

BeneVision N22/N19

Patient monitor



Physical Specifications

Weight	N22: 11.5 kg (25.4 lbs) N19: 10.3 kg (22.7 lbs) (Including screen with handle and navigation knob, main unit with a battery, iView module, Wi-Fi module.)
Size	N22: 641 x 383 x 115 mm (portrait) 566 x 458 x 115 mm (landscape) N19: 584 x 348 x 115 mm (portrait) 509 x 423 x 115 mm (landscape) (Including main unit, screen and screen handle.) Main unit: 268 x 268 x 68 mm
Display screen	Medical-grade colour TFT LCD, resistive or capacitive touch screen optional. 1680 x 1050 pixels Rotatable screen (Landscape and portrait).
Display traces	Up to 16 waveforms (portrait) Up to 13 waveforms (landscape)

ECG

Meet standards of IEC 60601-2-27 and IEC 60601-2-25.	
Lead set	3-lead: I, II, III 5-lead: I, II, III, aVR, aVL, aVF, V 6-lead: I, II, III, aVR, aVL, aVF, Va, Vb 12-lead: I, II, III, aVR, aVL, aVF, V1 to V6 Automatic 3/5/6/12 - lead recognition.
Input signal range	± 10 mV (p-p)
Electrode offset potential tolerance	± 500 mV
Sweep speed	6.25 mm/s, 12.5 mm/s, 25 mm/s, 50 mm/s
Gain	x 0.125, x 0.25, x 0.5, x 1, x 2, x 4, auto
Waveform format	Standard, Cabrera
Bandwidth	Diagnostic mode: 0.05 to 150 Hz Monitor mode: 0.5 to 40 Hz Surgical mode: 1 to 20 Hz ST mode: 0.05 to 40 Hz Extend Diagnostic mode: 0.05 to 350 Hz EMG 1 mode: 0.05 to 35 Hz EMG 2 mode: 0.05 to 20 Hz
CMRR	Diagnostic: > 90 dB Monitor, Surgical, ST mode: > 105 dB
Pace detection	Amplitude: ± 2 mV to ± 700 mV Width: 0.1 to 2 ms Rise time: 10 to 100 µs (without overshoot)
Defib. protection	Withstand 5000V (360J) defibrillation
Defib. recovery time	≤ 5 s
ESU recovery time	≤ 10 s
Provides Glasgow resting 12-lead ECG algorithm. (* These ECG specifications are from MPM Platinum module.)	

Heart Rate

HR range	Adult: 15 to 300 bpm Paediatric/Neonate: 15 to 350 bpm
HR accuracy	± 1 bpm or ± 1%, whichever is greater.
HR resolution	1 bpm

Arrhythmia Analysis

Intended use for adult, paediatric and neonate.
Multi-lead, 25 classifications. Asystole, VFib/VTac, Vtac, Vent. Brady, Extreme Tachy, Extreme Brady, Vrrhythm, PVCs/min, Pauses/min, Couplet, Bigeminy, Trigeminy, R on T, Run PVCs, PVC, Tachy, Brady, Missed Beats, PNP, PNC, Multif. PVC, Nonsus. Vtac, Pause, Irr. Rhythm., Afib.

ST Segment Analysis

Intended use for adult, and paediatric.	
ST range	- 2.0 to + 2.0 mV
ST accuracy	± 0.02 mV or ± 10%, whichever is greater (- 0.8 to + 0.8 mV)
ST resolution	0.01 mV

QT Analysis

Intended use for adult, paediatric, and neonate.	
Parameters	QT, QTc, ΔQTc
QTc formula	Bazett, Fridericia, Framingham, or Hodges
QT/QTc range	200 to 800 ms
QT accuracy	± 30 ms
QT resolution	4 ms
QTc resolution	1 ms
QT-HR range	Adult: 15 to 150 bpm Paediatric/Neonate: 15 to 180 bpm

Respiration

Lead	I or II, auto
RR range	0 to 200 rpm
RR Accuracy	± 1 rpm (0 to 120 rpm) ± 2 rpm (121 to 200 rpm)
RR Resolution	1 rpm
Apnea time	10, 15, 20, 25, 30, 35, 40 s

SpO₂

Meet standards of ISO 80601-2-61.	
SpO ₂ module	Mindray SpO ₂ , Nellcor SpO ₂
SpO ₂ range	0 to 100 %
SpO ₂ accuracy	Adult/Paediatric: ± 2 % (70 to 100%) Neonate: ± 3 % (70 to 100%)
Perfusion indicator (PI)	Yes, for Mindray SpO ₂
Pitch Tone	Yes
Dual-SpO ₂	Yes, SpO ₂ , SpO ₂ b, ΔSpO ₂
PR	
PR range	20 to 300 bpm (SpO ₂) 25 to 350 bpm (IBP) 30 to 300 bpm (NIBP)
PR accuracy	± 3 bpm (20 to 300 bpm, Mindray SpO ₂) ± 3 bpm (20 to 250 bpm, Nellcor SpO ₂) ± 1 bpm or ± 1 %, whichever is greater (IBP) ± 3 bpm or ± 3 %, whichever is greater (NIBP)
Refreshing rate	1 s

Temperature

Meet standard of ISO 80601-2-56.	
Technique	Thermal resistance
Channels	Up to 8 channels
Temp range	0 to 50 °C (32 to 122 °F)
Temp accuracy	± 0.1 °C or ± 0.2 °F (without probe)
Temp resolution	0.1 °C
Refreshing rate	1 s

Genius™ 2 Tympanic Thermometer

Temp range	33 to 42 °C (91.4 to 107.6 °F)
Calibrated accuracy	± 0.1 °C (environment temperature 25 °C, target temperature 36.7 to 38.9 °C) ± 0.2 °C (environment temperature 16 °C, target temperature 33 to 42 °C)
Temp resolution	0.1 °C
Response time	< 2 s

NIBP

Meet standards of ISO 80601-2-30.

Technique	Oscillometry
Operation mode	Manual, Auto, STAT
Parameters	Systolic, diastolic, mean
Max Measurement time	Adult/Paediatric: 180 s, Neonate: 90 s
Systolic range	Adult: 25 to 290 mmHg Paediatric: 25 to 240 mmHg Neonate: 25 to 140 mmHg
Diastolic range	Adult: 10 to 250 mmHg Paediatric: 10 to 200 mmHg Neonate: 10 to 115 mmHg
Mean range	Adult: 15 to 260 mmHg Paediatric: 15 to 215 mmHg Neonate: 15 to 125 mmHg
NIBP accuracy	Max mean error: ± 5 mmHg Max standard deviation: 8 mmHg
NIBP resolution	1 mmHg
Assisting Venous Puncture	Yes

IBP

Meet standard of IEC 60601-2-34.

Channels	Up to 8 channels
Sensitivity	5 $\mu\text{V}/\text{V}/\text{mmHg}$
Impedance range	300 to 3000 Ω
IBP range	-50 to 360 mmHg
IBP accuracy	± 1 mmHg or $\pm 2\%$, whichever is greater
IBP resolution	1 mmHg
PPV range	0 to 50 %
PAWP	Yes
ICP measurement	Support
Support waveforms overlapping.	

C.O.

Technique	Thermodilution
C.O. range	0.1 to 20 L/min
C.O. accuracy	± 0.1 L/min or $\pm 5\%$, whichever is greater
C.O. resolution	0.1 L/min
TB range	23 to 43 °C (73.4 to 109.4 °F)
TI range	0 to 27 °C (32 to 80.6 °F)
TB, TI accuracy	± 0.1 °C (without sensor)
TB, TI resolution	0.1 °C

PiCCO

Parameters	Measurement range	Coefficient of variation
CCO	0.25 to 25.0 L/min	$\leq 2\%$
C.O.	0.25 to 25.0 L/min	$\leq 2\%$
GEDV	40 to 4800 ml	$\leq 3\%$
SV	1 to 250 ml	$\leq 2\%$
EVLW	10 to 5000 ml	$\leq 6\%$
ITBV	50 to 6000 ml	$\leq 3\%$

(Coefficient of variation is measured using synthetic and/or database wave forms (laboratory testing.) Coefficient of variation= SD/mean error.)

TB range	25 to 45 °C
TB accuracy	± 0.1 °C (without sensor)
TI range	0 to 30 °C
TI accuracy	± 0.1 °C (without sensor)
pArt/pCVP range	-50 to 300 mmHg
pArt/pCVP accuracy	± 1 mmHg or $\pm 2\%$, whichever is greater

ScvO₂

ScvO ₂ range	0 to 99 %
ScvO ₂ accuracy	$\pm 3\%$ (50 to 80 %)

ICG

Technique	Thoracic electrical bioimpedance (TEB)
Provides monitoring parameters	ACI, VI, PEP, LVET, TFI, TFC, HR, C.O., C.I., SV, SVI, SVR, SVRI, PVR, PVRI, LCW, LCWI, LVSW, LVSWI, STR, VEPT
HR range	40 to 200 bpm (ICG), accuracy ± 2 bpm
C.O. range	1.0 to 15 L/min
SV range	5 to 250 ml

CCO/SvO₂

Interfaces with Edwards Vigilance II, or Vigileo monitor.

Vigilance II: CCO, CCI, C.O., C.I., SV, SVI, SVR, SVRI, RVEF, EDV, EDVI, ESV, ESVI, TB, SaO₂, VO₂, O₂El, DO₂, ScvO₂, SvO₂, SQL.

Vigileo: CCO, CCI, SV, SVI, SVR, SVRI, ScvO₂, SvO₂.

Artema Sidestream CO₂

Meet standard of ISO 80601-2-55.

**Options: Paramagnetic O₂ sensor.

CO ₂ sample flow rate	120 ml/min (DRYLINE II™ watertrap for adult/paediatric) 90 ml/min (DRYLINE II™ watertrap for neonate) 50 ml/min (DRYLINE PRIME™ watertrap)
CO ₂ sample flow rate accuracy	± 15 ml/min or $\pm 15\%$, whichever is greater.
CO ₂ Response time	< 5.5 s @ 120ml/min (for adult/paediatric) < 4.5 s @ 90 ml/min (for neonate) < 6 s @ 50 ml/min (with O ₂ monitoring) < 5 s @ 50 ml/min (without O ₂ sensor)
O ₂ Response time	< 5.5 s @ 120 ml/min < 5 s @ 90ml/min
Sweep speed	3 mm/s, 6.25 mm/s, 12.5 mm/s, 25 mm/s, 50 mm/s
CO ₂ range	0 to 20%
CO ₂ accuracy	$\pm 0.1\%$ (< 1 %) $\pm 0.2\%$ (1 to 4.9 %) $\pm 0.3\%$ (5 to 6.9 %) $\pm 0.4\%$ (7 to 11.9 %) $\pm 0.5\%$ (12 to 13 %) $\pm 0.43\% + 8\%\text{rel}$ (13.1 to 20 %)
CO ₂ resolution	1 mmHg
O ₂ range	0 to 100 %
O ₂ accuracy	$\pm 1\%$ (0 to 25 %) $\pm 2\%$ (25.1 to 80 %) $\pm 3\%$ (80.1 to 100 %)
O ₂ resolution	0.1 %
awRR range	0 to 150 rpm
awRR accuracy	± 1 rpm (0 to 59 rpm) ± 2 rpm (60 to 150 rpm)
Apnea time	10, 15, 20, 25, 30, 35, 40 s
Provide VCO ₂ , VO ₂ , MVCO ₂ , MVO ₂ , EE, RQ parameters, when monitoring with RM module.	
Oridion Microstream CO₂	
Meet standard of ISO 80601-2-55.	
Sample flow rate	50 ^{-7.5} ₊₁₅ ml/min
Initialisation time	30 s (typical)
Response time	2.9 s (typical)
Sweep speed	3 mm/s, 6.25 mm/s, 12.5 mm/s, 25 mm/s, 50 mm/s
CO ₂ range	0 to 99 mmHg
CO ₂ accuracy	± 2 mmHg (0 to 38 mmHg) $\pm 5\%$ of the reading (0.08 % increased in error for every 1 mmHg if the reading is more than 38) (39 to 99 mmHg)
awRR range	0 to 150 rpm
awRR accuracy	± 1 rpm (0 to 70 rpm) ± 2 rpm (71 to 120 rpm) ± 3 rpm (121 to 150 rpm)
Apnea time	10, 15, 20, 25, 30, 35, 40 s
Capnostat Mainstream CO₂	
Meet standard of ISO 80601-2-55.	
Rise time	< 60 ms
Sweep speed	3 mm/s, 6.25 mm/s, 12.5 mm/s, 25 mm/s, 50 mm/s
CO ₂ range	0 to 150 mmHg
CO ₂ accuracy	± 2 mmHg (0 to 40 mmHg) $\pm 5\%$ of the reading (41 to 70 mmHg)

$\pm 8\%$ of the reading (71 to 100 mmHg)
 $\pm 10\%$ of the reading (101 to 150 mmHg)
awRR range 0 to 150 rpm
awRR accuracy ± 1 rpm
Provide VCO₂, MVCO₂, FeCO₂, SlopeCO₂, Vtalv, MValv, Vdaw, Vdaw/Vt, Vdalv, Vdalv/Vt, Vdphy, Vd/Vt, when monitoring with RM module.

Multi-gas

Meet standard of ISO 80601-2-55.

Gas CO₂, O₂, N₂O, Des, Iso, Enf, Hal, Sev

Warm-up time ISO accuracy mode: 45 s
Full accuracy mode: 10 min

Sample flow rate (with DRYLINE II™ watertrap)
Adult/paediatric watertrap: 200 ml/min
Neonate watertrap: 120 ml/min

Sample flow rate accuracy ± 10 ml/min or $\pm 10\%$, whichever is greater.

Response time DRYLINE II™ watertrap and 2.5m sample line for adult/paediatric, 200 ml/min:

CO₂: ≤ 4.2 s

N₂O: ≤ 4.3 s

O₂: ≤ 4 s

Enf/Iso/Hal/Sev/Des: ≤ 4.5 s

DRYLINE II™ watertrap and 2.5m sample line for neonate, 120 ml/min:

CO₂: ≤ 4 s

N₂O: ≤ 4.2 s

O₂: ≤ 4 s

Enf/Iso/Hal/Sev/Des: ≤ 4.4 s

CO₂ range 0 to 30 %

CO₂ accuracy $\pm 0.1\%$ ABS (0 to 1%)

$\pm 0.2\%$ ABS (1 to 5%)

$\pm 0.3\%$ ABS (5 to 7%)

$\pm 0.5\%$ ABS (7 to 10%)

O₂ range 0 to 100 %

O₂ accuracy $\pm 1\%$ ABS (0 to 25%REL)

$\pm 2\%$ ABS (25 to 80%REL)

$\pm 3\%$ ABS (80 to 100%REL)

N₂O range 0 to 100 %

N₂O accuracy $\pm 2\%$ ABS (0 to 20%REL)

$\pm 3\%$ ABS (20 to 100%REL)

Enf/Iso/Hal/Sev/Des range 0 to 30 %

Enf/Iso/Hal accuracy $\pm 0.15\%$ ABS (0 to 1%REL)

$\pm 0.2\%$ ABS (1 to 5%REL)

Sev accuracy $\pm 0.15\%$ ABS (0 to 1%REL)

$\pm 0.2\%$ ABS (1 to 5%REL)

$\pm 0.4\%$ ABS (5 to 8%REL)

Des accuracy $\pm 0.15\%$ ABS (0 to 1%REL)

$\pm 0.2\%$ ABS (1 to 5%REL)

$\pm 0.4\%$ ABS (5 to 8%REL)

$\pm 0.6\%$ ABS (10 to 15%REL)

$\pm 1\%$ ABS (15 to 18%REL)

awRR range 2 to 100 rpm

awRR accuracy ± 1 rpm (2 to 60 rpm)

Apnea time 10,15,20,25,30,35,40 s

Provide MAC value (support calibrated by age).

Support two mixed gas identify and monitoring.

BISx/BISx4

Meet standard of IEC 60601-2-26.

Technique Bispectral Index

Impedance range 0 to 999 k Ω

EEG bandwidth 0.25 to 100 Hz

BIS range 0 to 100 (BIS, BIS L, BIS R)

SQI range 0 to 100 % (SQI, SQI L, SQI R)

ASYM 0 to 100%

DSA trend Yes

NMT

Meet the standard of IEC 60601-2-10.

Sensor type Acceleromyography sensor
Stimulation modes ST, TOF, PTC, DBS3.2, DBS3.3
Stimulation current range 0 to 60 mA
Stimulation current accuracy $\pm 5\%$ or ± 2 mA, whichever is greater.
Stimulation pulse width 100, 200 or 300 μ s, monophasic rectangle pulse
Stimulation pulse width accuracy $\pm 10\%$
Max. output voltage 300 V

EEG

Meet standard of IEC 60601-2-26.

EEG channels Up to 4 channels

Montage mode Bipolar mode, referential mode

Max. Input DC offset ± 500 mV DC

CMRR ≥ 100 dB @ 50Hz

Sampling Frequency 1024 Hz

Analog bandwidth 0.5 to 110 Hz

Measurement range 0.5 to 30 Hz

Low filter 0.16 Hz, 0.5 Hz, 1.0 Hz, 2.0 Hz.

High filter 15 Hz, 30 Hz, 50 Hz, 70 Hz.

Spectrum analysis SEF, MF, PPF, TF, Delta, Theta, Alpha, and Beda

DSA trend Yes

CSA trend Yes

RM

Technique Diff-Pressure flow

Monitoring parameters include PEEP, Pmean, PIP, Pplat, PEF, PIF, MVe, MV_i, TVe, TV_i, RR, I:E, FEV1.0, Compl, RSBI, NIF, WOB, RAW.

Flow range Adult/Paediatric: $\pm (2$ to 120) L/min

Neonate: $\pm (0.5$ to 30) L/min

Flow accuracy Adult/Paediatric: ± 1.2 L/min or $\pm 10\%$ of the reading, whichever is greater.

Neonate: ± 0.5 L/min or $\pm 10\%$, whichever is greater.

Flow resolution 0.1 L/min

Paw range -20 to 120 cmH₂O

Paw accuracy $\pm 3\%$ x reading

Paw resolution 0.1 cmH₂O

MVe/MV_i range Adult/Paediatric: 2 to 60 L/min

Infant: 0.5 to 15 L/min

MVe/MV_i accuracy $\pm 10\%$ x reading

MVe/MV_i resolution 0.01 L/min (MVe/MV_i < 10 L/min)

0.1 L/min (MVe/MV_i ≥ 10 L/min)

TVe/TV_i range Adult/Paediatric: 100 to 1500 ml

Infant: 20 to 500 ml

TVe/TV_i accuracy Adult/Paediatric: $\pm 10\%$ or ± 15 ml, whichever is greater.

Infant: $\pm 10\%$ or ± 6 ml, whichever is greater.

TVe/TV_i resolution 1 ml

awRR range 4 to 120 rpm

awRR accuracy ± 1 rpm (4 to 99 rpm)

± 2 rpm (100 to 120 rpm)

awRR resolution 1 rpm

Provide loops display.

tcGas

Interfaces with TCM CombiM, TCM TOSCA or SenTec SDM monitor.

tcpCO₂ range 5 to 200 mmHg

tcpCO₂ accuracy TOSCA Sensor 92, tc Sensor 54:

Better than 1 mmHg (1 % or 10 % CO₂)

Better than 3 mmHg (33 % CO₂)

tc Sensor 84:

Better than 1 mmHg (1 % or 10 % CO₂)

Better than 5 mmHg (33 % CO₂)

tcpO₂ range 0 to 800 mmHg

tcpO₂ accuracy tc Sensor 84:

Better than 1 mmHg (0 % O₂)

Better than 3 mmHg (21 % O₂)

Better than 5 mmHg (50 % O₂)

	Better than 25 mmHg (90 % O ₂)
SpO ₂ range	0 to 100 %
SpO ₂ accuracy	±3 % (70 to 100 %)
PR range	25 to 240 bpm
PR accuracy	±3 bpm
Power range	0 to 1000 mW
Power accuracy	±20 % of reading

rSO₂

Intended use for adult, paediatric, and neonate.

Technique	INVOS, NIRS (Near Infrared Spectroscopy)
Channels	Up to 4 channels
rSO ₂ range	15 to 95 %

Data Review

Trends data	120 hours with resolution no less than 1 min.
Events	1000 events, including parameter alarms, arrhythmia events technical alarms, and so on.

NIBP	1000 sets
Interpretation of resting	12-lead ECG results 20 sets
Full disclosure	48 hours for all parameters and waveforms (8G storage card) 48 hours at maximum. The specific storage time depends on the waveforms stored and the number of stored waveforms. (4G storage card)

OxyCRG	48 hours
ST review	120 hours @ 5 min
Minitrend	Yes

Alarms

Audible indicator	Yes, 3 different alarm tones, and prompt tone
Visible indicator	Red/yellow/cyan LED, and alarm message

Provide AlarmSight infographic alarm indicator.

Recorder

Method	Thermal dot array
Supports integrated recorder or two-slots recorder module.	
Traces	3 traces (paper 50 mm width, 20 m length)
Speed	25 mm/s, 50 mm/s

iView

CPU	Intel J1900 2GHz
Memory	4 GB
Hard-disk	mSATA SSD 120GB
OS	Windows 7 (default)

Special Functions

Clinical Assistive Application (CAA): HemoSight™, ST Graphic™, SepsisSight™, BoA Dashboard™, EWS, GCS.

Calculations (drug, hemodynamic, Oxygenation, Ventilation, Renal), and Titration table.

Support wireless connecting with BeneVision TM80 and BP10.

Wi-Fi Communications

Protocol	IEEE 802.11a/b/g/n
Modulation mode	DSSS and OFDM
Operating frequency	IEEE 802.11b/g/n (2.4G): ETSI/FCC/KC: 2.4 to 2.483 GHz MIC: 2.4 to 2.495 GHz IEEE 802.11a/n (5G): ETSI: 5.15 to 5.35 GHz, 5.47 to 5.725 GHz FCC: 5.15 to 5.35 GHz, 5.725 to 5.82 GHz MIC: 5.15 to 5.35 GHz KC: 5.15 to 5.35 GHz, 5.47 to 5.725 GHz,

Channel spacing	5.725 to 5.82 GHz
Wireless baud rate	5 MHz @ 2.4 GHz, 20 MHz @ 5 GHz IEEE 802.11a: 6 to 54 Mbps IEEE 802.11b: 1 to 11 Mbps IEEE 802.11g: 6 to 54 Mbps IEEE 802.11n: 6.5 to 72.2 Mbps
Output power	< 20dBm (CE requirement: detection mode- RMS) < 30dBm (FCC requirement: detection mode- peak power)
Operating mode	Infrastructure
Data security	WPA-PSK, WPA2-PSK, WPA-Enterprise, WPA2-Enterprise (EAP-FAST, EAP-TLS, EAP-TTLS, PEAP-GTC, PEAP-MSCHAPv2, PEAP-TLS, LEAP) Encryption: TKIP and AES

MPAN Communications

Modulation mode	GFSK
Operating frequency	2402 to 2480 MHz
Channel spacing	2 MHz
Wireless baud rate	1 Mbps
Output power	≤ 2.5 mW
Data Security	Private protocol

MPAN is used in device pairing for BeneVision TM80, BP10 NIBP module and BeneVision N series patient monitor.

Interfacing

Main unit	AC power connector (1) VP connector (1), VP1 for the secondary display Network connector (3), 100 Base-TX, IEEE 802.3 USB 2.0 connector (6) SMR connector (3) Nurse call connector (1)
iView interfacing	VP connector (1), VP2 USB 2.0 (4), Network connector (1), 1000Base-TX, IEEE 802.3
Barcode scanner	Support 1D and 2D barcode
Keyboard & Mouse	Support wire and wireless type
Remote Control	Support
Network printer	Support

Power

Line voltage	100 to 240 VAC (±10 %), 2.8A
Frequency	50/60 Hz (±3 Hz)
Battery	Rechargeable lithium-ion battery, 5600mAh One hour run time (typical)
Recharge time	5 hours to 90% when the monitor is off.

Environmental requirements

Temperature	Operating: 0 to 40 °C (32 to 104 °F) Storage: -20 to 60 °C (-4 to 140 °F)
Humidity	Operating: 15 to 95 % (non condensing) Storage: 10 to 95 % (non condensing)
Barometric	Operating: 427.5 to 805.5 mmHg (57.0 to 107.4 kPa) Storage: 120 to 805.5 mmHg (16.0 to 107.4 kPa)

Some of functions marked with an asterisk may not be available. Please contact your local Mindray sales representative for the most current information.

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