletons, twins, and even triplets
- **Fetal Movement Profile** (FMP) automatically detects fetal body movements for antepartum applications using an ultrasound transducer
- **External uterine activity** (Toco) monitoring
- **Smart Pulse** integrated into the Toco MP transducer detects the maternal pulse rate without the need for an additional sensor (SpO_2 or MECG), confirming correct fetal heart rate monitoring
- **Cross-Channel Verification** (CCV) detects the coincidence between all fetal and maternal heart and pulse rates
- **NST timer** for antepartum applications
- Optional **Non-Stress Test** (NST) report software allows the interpretation of fetal heart rate and Toco traces. It generates automatically a printed report for an NST, based on NICHD guidelines from 2008 for electronic fetal heart rate monitoring, or based on the Dawes/Redman method (not available for USA, other FDA regulated territories, and Canada).

- Optional **maternal noninvasive blood pressure** (NBP) including pulse rate
- Heart rate with **maternal ECG** (MECG)
- Cableless monitoring with an Avalon CL Transducer System
- Beltless monitoring with the Avalon CL Fetal & Maternal Pod and Patch (not available for USA, other FDA regulated territories, and Canada)
- Extended wireless monitoring with the Avalon CL Wide Range Pod
- Optional monitoring of maternal temperature with the Tympanic Temperature Thermometer
- Entering of manually taken maternal temperature
- Direct fetal heart rate monitoring with fetal **ECG (DECG)** including waveform display (FM30 only)
- Intrauterine pressure monitoring (IUP) (FM30 only)
- Optional maternal pulse oximetry (SpO_2) and continuous maternal pulse rate (FM30 only)
- Access of all screen-operable functions of the fetal monitor on a remote display through the support of the XDS Remote Display application in combination with IntelliSpace Perinatal

Monitor

- High-resolution **color TFT touchscreen display** with a wide viewing angle. Fetal and maternal measurements are displayed as large, easy-to-read numerics

- Intuitive user functionality via the touchscreen
- Quick and simple cleaning due to the absence of mechanical controls
- Optimized size and presentation of measurements with automatic screen layouts
- Displaying information such as **Patient Identification** (including the bed label when connected to a surveillance system such as IntelliSpace Perinatal), date and time, alarm information, recorder status, and prompt and error messages
- Fast access to functions, for example starting a recording or resetting the Toco baseline via configurable **SmartKeys**
- Adjustment of the heart rate and alarm volume with an indication of the current setting
- With the automatic channel management, all wired fetal transducers, patient modules, or remote event markers can be connected to any of the fetal sensor sockets at the left side of the monitor
- Identification of the relation between transducer and numeric through a **transducer finder LED**, with the position indication on the screen that shows to which fetal sensor socket a transducer is connected
- Comprehensive patient data presentation, including at-a-glance patient identification, and the choice to add **user-configurable notes** or **individual typed notes**
- Optional battery operation with a built-in Smart Battery (M4605A) and an external AC/DC power supply (M8023A with option E25). The fetal monitor can operate using battery power for at least four hours.

Recorder

- Built-in six-inch high-resolution thermal array recorder with paper type detection and paper-out warning
- Trace output of fetal and maternal heart rates, fetal movements, and uterine activity, and annotation of time, date, trace identification symbols, patient information, and software versions
- Maternal heart and pulse rate are printed every five minutes
- SpO_2 value is printed every five minutes (configurable to every 1 minute) (FM30 only)
- Maternal noninvasive blood pressure and temperature values are annotated at the end of the measurement
- Recording of six-second MECG and/or DECG wave snapshots with 25 mm/s scaling in parallel to, or separate from the fetal traces (FM30 only)
- Internal backup memory for at least 7 hours of trace data (>3.5 hours with previous hardware revision <A 00.18):
  - Stored data recording to print a specific patient episode from a selected patient at high speed, even multiple times
  - Bridge paper-out for printing the missing piece of trace after new paper has been loaded
  - Data recovery after an interruption of the online data transmission to an IntelliSpace Perinatal system over a LAN connection
- Paper Save Mode for maternal measurements

Alarms

When an alarm condition is fulfilled, it is signaled by the monitor in the following ways:
- An alarm tone sounds
- An alarm message is shown on the screen
- The numeric of the alarming measurement flashes on the screen

Alarm categories

- **Physiological Alarms**: are triggered by fetal and maternal parameters (for example, to indicate vital sign alarm limit violations)
- **Technical Alarms (INOPs):** are triggered by signal quality problems, equipment malfunction, or equipment disconnection

Alarm modes

- **All**: patient alarms and INOPs are enabled, with audible and visual indications active (default setting)
- **INOP only**: INOPs are enabled, with audible and visual indications active

Alarm suspension

- Alarms Off/Pause Alarms function
- Alarm pause period: one, two, or three minutes, or indefinite

Alarm latching/non-latching

- Visual
- Audible
- Visual and audible

Standard Interfaces

Cableless monitoring with the Avalon CL Transducer System, that is connected to a fetal sensor socket.

Optional Interfaces

LAN/RS232 System Interface

The LAN/RS232 interface has two fully isolated ports:

1. The LAN port is used to connect the monitor to an IntelliSpace Perinatal obstetrical information and surveillance system (revision E.0 or later) on a network. IntelliSpace Perinatal controls all patient admit/discharge events.
2. The RS232 port can be used for connecting the monitor to an obstetrical information and surveillance system, such as IntelliSpace Perinatal.

Dual system interface support: If an obstetrical information and surveillance system is connected via LAN, another information system (EMR) can be independently connected via RS232 in read-only mode.

Dual MIB/RS232 Interface

The dual MIB, Medical Information Bus (IEEE P1073), is a standard for interfacing medical devices, used for the Data Export functionality to export measurement values from the monitor to other devices or to connect the Tympanic Temperature Thermometer.

Flexible Nurse Call Interface

- Alarms generated on the monitor are signaled on an external device such as a nurse call system, a beeper, or a light
- Providing three general alarm relays
- Connection of the external device to the alarm relay of the monitor
- Configurable alarm criteria
- Active open and closed contacts and a user-definable delay time

Device Interface (USB Interfaces)

- USB interfaces are used to connect USB devices (mouse, keyboard, or barcode reader) to the monitor.

Service Features

- The Configuration Mode is password-protected and allows trained users to customize the monitor configuration
- The Demo Mode is password-protected and is intended for training and educational purposes
- The Service Mode is password-protected and ensures that only trained staff can access service tests and tasks
- The Support Tool uses the LAN interface of the fetal monitor and helps technical personnel to:
  - carry out configuration, upgrades, and troubleshooting on an individual monitor
  - share configuration settings between monitors
  - back up the monitor settings

Related Products

Avalon CL Transducer System

The monitor is compatible with the Avalon CL Transducer System allowing expectant mothers to be continuously monitored without wires, whether in the bath or shower, in the bed, or while ambulating. Refer to the Avalon CL Technical Data Sheet for further information.

Avalon CL Transducer System

Avalon CL Fetal & Maternal Pod and Patch

The CL F&M Pod provides measurement values for fetal and maternal heart rate and uterine activity. It is controlled via short-range radio from the Avalon CL base station and the connected fetal monitor. The operating range is in-room, unless the CL F&M Pod is used in connection with the CL Wide Range Pod.

The CL F&M Pod is assigned by docking it at the Avalon CL base station. For monitoring, the CL F&M Pod is placed on a CL F&M Patch and held in place by integrated magnets. Monitoring with the CL F&M Pod and Patch can continue when the patient takes a shower. The CL F&M Pod is not intended for underwater monitoring, for example in a bathtub.

Avalon CL Fetal & Maternal Pod

Avalon CL Wide Range Pod

The Avalon CL Wide Range Pod is an extension of the Avalon CL solution. The Avalon CL Wide Range Pod extends the signal range of the cableless and beltless measurements. It transmits the cableless and beltless measurement signals via the hospital WLAN to the fetal monitors. Wearing the Avalon CL Wide Range Pod, the patient can walk freely within the hospital's WLAN range during monitoring. Prior to use, the Avalon CL Wide Range Pod is charged with and assigned to the Avalon CL base station.

Avalon CL Wide Range Pod

Tympanic Temperature Thermometer

The monitor is compatible with the Tympanic Temperature Thermometer which measures the maternal temperature in the ear. The value of this measurement can be automatically adjusted to correspond to a different body reference site. The measured value is shown on the display of the thermometer and transmitted to the monitor. Refer to the Tympanic Temperature Thermometer Technical Data Sheet for further information.

Tympanic Temperature Thermometer

Regulatory and Standards Compliance

The monitor complies with the requirements of the European Medical Devices Directive 93/42/EEC and the following major international standards.

Safety Specifications

The fetal monitors comply with the following major international safety and performance standards:
- IEC 60601-1:2005+A1:2012 / EN 60601-1:2006+A1:2013
- IEC 60601-1-6:2010-A1:2013 / EN 60601-1-6:2010+A1:2015
- IEC 60601-1-8:2006+A1:2012 / EN 60601-1-8:2007+A1:2013
- IEC 60601-2-49:2011 / EN 60601-2-49:2015
- ANSI/AAMI ES60601-1:2005+A1:2012+C1:2009+A2:2010/2012
- CAN/CSA C22.2#60601-1-14
- JIS T 1303 2005

The possibility of hazards arising from hardware and software errors was minimized in compliance with ISO 14971:2007 / EN ISO 14971:2012 and IEC 60601-1:2005+A1:2012 / EN 60601-1:2006+A1:2013.

Alarm sounds are compliant with Standard IEC 60601-1-8:2006+A1:2012 / EN 60601-1-8:2007+A1:2013

Electromagnetic Compatibility

- IEC 60601-1-2:2007 / EN 60601-1-2:2007+AC:2010
- ICES-003:2012

The monitor is classified as electromagnetic emissions Class B, except when used with the IUP/ECG patient module M2738A, then it is classified as Class A.

This ISM device complies with Canadian ICES-003. Cet appareil ISM est conforme à la norme NMB-001 du Canada.

Environmental Specifications

The monitor may not meet the given performance specifications if it is stored and used outside the specified temperature and humidity ranges.

FM20/FM30 Monitor

Item	Condition	Range
Temperature range	Operating	without battery: 0-45°C (32-113°F) with fully charged battery: 0-40°C (32-104°F) with battery charging: 0-35°C (32-95°F)
	Storage	-20-60°C (-4-140°F) (except recorder paper)
Humidity range	Operating	<95% relative humidity @ 40°C (104°F)
	Storage	<90% relative humidity @ 60°C (140°F) (except recorder paper)
Altitude range	Operating	-500-3000 m (-1640-9840 ft)
	Storage	-500-13100 m (-1640-43000 ft)

Transducers (M2734A/M2734B/M2735A/M2736A/M2738A)

Item	Condition	Range
Temperature range	Operating	0–40°C (32–104°F)
	Storage	-20–60°C (-4–140°F)
Humidity range	Operating	<95% relative humidity @ 40°C (104°F)
	Storage	<90% relative humidity @ 60°C (140°F)
Altitude range	Operating	-500–3000 m (-1640–9840 ft)
	Storage	-500–13100 m (-1640–43000 ft)

Philips SpO_2 Sensors (FM30 only)

Item	Condition	Range
Temperature range	Operating	Reusable sensors (M119xX) 10–37°C (50–98.6°F)
		Disposable sensors (M113xA) 0–55°C (32–131°F)

Physical Specifications

FM20/FM30 Monitor

Item	Condition	Range
Power (without battery option)	Supply voltages	100–240 VAC ± 10%
	Supply frequency range	50–60 Hz
	Power consumption (current)	0.7–0.4 A
Dimensions and weight (W x H x D)	Without options	286 x 134 x 335 mm (11.3 x 5.3 x 13.2 in)
	Weight without battery	5.1 kg (11.2 lbs)
	Weight with battery	5.3 kg (11.7 lbs)
Classification	Degree of protection against electrical shock	Type CF
	Electrical class	Class II equipment
	Mode of operation	Continuous operation
	Startup time (time taken from switching on the monitor to seeing the first parameter labels)	<30 seconds
Ingress protection	(Provided recorder drawer is shut)	IPX1
Display	Resistive touchscreen with LED backlight	6.5” LCD 640 x 480 pixels

Transducers (M2734B/M2735A/M2736A/M2738A)

Product	Item	Range
M2734B/M2735A/M2736A	Diameter	83 mm (3.27 in)
	Weight	0.2 kg (0.5 lb)
	Degree of protection against electrical shock	Type CF
	Shock resistance	Withstands a 1 m drop to concrete surface with possible cosmetic damage only
	Ingress protection	IP68 (immersion up to 1 m water depth for 5 hours)

Product	Item	Range
M2738A	W x H x D	42 x 30 x 123 mm (1.7 x 1.2 x 4.8 in)
	Cable length	2.5 m (8.2 ft)
	Weight	0.2 kg (0.5 lb)
	Degree of protection against electrical shock	Type CF
	Shock resistance	Withstands a 1 m drop to concrete surface with possible cosmetic damage only
	Ingress protection	IP67 (immersion up to 0.5 m water depth for 30 minutes)

Performance Specifications

Complies with IEC 60601-2-37:2007 / EN 60601-2-37:2008. ECG measurement follows IEC 60601-2-27:2011 / EN 60601-2-27:2014 except clauses listed below:

- 201.6.2, 201.8.5.5
- 201.12.1.101
- 202.6.2.101

Fetal/Maternal Performance Specifications

Ultrasound (M2736A/AA)

Measurement method	Ultrasound Pulsed Doppler
US measurement range	50–240 bpm
Resolution	
Display	1 bpm
Printer	1/4 bpm
Jitter @ 200 bpm	≤3 bpm
US intensity	
Average output power	P = (7.4 ± 0.4) mW
Peak rarefactional pressure	p_r = (40.4 ± 4.3) kPa
Output beam intensity (I_{ob}) (= spatial average - temporal average intensity)	$I_{ob} = I_{sata}$ = (2.38 ± 0.59) mW/cm²
Spatial-peak temporal average intensity	I_{spta} = (15.0 ± 3.2) mW/cm²
Effective radiating area @ -12 dB	(3.11 ± 0.74) cm²

Ultrasound (M2736A/AA)

US frequency	1 MHz ± 100 Hz
US signal range	3.5 µVpp–350 µVpp @ 200 Hz
US burst	
Repetition rate	3.0 kHz
Duration	≤100 µs
Signal quality indication	
Good	Full
Acceptable	Half-full
Poor	Empty
Beat to beat change (max.) for ultrasound	28 bpm

Fetal Heart Rate (DECG) (FM30 only)

Measurement range	30–240 bpm
Resolution	
Display	1 bpm
Printer	1/4 bpm
Accuracy	±1 bpm or 1%, whichever is greater
Filter bandwidth	0.8–80 Hz
INOP auxiliary current (leads off detection)	<100 µA
Input signal range	
DECG	20 µVpp–6 mVpp
Defibrillator Protection	None
ESU Protection	None

Toco

Measurement method	Strain Gauge Sensor Element
Sensitivity	1 unit = 2.5 g
Resolution	
Display	1 unit
Printer	1/4 unit
Measurement range	400 units
Signal range	0–127 units
Maximum offset range	-300 units
Baseline setting	20 units
Auto offset correction	3 seconds after connecting the transducer, the Toco value is set to 20 units

Toco	
Auto zero adjust	Toco value is set to zero following a negative measurement value for 5 seconds

Pulse from Toco MP	
Measurement range	40–240 bpm
Accuracy	±2% or 1 bpm, whichever is greater
Resolution	1 bpm
Wavelength range	780–1100 nm
Emitted light energy	≤15 mW

Maternal Heart Rate (MECG)	
Measurement range	30–240 bpm
Resolution Display Printer	 1 unit 1/4 unit
Accuracy	±1 bpm or 1%, whichever is greater
Filter bandwidth	0.8–80 Hz
INOP auxiliary current (leads off detection)	<100 µA
Input signal range	
MECG	150 µVpp – 6 mVpp
Defibrillator protection	None
ESU protection	None

IUP (FM30 only)	
Measurement method	Passive Resistive Strain Gauge Elements
Measurement range	-100–300 mmHg
Signal range	-99–127 mmHg
Resolution Display Printer	 1 mmHg 1/4 mmHg
Sensitivity	5 µV/V/mmHg
Offset compensation	+100 to -200 mmHg
Baseline setting	0 mmHg

IUP (FM30 only)	
Accuracy (not including sensor accuracy)	±0.5% per 100 mmHg
Auto offset correction	3 seconds after connecting the transducer, the IUP value is set to 0 mmHg

Alarm Specifications

Fetal Heart Rate (Ultrasound Alarm Specifications)

FHR/DECG alarm limits	Range	Adjustment	Default
Bradycardia (low limit)	60–200 bpm	10 bpm steps	110 bpm
Tachycardia (high limit)	70–210 bpm	10 bpm steps	170 bpm

FHR/DECG Alarm Delay	Range	Adjustment	Default
Bradycardia (low limit)	10–300 seconds	10 seconds	240 seconds
Tachycardia (high limit)	10–300 seconds	10 seconds	300 seconds
Signal loss delay	10–300 seconds	10 seconds	

MHR/MECG Alarm Specifications

MHR/MECG alarm limits	Range	Adjustment	Default
High range	31–240 bpm	1 bpm steps (31–40 bpm), and 5 bpm steps (40–240 bpm)	120 bpm
Low range	30–235 bpm	1 bpm steps (30–40 bpm), and 5 bpm steps (40–235 bpm)	50 bpm
Tachycardia	Difference to high limit: 0–50 bpm	5 bpm steps	20 bpm
	Clamping at: 150–240 bpm	5 bpm steps	200 bpm

MHR/MECG alarm limits	Range	Adjustment	Default
Bradycardia	Difference to low limit: 0–50 bpm	5 bpm steps	20 bpm
	Clamping at: 30–100 bpm	5 bpm steps	40 bpm

Noninvasive Blood Pressure

Measurement Validation: In adult mode, the blood pressure measurements determined with this device comply with the American National Standard for Electronic or Automated Sphygmomanometers (ANSI/AAMI SP10-1992) in relation to mean error and standard deviation, when compared to intra-arterial or auscultatory measurements (depending on the configuration) in a representative patient population. For the auscultatory reference, the 5th Korotkoff sound was used to determine the diastolic pressure. Complies with IEC 80601-2-30:2009 / EN 80601-2-30:2010.

Noninvasive Blood Pressure Performance Specifications	
Measurement range	
Systolic	30–270 mmHg (4–36 kPa)
Diastolic	10–245 mmHg (1.5–32 kPa)
Mean	20–255 mmHg (2.5–34 kPa)
Accuracy	Max. std. deviation: 8 mmHg (1.1 kPa) Max. mean error: ±5 mmHg (±0.7 kPa)
Pulse rate	
Range	40–300 bpm
Accuracy (average over noninvasive blood pressure measurement cycle)	40–100 bpm: ±5 bpm 101–200 bpm: ±5% of reading 201–300 bpm: ±10% of reading
Measurement time	Typical at HR >60 bpm Auto/manual: 30 seconds Maximum time: 180 seconds
Cuff inflation time	Typical for normal cuff: less than 10 seconds
Initial cuff inflation pressure	165 ± 15 mmHg
Auto mode repetition times	1, 2, 2.5, 3, 5, 10, 15, 20, 30, 45, 60, or 120 minutes
Venipuncture mode inflation	
Inflation pressure	20–120 mmHg (3–16 kPa)
Automatic deflation after	170 seconds

Alarm Specifications NBP

Alarm Specifications	Range	Adjustment
Systolic	30–270 mmHg (4–36 kPa)	10–30 mmHg: 2 mmHg (0.5 kPa) >30 mmHg: 5 mmHg (1 kPa)
Diastolic	10–245 mmHg (1.5–2 kPa)	
Mean	20–255 mmHg (2.5–34 kPa)	

Overpressure Settings	Adjustment
>300 mmHg (40 kPa) >2 sec	not user adjustable

SpO_2 (FM30 only)

Maternal pulse oximetry provides SpO_2, pulse numerics, and a pulse trace for oxygen saturation (SpO_2) of maternal arterial hemoglobin. Pulse rate is derived from SpO_2 if ECG is not connected.

Complies with ISO 80601-2-61:2011 / EN ISO 80601-2-61:2011 (except alarm system; alarm system complies with IEC 60601-2-49:2011 / EN 60601-2-49:2015).

Measurement Validation: The SpO_2 accuracy has been validated in human studies against arterial blood sample reference measured with a CO-oximeter. Pulse oximeter measurements are statistically distributed, only about two-thirds of the measurements can be expected to fall within the specified accuracy compared to CO-oximeter measurements. Display Update Period: Typical: 2 seconds, Maximum: 30 seconds. Maximum with noninvasive blood pressure INOP suppression on: 60 seconds. The specified accuracy is the root-mean-square (RMS) difference between the measured values and the reference values.

SpO_2 Performance Specifications	
Range	0–100%

SpO_2 Performance Specifications

Accuracy	**Philips Reusable Sensors**: M1191A/B, M1191AL/BL, M1191ANL, M1192A, M1192AN = 2% (70%-100%) M1191T, M1192T, M1194A, M1194AN, M1196A, M1196T = 3% (70%-100%)
	Philips Disposable Sensors with M1943A(L): M1131A, M1901B, M1903B, M1904B = 3% (70%-100%) M1133A, M1134A = ±2% (70%-100%)
	Nellcor PB® Sensors with M1943A(L): MAX-A, MAX-AL, MAX-P, MAX-N, D-25, D-20, N-25, OxiCliq A, P, N = 3% (70%-100%)
	Masimo Reusable Sensors® with LNOP MP12 or LNC MP10: LNOP DC-I, LNOP DC-IP, LNOP YI, LNCS DCI, LNCS DCIP: 2% (70%-100%) LNOP TC-I, LNCS TC-I: 3.5% (70%-100%)
	Masimo Disposable Sensors® with LNOP MP12 or LNC MP10: LNOP Adt, LNOP Adtx, LNOP Pdt, LNOP Pdtx, LNCS Adtx, LNCS Pdtx: 2% (70%-100%) LNOP Neo-L, LNCS Neo-L: 3% (70%-100%)
Resolution	1%
Pulse	
Range	30-300 bpm
Accuracy	±2% or 1 bpm whichever is greater
Resolution	1 bpm
Sensors	
Wavelength range	500-1000 nm
Emitted light energy	≤15 mW
Pulse oximeter calibration range	70%-100%

[1] *Information about the wavelength range can be especially useful to clinicians (for instance, when photodynamic therapy is performed)*

Alarm Specifications SpO_2

SpO_2 Alarm	Range	Adjustment	Delay
SpO_2	50-100%	1% steps	(0, 1, 2, 3,... 30) + 4 seconds
Desat	50 - low alarm limit	1% steps	(0, 1, 2, 3,... 30) + 4 seconds
Pulse	30-300 bpm	1 bpm steps (30-40 bpm) 5 bpm steps (40-300 bpm)	max. 14 seconds
Tachycardia	Difference to high limit 0-50 bpm	5 bpm steps	max. 14 seconds
	Clamping at 150-300 bpm	5 bpm steps	max. 14 seconds
Bradycardia	Difference to low limit 0-50 bpm	5 bpm steps	max. 14 seconds
	Clamping at 30-100 bpm	5 bpm steps	max. 14 seconds

External Power Supply Specifications

M8023A External Power Supply

Dimensions and Weight	
W x H x D	208 x 105 x 135 mm (8.2 x 4.1 x 5.3 in)
Weight	0.6 kg (1 lbs)
Power Specifications	
Line Voltage	100-240 V approximately
Current	1.3-0.7 A
Frequency	50-60 Hz approximately
Indicators	
AC Power	Green LED
Ingress Protection	IP31 (protected against the ingress of solid foreign objects 2.5 mm in diameter or larger, and the ingress of water when water is dripping vertically) when rested on its rubber feet on a flat, level surface. IP32 when mounted with the connectors facing downwards.

Performance Specifications Avalon FM20/30 Battery Option E25

M4605A Battery

Operating time (with new, fully charged battery)	Basic monitoring configuration: >2 hours (Display brightness: 70%, Recorder: "On" at 3 cm/min, NBP: Auto Mode at 15 min, 2 US transducers, 1 Toco+ with MECG, 1 Patient Module with DECG)

M4605A Battery	
Charge Time	When the monitor is off, approx. 6 hours. When monitor is in use, more than 10 hours (depending on monitor configuration)

Recorder Specifications

Built-in Thermal Array Fetal Trace Recorder	
Type	Standard Z-fold thermal paper
Standard speeds (real-time traces)	3 cm/min, 2 cm/min, 1 cm/min
Paper and Printing	
ECG Wave Recording (FM30 only. Not real-time.)	Emulated 25 mm/s print speed is variable up to 20 mm/s and depends on the print load
Paper advance	Up to 20 mm/s
Sensing	Optical Reflex Sensor for black page marks
Accuracy @ 3 cm/min, 2 cm/min, 1 cm/min	±5 mm/page
Usable Print Width	128 mm
Resolution	8 dots/mm (200 dpi)
Time delay to see trace on paper	<30s @ 1 cm/min
Trace Separation Offset for FHR (Ultrasound/DECG)	
Twin	
Standard	FHR2 +20 bpm
Classic	FHR2 +20 bpm
Triplet	
Standard	FHR2 +20 bpm/FHR3-20 bpm
Classic	FHR1 +20 bpm/FHR3-20 bpm

Ordering Information and Accessory Options

You can order the Avalon FM20/FM30 fetal monitor with the product number M2702A/M2703A. There are several ordering options available.

Fetal Monitor Ordering Options

The following tables give an overview of the monitor's standard capabilities and its options. To order, precede the required option number with M2702A or M2703A (for example, M2702A with option B71 adds the noninvasive blood pressure measurement). "L" options let you modify your order. Features listed as options can also be added at a later time (see "Upgrade Options" on page 18).

The fetal monitor can be operated with the Avalon CL Transducer System, or with cabled transducers. The maternal measurements NBP and SpO_2 can also be measured cablelessly by ordering the IntelliVue Cableless Pods that are supported by the Avalon CL Transducer System.

If you want to operate the fetal monitor only cablelessly, order the L00 option so that the fetal monitor is delivered without cabled transducers. The fetal monitor can also be ordered with both, cabled and cableless transducers, to switch between cabled and cableless monitoring, if necessary. Refer to "Additional Accessories" on page 16 for a list of items shipped as part of the standard configuration. Start-up quantities of fetal supplies are available in five convenient kits.

Fetal Monitor Options for the Avalon CL Transducer System

Description	Comments	Options
FM20/30 Fetal Monitor (M2702A/ M2703A)	The monitor is delivered without cabled transducers and adapter cables. The Avalon CL Transducer System is required for monitoring.	L00
CL Base Station (866074)		
CL Toco+MP Transducer (866075)		
CL Ultrasound Transducer (866076)	See the Avalon CL Technical Data Sheet for ordering details, options, and accessories.	
CL ECG/IUP Transducer (866077)		
CL Wide Range Pod (866487)		
CL Fetal & Maternal Pod (866488)	Not available for USA, other FDA regulated territories, and Canada.	

Description	Comments	Options
IntelliVue CL SpO_2 Pod (865215)	See the IntelliVue Cableless Measurements Technical Data Sheet for ordering details, options, and accessories.	
IntelliVue CL NBP Pod (865216)		

Optional Interfaces

Description	Comments	Options[1]
System Interface (RS232 port and LAN port)	For interfacing to Philips IntelliSpace Perinatal and service (software upgrade).	J70
Dual MIB/RS232 interface board	For data export or interface to the Tympanic Temperature Thermometer.	J13
Dual PS/2 interface board	For keyboard and mouse connection (M8024A #A01)	J22
Quad. USB interface board	For keyboard, mouse, or barcode reader)	J25
Flexible Nurse Call Relay interface board		J30

1 Only two interfaces from the Jxx options can be fitted in the fetal monitor at the same time.

Paper Scaling Options (Factory configuration)

Description	Options
50-210 bpm paper scaling	P01
30-240 bpm paper scaling	P02

Transport Options (Battery and External Power Supply)

Description	Options
Battery (M4605A), external power supply (M8023A with option E25), and MSL cable (1 m)	E25

Standard Measurements Cabled Transducers

Fetal Heart Rate (FHR)

Description	Comments	Option
Ultrasound FHR singletons 1 M2736A (M2736AA for US) transducer	M2736A includes fetal movement	L01
Ultrasound FHR twins 2 M2736A (M2736AA for US) transducers	Profile (FMP)	L02
Ultrasound FHR triplets 3 M2736A (M2736AA for US) transducers	Option C73 is required.	L03

Direct ECG (DECG) FM30 only

Includes DECG wave display. All transducers require a K51 DECG adapter cable.

Description	Option
M2735A Toco+ transducer (includes ECG/IUP capability)	L11
1 M2738A ECG/IUP patient module	L21
2 M2738A ECG/IUP patient modules	L22
3 M2738A ECG/IUP patient modules	L23

DECG Accessories: Philips DECG Solution	Part No.
DECG reusable leg plate adapter cable (with flushing port) (K51)	989803137651
DECG leg attachment electrode for DECG leg plate adapter cable, box of 25	989803139771
DECG fetal scalp electrode: single spiral, worldwide availability, box of 25	989803137631

DECG Accessories: Philips DECG Solution	Part No.
DECG fetal scalp electrode: double spiral, Europe only. Not for USA, box of 25	989803137641

Remote Event Marker

Description	Option
Remote Event Marker (989803143411) Can be connected to the fetal sockets at the fetal monitor and is operated manually to record an event on the trace.	L30

Uterine Measurements

Toco (External)

Toco and maternal pulse are measured in parallel.

Description	Option
M2734B Toco MP transducer (maternal Smart Pulse integrated)	L10
M2735A Toco+ transducer (includes ECG/IUP capability)	L11

Intrauterine Pressure (FM30 only)

Description	Option
M2735A Toco+ transducer (includes ECG/IUP capability)	L11*
1 M2738A ECG/IUP patient module	L21*
2 M2738A ECG/IUP patient modules	L22*
3 M2738A ECG/IUP patient modules	L23*

** All transducers require a K52 IUP adapter cable*

Koala IUP Accessories	Part No.
Disposable Koala IUP catheter, box of 10	M1333A
Reusable IUP adapter cable (corresponds to option K52)	989803143931

Optional Fetal Measurements

Description	Option
NST Report capability and NST trace interpretation. Analyzes the data according to the NICHD or based on the Dawes & Redman guidelines (not available for USA, other FDA regulated territories, and Canada)	C71
Triple FHR via ultrasound Requires the option L03. FM30 only: Triplets monitoring is also possible with 2 x US and 1 x DECG (membranes ruptured)	C73

Maternal Heart Rate (MHR)

Maternal Pulse (MP) Rate Monitoring

Description	Option
M2734B Toco MP transducer (maternal Smart Pulse integrated) Toco and maternal pulse are measured in parallel	L10

Maternal ECG (MECG) Heart Rate Monitoring

All transducers require a K53 MECG adapter cable. MECG wave available with FM30 only.

Description	Option
M2735A Toco+ transducer (includes ECG/IUP capability)	L11
1 M2738A ECG/IUP patient module	L21
2 M2738A ECG/IUP patient modules	L22
3 M2738A ECG/IUP patient modules	L23

MECG Accessories	Part No.
MECG adapter cable (corresponds to option K53)	M1363A
Foam MECG electrodes, snap-fit, for MECG adapter cable, 5 per pack, 300 per case	40493D
Foam MECG electrodes, snap-fit, for MECG adapter cable, 30 per pack, 300 per case	40493E

Optional Maternal Measurements

Noninvasive Blood Pressure (NBP)

Description	Option
Noninvasive Blood Pressure (NBP) with pulse rate	B71

Description	Option
Antimicrobial NBP cuff assortment (Accessory option)	K31

Noninvasive Blood Pressure Accessories

Multi-Patient Comfort Cuffs with M1598B (1.5 m) or M1599B (3.0 m) Tubing

Maternal Patient Category	Limb Circumference	Part No.
Adult (thigh)	42.0–54.0 cm	M1576A
Large adult	34.0–43.0 cm	M1575A
Adult	27.0–35.0 cm	M1574A
Small adult	20.5–28.0 cm	M1573A
Cuff kit of 4 adult sizes		M1578A

Disposable Cuffs with M1598B (1.5 m) or M1599B (3.0 m) Tubing

Maternal Patient Category	Limb Circumference	Part No.
Adult (thigh)	42.0–54.0 cm	M1879A
Large adult	34.0–43.0 cm	M1878A
Adult	27.0–35.0 cm	M1877A
Small adult	20.5–28.0 cm	M1876A
Cuff kit of 4 adult sizes		M1578A

Antimicrobial Coated Reusable Cuffs with M1598B (1.5 m) or M1599B (3.0 m) Tubing

Maternal Patient Category	Limb Circumference	Part No.
Adult thigh (gray)	45.0–56.5 cm	M4559B
Adult thigh (gray), pack of 5 cuffs	45.0–56.5 cm	M4559B5
Large adult X-long (burgundy)	35.5–46.0 cm	M4558B
Large adult X-long (burgundy), pack of 5 cuffs	35.5–46.0 cm	M4558B5
Large adult (burgundy)	35.5–46.0 cm	M4557B
Large adult (burgundy), pack of 5 cuffs	35.5–46.0 cm	M4557B5
Adult X-long (navy blue)	27.5–36.5 cm	M4556B
Adult X-long (navy blue), pack of 5 cuffs	27.5–36.5 cm	M4556B5
Adult (navy blue)	27.5–36.5 cm	M4555B
Adult (navy blue), pack of 5 cuffs	27.5–36.5 cm	M4555B5
Small adult (royal blue)	20.5–28.5 cm	M4554B
Small adult (royal blue), pack of 5 cuffs	20.5–28.5 cm	M4554B5
Cuff kits containing one small adult, one adult, one large adult, and one thigh cuff		864288
Cuff kits containing one small adult, one adult, one adult X-long, one large adult, one large adult X-long, and one thigh cuff		864291

Soft Single Patient Single-Hose Disposable Cuffs with M1598B (1.5 m) or M1599B (3.0 m) Tubing

Maternal Patient Category	Limb Circumference	Part No.
Adult (thigh)	45.0–56.5 cm	M4579B
Large adult X-long	35.5–46.0 cm	M4578B
Large adult	35.5–46.0 cm	M4577B
Adult X-long	27.5–36.5 cm	M4576B
Adult	27.5–36.5 cm	M4575B

Maternal Patient Category	Limb Circumference	Part No.
Small adult	20.5–28.5 cm	M4574B

NBP Cuff Assortment Kit

Description	Part No.
Antimicrobial NBP cuff assortment kit with 3 m (10 ft) connection tubing (corresponds to option K31)	M1599B (tubing) M1573A M1574A M1575A

Pulse Oximetry

Measurement	Description	Option
Pulse Oximetry (maternal SpO_2)	B73 includes NBP monitoring (FM30 only)	B73
Reusable maternal SpO_2 sensor	M1191BL (3 m cable)	K91

SpO_2 Accessories

All listed sensors operate without the risk of exceeding 41°C on the skin if the initial skin temperature is below 37°C (FM30 only).

Philips Reusable Sensors

Description	Part No.
Adult sensor (2.0 m cable), for patients over 50 kg. Any finger except thumb.	M1191B*
M1191B with longer cable (3.0 m)	M1191BL*
Small adult, pediatric sensor (1.5 m cable) for patients between 15 kg and 50 kg. Any finger except thumb. Use only on adult patients with FM30/40/50.	M1192A*
Ear sensor (1.5 m cable) for patients more than 40 kg. Use only on adult patients with FM30/40/50.	M1194A*
Adult clip sensor (3 m cable) for patients over 40 kg. Any finger except thumb.	M1196A*
Adult clip sensor (2 m cable) for patients over 40 kg. Any finger except thumb.	M1196S*

** No adapter cable required.*

Description	Part No.
Adult sensor (0.45 m cable), for patients over 50 kg. Any finger except thumb.	M1191T*
Small adult or pediatric sensor (0.45 m cable) for patients between 15 kg and 50 kg. Any finger except thumb. Use only on adult patients with FM30/40/50.	M1192T*
Adult clip sensor (0.9 m cable) for patients over 40 kg. Any finger except thumb.	M1196T*

** Requires M1943A (1.0 m) or M1943AL (3.0 m) adapter cable.*

Description	Part No.
Special Edition (SE): Adult sensor (3 m cable), for patients over 50 kg. Any finger except thumb.	M1191ANL*
Special Edition (SE): Small adult or pediatric sensor (1.5 m cable) for patients between 15 kg and 50 kg. Any finger except thumb. Use only on adult patients with FM30/40/50.	M1192AN*
Special Edition (SE): Ear sensor (1.5 m cable) for patients more than 40 kg.	M1194AN*

** No adapter cable required. SE sensors work with FM30/40/50, as well as with OxiMax-compatible SpO_2 versions of other Philips monitors.*

Philips Disposable Sensors

Description	Part No.
Identical to OxiMax MAX-A	M1904B*
Identical to OxiMax MAX-P	M1903B*
Identical to OxiMax MAX-N	M1901B*

** Requires M1943A (1.0 m) or M1943AL (3.0 m) adapter cable. Not available in the USA.*

Description	Part No.
Adult/pediatric finger sensor (0.45 m cable). Use only on adult patients with FM30/40/50.	M1131A*
Adult/pediatric finger sensor (0.9 m cable) for patients >40 kg. Any finger except thumb. Use only on adult patients with FM30/40/50.	M1133A*

** Requires M1943A (1.0 m) or M1943AL (3.0 m) adapter cable*

Nellcor Sensors

Nellcor sensors must be ordered from Medtronic.

Product Name	Description
OxiMax MAX-A*	Adult finger sensor (patient size >30 kg)
OxiMax MAX-AL*	OxiMax MAX-A with long cable

Product Name	Description
OxiMax MAX-P*	Pediatric or small adult foot/hand sensor (patient size 10-50 kg). Use only on adult patients with FM30/40/50.
OxiMax MAX-N*	Adult finger or neonatal foot/hand sensor (patient size >40 kg or <3 kg). Use only on adult patients with FM30/40/50.

** Requires M1943A (1.0 m) or M1943AL (3.0 m) adapter cable.*

Product Name	Description
Oxisensor II D-25*	Adult sensor (patient size >30 kg)
Oxisensor II D-20*	Pediatric sensor or small adult (patient size 10-50 kg). Use only on adult patients with FM30/40/50.
Oxisensor II N-25*	Neonatal/adult sensor (patient size <3 kg or >40 kg). Use only on adult patients with FM30/40/50.

** Requires M1943A (1.0 m) or M1943AL (3.0 m) adapter cable*

Product Name	Description
OxiCliq A*	See OxiMax MAX-A
OxiCliq P*	See OxiMax MAX-P. Use only on adult patients with FM30/40/50.
OxiCliq N*	See OxiMax MAX-N. Use only on adult patients with FM30/40/50.

** Requires M1943A (1.0 m) or M1943AL (3.0 m) adapter cable together with OC-3 adapter cable*

Masimo LNOP Reusable Sensors

Product Name	Description	Part No.
LNOP DCI*	Adult finger sensor (>30 kg)	989803140321
LNOP DCIP*	Pediatric finger sensor (10-50 kg). Use only on adult patients with FM30/40/50.	989803140331
LNOP YI*	Multi-site sensor (>1 kg). Use only on adult patients with FM30/40/50.	n/a
LNOP TC-I*	Ear sensor (>30 kg). Use only on adult patients with FM30/40/50.	989803140341

** These sensors require the adapter cable Masimo MP12 Cable (M1020-61100).*

Masimo LNCS Reusable Sensors

Product Name	Description	Part No.
LNCS DCI*	Adult Finger Sensor (>30 kg)	989803148281
LNCS DCIP*	Pediatric Finger Sensor (10-50 kg). Use only on adult patients with FM30/40/50.	989803148291
LNCS TC-I*	Ear Sensor (>30 kg). Use only on adult patients with FM30/40/50.	989803148301

** These sensors require the adapter cable LNC MP10 (989803148221).*

Masimo LNOP Disposable Adhesive Sensors

Product Name	Description	Part No.
LNOP Adt*	Adult Sensor (>30 kg)	989803140231
LNOP Adtx*	Adult Sensor (>30 kg)	n/a
LNOP Pdt*	Pediatric Sensor (10-50 kg). Use only on adult patients with FM30/40/50.	989803140261
LNOP Pdtx*	Pediatric Sensor (10-50 kg). Use only on adult patients with FM30/40/50.	n/a
LNOP Neo-L*	Neonatal (<3 kg) or Adult adhesive Sensor (>40 kg). Use only on adult patients with FM30.	989803140291

** These sensors require the adapter cable Masimo MP12 Cable (M1020-61100).*

Masimo LNCS Disposable Adhesive Sensors

Product Name	Description	Part No.
LNCS Adtx*	Adult Sensor (>30 kg)	989803148231
LNCS Pdtx*	Pediatric Finger Sensor (10-50 kg). Use only on adult patients with FM30/40/50.	989803148241

Product Name	Description	Part No.
LNCS Neo-L*	Neonatal Foot Sensor (<3 kg) or Adult Finger Sensor (>40 kg). Use only on adult patients with FM30/40/50.	989803148271

** These sensors require the adapter cable LNC MP10 (989803148221).*

Tympanic Temperature Thermometer

Tympanic Temperature Thermometer	Part No.
Tympanic Temperature Thermometer (requires J13), including: • A base station for mounting on a table, wall, or a roll stand • A starter pack of 96 probe covers	866149
Adding a 1.5 m, RS232 connection cable	866149 #A01
Adding a 3.0 m, RS232 connection cable	866149 #A02

Additional Accessories

The following accessories are delivered with any fetal monitor order.

Description	Quantity
Fetal paper pack (country-specific, installed)	1
Power cable	1
Documentation DVD (Instructions for Use, and all other fetal monitor documentation)	1

Fetal Supplies Starter Kits

Description	Contents	Kit Number
Standard Antepartum Kit (North America)	Paper (30-240), belts, gel, belt buttons, belt clips	862214
Standard Antepartum Kit (Europe, Latin America, Asia)	Paper (50-210), belts, gel, belt buttons, belt clips	862215
Standard Antepartum Kit (Japan)	Paper (50-210), belts, gel, belt buttons, belt clips	862216
Intrapartum DECG Kit (single spiral) FM30 only	Fetal scalp electrodes, fetal adhesive pad electrodes	862217
Intrapartum DECG Kit (double spiral) FM30 only	Fetal scalp electrodes, fetal adhesive pad electrodes	862218

Additional Fetal Accessories

Fetal Accessories

Description	Content	Part No.
Belt (reusable, gray, water resistant)	32 mm wide, 15 m roll (32 mm belts for use with M2738A Patient Module only)	M4601A
	60 mm wide, 5 belts	M4602A
	60 mm wide, 15 m roll	M4603A
	50 mm wide, 5 belts	M1562B
Belt (disposable, yellow, water resistant)	60 mm wide, pack of 100	M2208A
Ultrasound Gel	12 bottles	40483A
	5 liter refill (with dispenser) for 40483A. Shelf life: 24 months maximum	40483B
Belt Buttons and Belt Clip	Belt buttons (pack of 10)	M1569A
	Butterfly belt clip (pack of 6)	989803143401

Recorder Paper

Supplied in cases of 40 packs. Each pack has 150 numbered pages.

	USA/Canada and Asia	Europe/Japan	Japan
FHR Scale	30-240	50-210	50-210
Grid Color	Red/Orange	Green	Green
Scale units	mmHg and kPa	mmHg	mmHg
Highlighted 3 cm lines?	Yes	No	Yes
Part No.	M1910A	M1911A	M1913A/ M1913J

Input Devices

Description	Part No./Option
Slimline keyboard with integrated trackball (includes spill cover)	M8024A #A01
Optical mouse	M8024A #B01
Trackball	M8024A #C01
Wireless trackball	M8024A #C02
Hand-Track	M8024A #C03

Mounting Hardware

Mounts, Carts, and Rollstands

Description	Picture	Part No./Option
Flush Wall Mount for a flat wall mounting		M2740A #A01
Wall Mount (Arm)		M2740A #A05
Bed Hanger		M2740A #B01
Cart with fixed angle mount and two drawers		M2740A #C02

Description	Picture	Part No./Option
Rollstand with tray		M2740A #R01
Mounting Kit for Avalon CL for use with M2740A #C02		M2740A #U02
Wall Channel required for wall mounts A01 and A05		M2740A #W01
Additional drawer for the cart		M2740A Option C11

Upgrade Options

Upgrade options are prefixed with M2702AU/M2703AU. For example, to add a system interface upgrade, order M2702AU option J70.

Description	Option
Noninvasive blood pressure, no supplies included	B71
Pulse oximetry (SpO_2), no supplies included (FM30 only)	B72
NBP and SpO_2 measurement (FM30 only)	B73
NST Trace Interpretation	C71
Maternal Pulse	C72
Triplets monitoring capability	C73
Intrapartum	C81
Battery upgrade for monitors with Rev. G software or higher	E25
Dual MIB/RS232 Interface for Data Export functionality, and for maternal infrared temperature measurement	J13
Dual PS/2 Interface for connecting a keyboard and mouse	J22
Quadruple USB Interface (keyboard, mouse, barcode reader)	J25
Flexible Nurse Call Relay Interface	J30
System Interface: RS232 port and LAN port	J70
Release J.3 Software Upgrade	SJ3
Release L.3 Software Upgrade	SL3

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How to reach us:
www.healthcare.philips.com
healthcare@philips.com

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The Avalon Fetal monitors comply with the requirements of the Council Directive 93/42/EEC of 14 June 1993 (Medical Device Directive) as amended.