BeneVision N17/N15/N12

Patient monitor

Physical Specifications

Weight	N17: 7.3 kg (16.1 lbs) N15: 5.4 kg (11.9 lbs) N12: 4.1 kg (9.1 lbs) (Standard configuration, excluding modules, recorder, battery and accessories.)
Size	N17: 466 x 355 x 210 mm N15: 396 x 313 x 193 mm N12: 313 x 290 x 161 mm
Display screen	Medical-grade colour TFT LCD, capacitive touch screen, support multi-touch operation. N17: 18.5-inch, 1920 x 1080 pixels (FHD) N15: 15.6-inch, 1920 x 1080 pixels (FHD) N12: 12.1-inch, 1280 x 800 pixels (WXGA)
Display traces	N17: Up to 12 waveforms N15: Up to 10 waveforms N12: Up to 8 waveforms

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, Vrhythm, 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
Sweep speed	3mm/s,6.25mm/s,12.5mm/s,25mm/s,50 mm/s

SpO_2

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/Pediatric: ± 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_2b, 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 μV/V/mmHg
Impedance range	300 to 3000 Ω
IBP range	-50 to 360 mmHg
IBP accuracy	±1 mmHg or ±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 ±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	≤ 2%
C.O.	0.25 to 25.0 L/min	≤ 2%
GEDV	40 to 4800 ml	≤ 3%
SV	1 to 250 ml	≤ 2%
EVLW	10 to 5000 ml	≤ 6%
ITBV	50 to 6000 ml	≤ 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 ± 2 %, whichever is greater

$ScvO_2$

$ScvO_2$ range	0 to 99 %
$ScvO_2$ accuracy	± 3% (50 to 80 %)

ICG

Technique	Thoracic electrical bioimpediance (TEB)

Provides monitoring paramters 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/SvO_2

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, SaO_2, VO_2, O_2EI, DO_2, $ScvO_2$, SvO_2, SQI.

Vigileo: CCO, CCI, SV, SVI, SVR, SVRI, $ScvO_2$, SvO_2.

Artema Sidestream CO_2

Meet standard of ISO 80601-2-55.

**Options: Paramagnetic O_2 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 ±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	± 0.1% (< 1 %)
	± 0.2% (1 to 4.9 %)
	± 0.3% (5 to 6.9 %)
	± 0.4% (7 to 11.9 %)
	± 0.5% (12 to 13 %)
	± 0.43% + 8%rel (13.1 to 20 %)
CO_2 resolution	1 mmHg
O_2 range	0 to 100 %
O_2 accuracy	±1 % (0 to 25 %)
	±2 % (25.1 to 80 %)
	±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

Oridion Microstream CO_2

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)
	±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 CO_2

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)
	±5 % of the reading (41 to 70 mmHg)
	±8 % of the reading (71 to 100 mmHg)
	±10 % of the reading (101 to 150 mmHg)

awRR range	0 to 150 rpm
awRR accuracy	±1 rpm

Multi-gas

Meet standard of ISO 80601-2-55.

Gas	CO_2, O_2, N_2O, 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 ±10%, whichever is greater.
Response time	DRYLINE II ™ watertrap and 2.5m sample line for adult/paediatric, 200 ml/min: CO_2: ≤ 4.2 s N_2O: ≤ 4.3 s O_2: ≤ 4 s Enf/Iso/Hal/Sev/Des: ≤ 4.5 s DRYLINE II ™ watertrap and 2.5m sample line for neonate, 120 ml/min: CO_2: ≤ 4 s N_2O: ≤ 4.2 s O_2: ≤ 4 s Enf /Iso/Hal/Sev/Des: ≤ 4.4 s
CO_2 range	0 to 30 %
CO_2 accuracy	±0.1%ABS (0 to 1%) ±0.2%ABS (1 to 5%) ±0.3%ABS (5 to 7%) ±0.5%ABS (7 to 10%)
O_2 range	0 to 100 %
O_2 accuracy	±1%ABS (0 to 25%REL) ±2%ABS (25 to 80%REL) ±3%ABS (80 to 100%REL)
N_2O range	0 to 100 %
N_2O accuracy	±2%ABS (0 to 20%REL) ±3%ABS (20 to 100%REL)
Enf/Iso/Hal/Sev/Des range	0 to 30 %
Enf/Iso/Hal accuracy	±0.15%ABS (0 to 1%REL) ±0.2%ABS (1 to 5%REL)
Sev accuracy	±0.15%ABS (0 to 1%REL) ±0.2%ABS (1 to 5%REL) ±0.4%ABS (5 to 8%REL)
Des accuracy	±0.15%ABS (0 to 1%REL) ±0.2%ABS (1 to 5%REL) ±0.4%ABS (5 to 8%REL) ±0.6%ABS (10 to 15%REL) ±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 kΩ
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	± 5% or ±2 mA, whichever is greater.
Stimulation pulse width	100, 200 or 300 µs, monophasic rectangle pulse
Stimulation pulse width accuracy	± 10 %
Max. output voltage	300 V

EEG

Meet standard of IEC 60601-2-26.

EEG channels	Up to 4 channels
Montage mode	Biopolar 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 Beta
DSA trend	Yes
CSA trend	Yes

RM

Technique	Diff-Pressure flow

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

Flow range	Adult/Paediatric: ± (2 to 120) L/min Neonate: ± (0.5 to 30) L/min
Flow accuracy	Adult/Paediatric: ± 1.2 L/min or ± 10% of the reading, whichever is greater. Neonate: ± 0.5 L/min or ± 10% of the reading, whichever is greater.
Flow resolution	0.1 L/min
Paw range	-20 to 120 cmH2O
Paw accuracy	± 3% x reading
Paw resolution	0.1 cmH2O
MVe/MVi range	Adult/Paediatric: 2 to 60 L/min Infant: 0.5 to 15 L/min
MVe/MVi accuracy	± 10% x reading
MVe/MVi resolution	0.01 L/min (MVe/MVi < 10 L/min) 0.1 L/min (MVe/MVi ≥ 10 L/min)
TVe/TVi range	Adult/Paediatric: 100 to 1500 ml Infant: 20 to 500 ml
TVe/TVi accuracy	Adult/Paediatric: ±10% or ±15 ml, whichever is greater. Infant: ±10% or ±6 ml, whichever is greater.
TVe/TVi 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 VCO_2, VO_2, $MVCO_2$, MVO_2, EE, RQ parameters, when monitoring with Sidestream CO_2 or AG module configured with the paramagnetic O_2.sensor.

Provide VCO2, MVCO2, FeCO2, SlopeCO2, Vtalv, MValv, Vdaw, Vdaw/Vt, Vdalv, Vdalv/Vt, Vdphy, Vd/Vt, when monitoring with Mainstream CO_2 module.

tcGas

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

$tcpCO_2$ range	5 to 200 mmHg
$tcpCO_2$ accuracy	TOSCA Sensor 92, tc Sensor 54: Better than 1 mmHg (1 % or 10 % CO_2) Better than 3 mmHg (33 % CO_2) tc Sensor 84: Better than 1 mmHg (1 % or 10 % CO_2) Better than 5 mmHg (33 % CO_2)
$tcpO_2$ range	0 to 800 mmHg
$tcpO_2$ accuracy	tc Sensor 84: Better than 1 mmHg (0 % O_2) Better than 3 mmHg (21 % O_2)

	Better than 5 mmHg (50 % O_2)
	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

rSO_2

Intended use for adult, paediatric, and neonate.

Technique	INVOS, NIRS (Near Infrared Spectroscopy)
Channels	Up to 4 channels
rSO2 range	15 to 95 %

Data Review

Trends data	> 120 hours with resolution no less than 1min.
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 at maximum. The specific storage time depends on the waveforms stored and the number of stored waveforms.
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.

iView

N17 supports 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, 5.725 to 5.82 GHz
Channel spacing	5 MHz @ 2.4 GHz, 20 MHz @ 5 GHz
Wireless baud rate	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) DVI port (1) Network connector (1), 100 Base-TX, IEEE 802.3 USB 2.0 connector (4) SMR connector (1) Nurse call connector (1) N17/N15 integrated Module slots: 6 slots N12 integrated Module slots: 4 slots
iView interfacing	DVI (1), 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
Thermal Recorder	3 traces (paper 50 mm width, 20 m length)
Network printer	Support

Power

Line voltage	100 to 240 VAC (±10 %), 2A
Frequency	50/60 Hz (±3 Hz)
Battery	Rechargeable lithium-ion battery, 4500mAh N17/N15: > 2 hours run time (typical) N12: > 4 hours run time (typical)
Recharge time	4 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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