Adult: 15 to 260 mmHg
Pediatric: 15 to 215 mmHg
Neonate: 15 to 125 mmHg

Accuracy
Max Mean Error: ± 5 mmHg
Max Standard Deviation: 8 mmHg

Cuff Deflation Technique Step bleed

Initial Cuff Inflation
Adult: 80 to 280 mmHg (default: 160 mmHg)
Pediatric: 80 to 210 mmHg (default: 140 mmHg)
Neonate: 60 to 140 mmHg (default: 90 mmHg)

Over Pressure Protection
Adult/ Pediatric: 297 ± 3 mmHg
Neonate: 147 ± 3 mmHg

Max Measurement time
Adult/Pediatric: 180 sec
Neonate: 90 sec

Assisting Venous Puncture Yes

Pulse Rate Range 30 to 300 bpm

Pulse Rate Accuracy ± 3 bpm or ± 3 %, whichever is greater

IBP

Meet standard of IEC 60601-2-34.

Number Up to 8 channels

Measurement Range -50 to 360 mmHg

Resolution 1 mmHg

Accuracy ± 1 mmHg or ±2 %, whichever is greater (excluding sensor error)

Sensitivity 5 µV/V/mmHg

Impedance Range 300 to 3000 Ω

PPV Range 0 to 50 %

PAWP Yes

ICP measurement Support

Support waveforms overlapping.

Pulse Rate Range 25 to 350 bpm

Pulse Rate Accuracy ±1 bpm or ±1 %, whichever is greater

Cardiac Output

Method Thermodilution

Measurement Range 0.1 - 20 L/min

Resolution 0.1 L/min

Accuracy ±0.1 L/min or ±5%, whichever is greater

TB Range 23 to 43 °C / 73.4 to 109.4 °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 23 to 43 °C / 73.4 to 109.4 °F

TB, TI Accuracy ± 0.1 °C (without sensor)

TB, TI Resolution 0.1 °C

pArt/pCVP Range -50 to 300 mmHg

pArt/pCVP Accuracy ± 1 mmHg or ± 2 %, whichever is greater

$ScvO_2$

Range 0 to 99 %

Accuracy ± 3% (50 to 80 %)

ICG

Method Thoracic electrical bioimpedance (TEB)

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

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

Continuous Cardiac Output Interface

Measured Parameter Consistent with CCO-related parameters outputted by Vigilance II®, Vigileo™, EV1000 or HemoSphere

Artema Sidestream CO_2

Meet standard of ISO 80601-2-55.

Measurement Range
$etCO_2$: 0 to 150 mmHg
O_2 (optional): 0 to 100 %

CO_2 Accuracy
0 to 40 mmHg: ± 2mmHg
41 to 76 mmHg: ± 5% of reading
77 to 99 mmHg: ± 10% of reading
100 to 150 mmHg: ± (3 mmHg+8% of reading)

O_2 Accuracy
0 to 25 %: ±1 %
25.1 to 80 %: ±2 %
80.1 to 100 % ±3 %

Resolution
$etCO_2$: 1 mmHg
O_2 (optional): 1 %

Sample Flow Rate
Adult/Pediatric: 120 ml/min (with or without O_2 monitoring)
Neonate: 70 ml/min or 90 ml/min, selectable
90 ml/min (with O_2 monitoring)

Sample Flow Rate Tolerance
±15 ml/min or ±15 %, whichever is greater.

Warm-up Time 90 sec (maximum), 20 sec (typically)

Measured with a neonatal watertrap and 2.5-meter neonatal sampling line, or an adult watertrap and a 2.5-meter adult sampling line:

Rise Time
$etCO_2$: ≤ 250 ms @ 70 ml/min (Neonate watertrap)
≤ 250 ms @ 90 ml/min (Neonate watertrap)
≤ 300 ms @ 120 ml/min (Adult watertrap)
O_2 (optional): ≤ 800 ms @ 90 ml/min (Neonate watertrap)
≤ 750 ms @ 120 ml/min (Adult watertrap)

Sampling Delay Time
$etCO_2$: ≤ 5.0 sec @ 70 ml/min (Neonate watertrap)
≤ 4.5 sec @ 90 ml/min (Neonate watertrap)
≤ 5.0 sec @ 120 ml/min (Adult watertrap)
O_2 (optional): ≤ 4.5 sec @ 90 ml/min (Neonate watertrap)

awRR:	1 rpm	

Full Accuracy

Gases	Range (%REL)	Accuracy (%ABS)
CO_2:	0 to 1 %	± 0.1 %
	1 to 5 %	± 0.2 %
	5 to 7 %	± 0.3 %
	7 to 10 %	± 0.5 %
	> 10 %	Not specified
N_2O:	0 to 20 %	± 2 %
	20 to 100 %	± 3 %
Des:	0 to 1 %	± 0.15 %
	1 to 5 %	± 0.2 %
	5 to 10 %	± 0.4 %
	10 to 15 %	± 0.6 %
	15 to 18 %	± 1 %
	> 18 %	Not specified
Sev:	0 to 1 %	± 0.15 %
	1 to 5 %	± 0.2 %
	5 to 8 %	± 0.4 %
	> 8 %	Not specified
Enf/Iso/Hal:	0 to 1 %	± 0.15 %
	1 to 5 %	± 0.2 %
	> 5 %	Not specified
O_2:	0 to 25 %	± 1 %
	25 to 80 %	± 2 %
	80 to 100 %	± 3 %
awRR:	2 to 60 rpm	± 1 rpm
	> 60 rpm	Not specified

Rise Time

Sampling flow 120 ml/min, using the DRYLINE II ™ watertrap and a neonatal 2.5m sampling line,

CO_2/ N_2O:	≤ 250 ms
Iso/Hal/Sev/Des:	≤ 300 ms
Enf:	≤ 350 ms
O_2:	≤ 600 ms

Sampling flow 200ml/min, using DRYLINE II ™ watertrap and an adult 2.5m sampling line:

CO_2/ N_2O:	≤ 250 ms
Iso/Hal/Sev/Des:	≤ 300 ms
Enf:	≤ 350 ms
O_2:	≤ 500 ms

Sampling Delay Time

Sampling flow 120 ml/min, using the DRYLINE II ™ watertrap and a neonatal 2.5m sampling line,

CO_2:	≤ 4 sec
N_2O:	≤ 4.2 sec
O_2:	≤ 4 sec

Enf /Iso/Hal/Sev/Des: ≤ 4.4 sec

Sampling flow 200ml/min, using DRYLINE II ™ watertrap and an adult 2.5m sampling line:

CO_2:	≤ 4.2 sec
N_2O:	≤ 4.3 sec
O_2:	≤ 4 sec

Enf/Iso/Hal/Sev/Des: ≤ 4.5 sec

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

Provide MAC value (support calibrated by age).

Support two mixed gas identify and monitoring.

RM

Method	Diff-Pressure flow
Measurement Range	
Flow	Adult/Pediatric: ± (2 to 120) L/min
	Neonate: ± (0.5 to 30) L/min
Paw	-20 to 120 cmH_2O
MVe/MVi	Adult/Pediatric: 2 to 60 L/min
	Infant: 0.5 to 15 L/min
TVe/TVi	Adult/Pediatric: 100 to 1500 ml
	Infant: 20 to 500 ml
awRR range	4 to 120 rpm
Resolution	
Flow	0.1 L/min
Paw	0.1 cmH_2O
MVe/MVi	0.01 L/min (MVe/MVi < 10 L/min)
	0.1 L/min (MVe/MVi ≥ 10 L/min)
TVe/TVi	1 ml
awRR:	1 rpm
Accuracy	
Flow	Adult/Pediatric: ± 1.2 L/min or ± 10% of the reading, whichever is greater.
	Neonate: ± 0.5 L/min or ± 10%, whichever is greater.
Paw	± 3% of reading
MVe/MVi	± 10% of reading
TVe/TVi	Adult/Pediatric: ±10% or ±15 ml, whichever is greater.
	Infant: ±10% or ±6 ml, whichever is greater.
awRR:	±1 rpm (4 to 99 rpm)
	±2 rpm (100 to 120 rpm)

Provide loops display.

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

rSO_2

Patient	Adult/Pediatric/Neonate.
Method	INVOS, NIRS (Near Infrared Spectroscopy)
Number	Up to 4 channels
Measurement Range	15 to 95 %

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 300μs,monophasic rectangle pulse
Stimulation Pulse Width Accuracy	
	± 10 %
Max. Output Voltage	300 V

BISx/BISx4

Meet standard of IEC 60601-2-26.

Method	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

EEG/aEEG

Meet standard of IEC 60601-2-26.

EEG Channels	Up to 4 channels
Montage Mode	Biopolar mode, referential mode
Input Signal Range	- 2 mVp-p to + 2mVp-p
Max. Input DC Offset	± 500 mV
CMRR	≥ 100 dB @51 kΩ imbalance and 60 Hz
Noise Level	≤ 0.5 μV rms (0.5 Hz to 70 Hz)
Differential Input Impedance	
	> 15 MΩ @10 Hz
Electrode Impedance	
Range	1 to 90 kΩ
Accurancy	± 1 kΩ or ± 10%, whichever is greater
Sampling Frequency	EBN EEG: 1024 Hz
	Mindray EEG: 256Hz
Analog bandwidth	EBN EEG: 0.5 to 110 Hz
	Mindray EEG/aEEG: 0.1 to 110 Hz
Spectrum analysis	SEF, MF, PPF, TP, SR, EMG, Delta, Theta, Alpha, Beda
Trend	DSA, CSA

ANI

Patient	Adult, Pediatric (over 12 years old)
Measurement Range	ANIi: 12 to100
	ANIm: 12 to 100
	Energy: 0.00 to 65.54

tcGas

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

Measurement Range	
$tcpCO_2$	5 to 200 mmHg
$tcpO_2$	0 to 800 mmHg
SpO2	0 to 100 %
PR	25 to 240 bpm
Power	0 to 1000 mW
Accuracy	
$tcpCO_2$	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)
$tcpO_2$	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	±3 % (70 to 100 %)
PR	±3 bpm
Power	±20 % of reading

iView (for N17 only)

CPU	Intel Pentium N4200 2.5GHz
Memory	8 GB
Hard-disk	mSATA SSD 128GB
OS	Windows 10

Recorder

Type	Thermal array
Speed	25 mm/sec, 50 mm/sec
Trace	Up to 3 (paper 50 mm width, 20 m length)

Supports integrated recorder module.

Alarms

Audible indicator	Yes, 4 different alarm tones, and prompt tone
Visible indicator	Red/yellow/cyan LED, and alarm message

Provide AlarmSight infographic alarm indicator.
Support iAlarm features (alarm limits recommendations, etc.)
Support iStatus combined alarms

Data Storage

Trends Data	> 120 hrs @ 1min, 4 hrs @ 5 sec.
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 hrs
ST review	120 hrs @1 min
Minitrend	Yes

Special Functions

Clinical Assistive Application (CAA):
HemoSight™, ST Graphic™, SepsisSight™, BoA Dashboard™, EWS, GCS, ECG 24h Summary, Pace View, AF Summary, NeuroSight
Support calculations (drug, hemodynamic, Oxygenation, Ventilation, Renal), and Titration table.
Support wireless connection with BeneVision TM80 and BP10.
Support nView remote display tool

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 (802.11 b/g/n)
	20 MHz @ 5 GHz (802.11 a/n)
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

Output

Auxiliary Output

Standard	Meets the requirements of ANSI/AAMI/IEC 60601-1 for short-circuit protection and leakage current

ECG Analog Output
Bandwidth (- 3 dB; reference frequency: 10 Hz)

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
QRS Delay	≤ 25 ms (in diagnostic mode, and non-paced)
Sensitivity	1 V/mV, ± 5 %

Pace Enhancement

Signal Amplitude:	V_{oh} ≥ 2.5 V
Pulse Width: 10 ms ± 5 %	
Signal Rising and Falling Time:	
	≤ 100 μs

IBP Analog Output
Bandwidth (- 3 dB; reference frequency: 10 Hz)
0 to 40 Hz

Max. Transmission Delay	30 ms
Sensitivity	1 V/100 mmHg, ± 5 %

Interfacing

AC Power Connector	1

RJ45 Network Connector, 100 Base-TX, IEEE 802.3

N17:	2 (1 for iView)
N15/N12:	1

USB 2.0 Connector

N17:	8 (4 for iView)
N15/N12:	4

Nonstandard USB SMR Connector

N17/N5:	1 to connect SMR, N1/T1 docking station
N12:	1 to connect N1/T1 docking station

Standard DVI-D Video Interface Connector

N17:	2 (1 for iView)
N15/N12:	1

BNC Connector	1

Equipotential Grounding Terminal
1
Multifunction Connector for Defib Sync and Analog Output
1 on multi-parameter module

Module Slot

N17/N15:	6 slots
N12:	4 slots

Barcode Scanner	Support 1D and 2D barcode
Keyboard & Mouse	Support wire and wireless type via USB
Remote Control	Support
Network Printer	Support

Battery

Type	Rechargeable lithium-ion
Number of Battery	1
Capacity	4500mAh
Run Time	when powered by a new fully-charged battery at 25 °C±5 °C with 5-lead ECG , SpO2, and auto NIBP measurements every 15 min, and screen brightness set to 1.
N17/N15:	> 2 hrs
N12:	> 4 hrs
Recharge Time	4.5 hrs to 90% when the monitor is off.

Power Requirements

AC Voltage	100 to 240 VAC (±10 %)
Current	2.0 to 0.9 A
Frequency	50 Hz/60 Hz (±3 Hz)

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)

Safety

Type of Protection Class I

Degree of Protection	MPM/IBP/C.O./NMT/(a)EEG/PiCCO/ANI module: CF
	$ScvO_2$/CO_2/AG/ICG/BIS/RM/rSO_2 module: BF

Protection Against Ingress of Fluids
IPX1

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

www.mindray.com

P/N:ENG- BeneVision N17/N15/N12 Datasheet-210285x4P-20211225