

EEG Bandwidth: 0.25 - 100 Hz
 Patient Leakage: <10uA
 Alarm limit: BIS high: (low limit +2)~100
 BIS low: 0~ (high limit -2)
 Calculated parameters: SQI,EMG, SR, SEF, TP
 Impedance range: 0~999Kohm

*: 10 % to 90 %, gas sample flow rate 120ml/min, using the DRYLINE™ watertap and neonatal DRYLINE™ sampling line (2.5m)
 **: 10 % to 90 %, gas sample flow rate 200ml/min, using the DRYLINE™ water trap and adult DRYLINE™ sampling line (2.5m).

Active AGSS:
 High flow, low vacuum
 Applies with ISO 8835-3:1997
 Connectors apply with BS 6834:1987
 Flow of suction: 50-80L/min
 Resistance: 0.75KPa @ 75L/min
 Pressure release: compensation port to atmosphere
 Filter: Stainless steel reseau with 140-150µm of diameter
 Safety: Float sinks down while flow of suction is lower than 50L/min

Environment specification
 Operation conditions
 Temperature: 10~40°C
 Relative humidity: 15~95%(noncondensing)
 Barometric (KPa): 70~106 kPa
Storage conditions
 Temperature: -20~55°C
 Relative humidity: 10~95%(noncondensing)
 Barometric (KPa): 50~106 kPa (optional Artema Multi-Gas module: 70~106 kPa)

With isolation transformer		
External AC power supply		
Input voltage	100 to 120 V	220 to 240 V
Input current	8.5 A	3.5 A
Input frequency	50/60 Hz	
Leakage current	< 500µA	
Auxiliary output supply		
Output voltage	100 to 120 V	220 to 240 V
Output frequency	50/60 Hz	
Output current(outlet 1)	3.8 A	1.6 A
Output current(outlet 2)	1.0 A	0.5 A
Output current(outlet 3)	1.0 A	0.5 A
Without isolation transformer		
External AC power supply		
Input voltage	100 to 240 V	100 to 120 V
Input current	8.5 to 3.5 A	8.5 A
Input frequency	50/60 Hz	
Leakage current	< 500µA	
Auxiliary output supply		
Output voltage	100 to 240 V	100 to 120 V
Output frequency	50/60 Hz	
Output current(outlet 1)	3.8 to 1.6 A	3.8 A
Output current(outlet 2)	1.0 to 0.5 A	1.0 A
Output current(outlet 3)	1.0 to 0.5 A	1.0 A

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DISTRIBUTOR:

WATO™ EX-65

Anesthesia Machines

Technical specifications

Physical specifications
Dimensions and Weight
 Height: 1350 mm
 Width: 700 mm (dual vaporizers without breathing circuit)
 950 mm (dual vaporizers with breathing circuit)
 Depth: 610 mm
 Weight: <120 kg (including trolley base, without vaporizer and cylinder)

Top Shelf
 Weight limit: 30kg
 Width: 480mm
 Depth: 440mm

Retractable work surface
 Height: 860 mm
 Area: 1012 cm²

LED Light
 Illuminates all work surface

DIN Rail
 Side of machine: 370mm

Drawers(two)-Locking (internal dimensions)
 Height: 170 mm
 Width: 350 mm
 Depth: 270 mm

Casters
 Diameter: 125 mm
 Brakes: Individual locking

Screen
 Display type: Color active matrix TFT
 Display size: 10.4 in diagonal
 Resolution: 800×600
 Brightness: Adjustable
 Multi-display selectable: Standard, large font or monitoring
 Display Parameters: All settings and alarm parameters(Breath rate, I: E ratio, tidal volume, minute volume, PEEP, peak pressure, Resistance, Compliance, FiO₂, EtCO₂, Pmean, Pplat and electronic flow indicated bars)
 Display Graphics: Standard: Waves of Pressure-Time, Flow-Time, Volume-Time;
 Optional: Loops of Pressure-Volume and Flow-Volume, Wave of Co₂, Trend of EEG and BIS.
 The time of operation will be displayed on the screen
 Timer: F-V, P-V and F-P loops
 Loops:

Ventilator Specifications
Standby Mode: Machine is on call; System settings, ventilation and alarm parameters can be set

Modes of Ventilation-Standard
 Volume-Controlled Ventilation (VCV) with tidal volume compensation
 Manual
 Pressure Control Ventilation (PCV)

Modes of Ventilation-Optional
 Synchronized Intermittent Mandatory Ventilation (SIMV) (volume and pressure)
 Pressure Support Ventilation (PSV) with Apnea backup

Ventilator Parameter Ranges
 Tidal volume range: 20~1500 ml (VCV and SIMV-VC)
 Incremental settings: 20~100ml (increments of 5 ml)
 100~300 ml (increments of 10 ml)
 300 ~1500 ml (increments of 25 ml)
 Pressure (inspired) range: S~60 cmH₂O
 increments of 1 cmH₂O
 Pressure (limit) range: 10~100 cmH₂O
 increments of 1 cmH₂O
 Pressure (support) range: 5 to 60 cmH₂O
 increments of 1 cmH₂O
 Rate range: 4~100 bpm
 increments of 1 bpm (VCV, PCV)
 4~60 bpm



increments of 1 bpm (SIMV, PSV)
 Inspiratory/Expiratory ratio (I:E) range: 4:1~1:8
 increments of 0.5 (VCV, PCV)
 Inspiratory time: 0.4~5.0 seconds
 increments of 0.1 seconds (SIMV)
 Trigger window: 5~90%
 increments of 5% (SIMV)
 Pressure trigger: -20 ~ -1 cmH₂O
 increments of -1 cmH₂O (SIMV, PSV)
 Flow trigger: 0.5~15L/min
 increments of 0.5 L/min (SIMV, PSV)
 Inspiratory termination level: 5~60% of peak inspiratory flow
 increments of 5% (PSV)
 Backup time: 5-30 seconds
 increments of 5 seconds (PSV)
 Inspiratory pause time: OFF, 5~60% of inspiratory time
 Positive End Expiratory Pressure (PEEP)
 Type: Integrated, electronically controlled
 Range: OFF, 4 ~30 cmH₂O
 increments of 1 cmH₂O

Ventilator Performance
 Pressure range at inlet: 0.28~0.6 MPa
 Peak gas flow: 100 L/min plus fresh gas
 Flow valve range: 1 to 100 L/min

Ventilator Accuracy
 Delivery/ monitoring accuracy
 Volume delivery: < 75 ml, ±15ml
 ≥ 75 ml, ±20ml or ±10%, whichever is larger
 Psupport/inspired: ±3.0 cmH₂O, or ±8%, whichever is larger
 Plimit: ±4.0 cmH₂O, or ±10%, whichever is larger
 PEEP delivery: ±2.0 cmH₂O, or ±10%, whichever is larger
 Volume monitoring: < 75 ml, ±15ml
 ≥ 75 ml, <1500 ml, ±20ml or ±10%, whichever is larger
 >1500 ml, unspecified
 Pressure monitoring: ±3.0 cmH₂O, or ±8%, whichever is larger

Alarm Settings
Tidal volume(expiratory):
 High: 5~1600 ml
 Low: 0 ~1595 ml
Minute volume(expiratory):
 High: 0.2 ~100
 Low: 0 ~99
Inspired oxygen:
 High: 20~100%
 Low: 18 ~ 98%
 Low airway pressure: 0 ~98 cmH₂O
 High pressure: 2 ~100cmH₂O
 Apnea alarm: 20s
 Rate : High: 4 ~ 100bpm
 Low: 2~98bpm

Ventilator Monitoring
 Minute volume range (expiratory) : 0~100 L/min
 Tidal volume range (expiratory) : 0~2500 ml
 Inspired oxygen(FiO₂): 18~ 100%
 Peak pressure: -20~120 cmH₂O
 Mean pressure: -20 ~120 cmH₂O
 Plateau pressure: -20-120 cmH₂O
 Sweep speed: 6.25 mm/s or 12.5 mm/s
 Positive End Expiratory Pressure (PEEP): 0~70 cmH₂O

WATO™ EX-65 Anesthesia Machines

Trend Chart: Continuous trend information together with time discrete events are stored and shown by lines for the latest 24 hours with 5 seconds resolution for TV_E, P_{peak}, MV, P_{plat}, PEEP, P_{mean}, Rate and optional FiO₂, EtCO₂, BIS.

New trend chart will be recorded when restart the machine

Trend Table: Continuous trend information together with time discrete events are stored and shown by table for the latest 24 hours for TV_E, P_{peak}, MV, P_{plat}, PEEP, P_{mean}, Rate and optional FiO₂, EtCO₂, BIS.

Resolution: 30s, 1min, 5 min, 30 min, optional
New trend table will be recorded when restart the machine

Vaporizer

Type: Penlon Sigma Delta® or Sigma Alpha® vaporizer, options include Desflurane, Isoflurane, Enflurane, Sevoflurane and Halothane vaporizers

Position of vaporizer: one or dual-positions

Installation mode: selectatec® with interlock

Power and Battery Backup

Battery backup: 60 min for 1 piece battery (powered by new fully-charged batteries with 25°C ambient temperature)
120 min for 2 piece battery (powered by new fully-charged batteries with 25°C ambient temperature)

Battery type: Build-in Li-ion battery, 11.1 VDC, 4400 mAh
Number of batteries: 1 or 2 pieces
Time to shutdown: 5 min at least (powered by new fully-charged batteries after the first low-power alarm)

Charge time: Approximately 8 hours (in running status or stand by mode)

Power cord: 5 m

Inlet and Outlet Modules

Interface Specifications

Wire network: RJ 45 connector 100-Base-TX support HL7 communication license and upgrading of main unit

Pneumatic Specifications

Switching Auxiliary Common Gas Outlet(ACGO)

Connector: ISO 22 mm OD and 15 mm ID
The outlet locates at the inspiratory limb

Gas Supply

Pipeline input range: 0.28~0.6MPa

Pipeline connections: NIST or DISS

Cylinder input: PISS
Maximum 2 cylinders, optional

Primary regulator nominal output: 207kPa

Electronic display and mechanical control flow meters

O₂ range: 0~10 L/min
N₂O range: 0~10 L/min
Air range: 0~10L/min
Accuracy: $\pm 10\%$ of indication

Auxiliary O₂ Flowmeter (Optional)

Range: 0~15 L/min
Indicator: Flow tube

Hypoxic Guard System

Type: Mechanical
Range: Provides a nominal minimum 25% concentration of oxygen in O₂/N₂O mixture

O₂ Controls

Method: N₂O shut off with loss of O₂ pressure
Supply failure alarm: <220kPa

O₂ Flush: 25~75 L/min

Breathing Circuit Specification

System Pressure Gauge:
Range: -20~100 cmH₂O
Accuracy: $\pm 2.5\%$ full scale
Bag/Mechanical Ventilation Switch:
Type: Bi-stable
Control: the switch between manual ventilation and ventilator

Adjustable Pressure Limiting (APL) valve:

Range: 1~75 cm H₂O
Tactile knob indication at: >30 cm H₂O
Accuracy: ± 10 cm H₂O
start pressure : 1 cm H₂O

Breathing Circuit Parameters:

Compliance: $\cong 4$ mL/100Pa
Automatically compensates for compression loss with in the breathing circuit in mechanical mode
Expiration resistance: < 6 cm H₂O @60 L/min
Inspiration resistance: < 6 cm H₂O @60 L/min
Material: The material contact exhaled gas is autoclavable except flow sensors, O₂ fell cell and mechanical pressure meter; All material contact exhaled gas is natural latex free.
Operational Modes: Closed and semi-closed circuit system
Volume of CO₂ canister: about 1500
Water Trap: 6mL, easy to be disassembled
Port and Connectors:
Inspiration/ expiration connector: 22 mm OD and 15 mm ID conical connector
Manual bag port: 22 mm OD and 15 mm ID conical connector

Gas Monitoring

Carbon Dioxide (CO₂) Modules

Method: Infrared absorption
Module type: Mindray side-stream, Capnostat mainstream and Oridion micro-stream, optional
Standby or Measurement
Work mode: Standby or Measurement
Displayed numerics: EtCO₂, FiCO₂
Wave forms: Capnography
Wave type: The CO₂ wave is displayed as a filled area.
Sweep: 6.25 mm/s, 12.5 mm/s

Mindray Side-stream Carbon Dioxide (CO₂) Module

Measurement range: 0~99 mmHg
Accuracy: ± 2 mmHg (0~40 mmHg)
 $\pm 5\%$ of reading (41~76 mmHg)
 $\pm 10\%$ of reading (77~99 mmHg)

Resolution: 1 mmHg
Gas compensations: N₂O, O₂ and Anesthetic Gas(only for Desflurane) compensation, optional

Humidity compensation: BTPS or ATPD
BTPS: Body Temperature and Pressure, Saturated Gas
ATPD: Ambient Temperature and Pressure, Dry Gas
Sampling rate: 70 or 100ml/min
Sampling rate accuracy: $\pm 15\%$ or 15ml/min whichever is larger
Start-up time: Less than 1 min to enter ISO accuracy mode;
10 minute later to enter full accuracy status;

Response time: When measured with a neonatal watertrap and a 2.5 m-long neonatal sampling line:
<3.5 s @ 100 ml/min
<4 s @ 70 ml/min

When measured with an adult watertrap and a 2.5 m-long adult sampling line:
<5.5 s @ 100 ml/min
<7 s @ 70 ml/min

Delay time: When measured with a neonatal watertrap and a 2.5m-long neonatal sampling line:
<3 s @ 100 ml/min
<3.5 s @ 70 ml/min

When measured with an adult watertrap and a 2.5m-long adult sampling line:
<5 s @ 100 ml/min
<6.5 s @ 70 ml/min

Alarm limit: EtCO₂ high:(low limit+2) to 99mmHg
EtCO₂ low: 0 to (high limit-2) mmHg
FiCO₂ High: 0 to 99mmHg
Increments of 1 mmHg

Capnostat Mainstream CO₂ Module

Measurement range: 0~150 mmHg
Accuracy: ± 2 mmHg(0~40 mmHg)
 $\pm 5\%$ of reading(41~70 mmHg)
 $\pm 8\%$ of reading(71~100 mmHg)
 $\pm 10\%$ of reading(101~150 mmHg)

Resolution: 0.1 mmHg(0~69mmHg)
0.25mmHg(70~150mmHg)

Response time: < 60 ms
Gas compensations: O₂ compensations, AG compensations, Balance gas(room air or N₂O)compensations.

Alarm limit: EtCO₂ High:(low limit+2) to 150mmHg
EtCO₂ Low: 0 to (high limit-2) mmHg
FiCO₂ High:0 to 150mmHg
Increments of 1 mmHg

Micro-Stream CO₂ Module

Measurement range: 0~99 mmHg
Accuracy: ± 2 mmHg(0~38 mmHg)
 $\pm 5\%$ (39~99 mmHg)

Resolution: Waveform: 0.1mmHg
Value: 1mmHg

Sampling rate: 50ml/min
Sampling accuracy: -7.5 ml/min~+15 ml/min
Initialization time: 30s(typical)

Response time: reaches 5% steady-state accuracy within 3 minutes
2.9s(typical) including the rising time and the delay time (adopting the Filter Line of standard length)

Rising time: <190ms(rising from 10% to 90%)

Delay time: 2.7s (typical)

Alarm range: EtCO₂ high:(low limit+2) to 99mmHg
EtCO₂ low: 0 to (high limit-2) mmHg
FiCO₂ High: 0 to 99mmHg
Increments of 1 mmHg

Anesthetic Agent (AA) Module

Module type: Module with three slots (optional for BIS module and O₂ module)

Measurement mode: Side-stream
Warm-up time: 45s (ISO accuracy mode); 10 min(full accuracy mode)
ISO accuracy specifications:

Most errors the same as full accuracy specifications, a few different as follows:
Add $\pm 0.3\%$ ABS to error for CO₂;
Add $\pm 8\%$ REL to error for all anesthetic agents;
N₂O error is $\pm (8\% \text{REL} + 2\% \text{ABS})$.

Pump rate: 120/ min, 150/ min, 200 ml/min, optional;
Accuracy: ± 10 ml/min or $\pm 10\%$, whichever is greater.
Monitored parameters: CO₂, N₂O, AA, MAC, Paramagnetic O₂, and BIS (optional)

AA(Anesthetic Agent) : Enflurane(Enf), Isoflurane(Iso), Sevoflurane(Sev), Desflurane(Des) and Halothane(Hal)

Refreshing rate: 1 second
Displayed numerics: EtCO₂, FiCO₂, EtN₂O, FiN₂O, EtAA, FIAA, MAC, FiO₂, EtO₂ and BIS(optional)

Wave type: Fill
Fill: The CO₂ wave is displayed as a filled area.
Sweep: 6.25 mm/s, 12.5 mm/s

Carbon dioxide(CO₂)

EtCO₂: End-tidal CO₂ concentration
FiCO₂: Inspired CO₂ concentration
Range: 0 to 30%
Accuracy: Concentration(%REL) Error(%ABS)
0 to 1 ± 0.1
1 to 5 ± 0.2
5 to 7 ± 0.3
7 to 10 ± 0.5
>10 Unspecified

Adjustable low and high alarm limits for EtCO₂ and FiCO₂
Oxygen(O₂, Paramagnetic)

FiO₂: Inspired O₂ concentration
EtO₂: End-tidal O₂ concentration
Range: 0 to 100%
Accuracy: Concentration(%REL) Error(%ABS)
0 to 25 ± 1
25 to 80 ± 2
80 to 100 ± 3

Adjustable low and high alarm limits for EtO₂ and FiO₂

Nitrous Oxide(N₂O)

FiN₂O: Inspired N₂O concentration
EtN₂O: End-tidal N₂O concentration
Range: 0 to 100 %
Accuracy: Concentration(%REL) Error(%ABS)
0 to 20 ± 2
20 to 100 ± 3

Adjustable low and high alarm limits for EtN₂O and FiN₂O

Anesthetic Agent(AA)

FiAA : Inspired AA concentration
EtAA : End-tidal AA concentration
Range: 0 to 30 %
Accuracy: Concentration(%REL) Error(%ABS)

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 Unspecified

Sev: 0 to 1 ± 0.15
1 to 5 ± 0.2
5 to 8 ± 0.4
>8 Unspecified

Iso, Enf, Hal: 0 to 1% ± 0.15
1 to 5% ± 0.2
> 5 % Unspecified

Rise time*: CO₂ ≤ 250 ms (fall time: 200ms)

N₂O ≤ 250 ms

O₂ ≤ 600 ms

Hal, Iso, Sev, Des ≤ 300 ms

Enf ≤ 350 ms

Rise time**: CO₂ ≤ 250 ms (fall time: 200 ms)

N₂O ≤ 250 ms

O₂ ≤ 500 ms

Hal, Iso, Sev, Des ≤ 300 ms

Enf ≤ 350 ms

Delay time: <4s

Refreshing time: one second

Calibration: once per year

Adjustable low and high alarm limits for EtAA and FiAA

Alarm limit

CO₂ alarm limit: EtCO₂ High: (low limit + 2) to 76 mmHg
EtCO₂ Low : 0 to (high limit - 2)mmHg
FiCO₂ High: (low limit + 2) to 76 mmHg
FiCO₂ Low : 0 to (high limit - 2)mmHg
Increments of 1 mmHg

O₂ alarm limit: EtO₂ High: (low limit + 0.3) to 100 %
EtO₂ Low : 18 to (high limit - 0.3)%
FiO₂ High: (low limit + 0.3) to 100 %
FiO₂ Low : 18 to (high limit - 0.3)%
Increments of 0.1

N₂O alarm limit: EtN₂O High: (low limit + 2) to 100 %
EtN₂O Low :0 to (high limit - 2)%
FiN₂O High:(low limit + 2) to 100 %
FiN₂O Low :0 to (high limit - 2)%
Increments of 1%

Des alarm limit: EtDes High: (low limit + 0.2) to 18.0 %
EtDes Low : 0 to (high limit - 0.2)%
EtDes High: (low limit + 0.2) to 18.0 %
EtDes Low : 0 to (high limit - 0.2)%
Increments of 0.1%

Sev alarm limit: EtSev High: (low limit + 0.2) to 8.0 %
EtSev Low : 0 to (high limit - 0.2)%
EtSev High: (low limit + 0.2) to 8.0 %
EtSev Low : 0 to (high limit - 0.2)%
Increments of 0.1%

FiSev High: (low limit + 0.2) to 8.0 %
FiSev Low : 0 to (high limit - 0.2)%
FiSev High: (low limit + 0.2) to 8.0 %
FiSev Low : 0 to (high limit - 0.2)%
Increments of 0.1%

Iso /Enf/ Hal alarm limit : EtHal/Enf/Iso High:(low limit + 0.2) to 5.0 %
EtHal/Enf/Iso Low :0 to (high limit - 0.2)%
FiHal/Enf/Iso High:(low limit + 0.2) to 5.0 %
FiHal/Enf/Iso Low :0 to (high limit - 0.2)%
Increments of 0.1%

Sev alarm limit: EtSev High: (low limit + 0.2) to 8.0 %
EtSev Low : 0 to (high limit - 0.2)%
EtSev High: (low limit + 0.2) to 8.0 %
EtSev Low : 0 to (high limit - 0.2)%
Increments of 0.1%

FiSev High: (low limit + 0.2) to 8.0 %
FiSev Low : 0 to (high limit - 0.2)%
FiSev High: (low limit + 0.2) to 8.0 %
FiSev Low : 0 to (high limit - 0.2)%
Increments of 0.1%

Iso /Enf/ Hal alarm limit : EtHal/Enf/Iso High:(low limit + 0.2) to 5.0 %
EtHal/Enf/Iso Low :0 to (high limit - 0.2)%
FiHal/Enf/Iso High:(low limit + 0.2) to 5.0 %
FiHal/Enf/Iso Low :0 to (high limit - 0.2)%
Increments of 0.1%

Sev alarm limit: EtSev High: (low limit + 0.2) to 8.0 %
EtSev Low : 0 to (high limit - 0.2)%
EtSev High: (low limit + 0.2) to 8.0 %
EtSev Low : 0 to (high limit - 0.2)%
Increments of 0.1%

FiSev High: (low limit + 0.2) to 8.0 %
FiSev Low : 0 to (high limit - 0.2)%
FiSev High: (low limit + 0.2) to 8.0 %
FiSev Low : 0 to (high limit - 0.2)%
Increments of 0.1%

Iso /Enf/ Hal alarm limit : EtHal/Enf/Iso High:(low limit + 0.2) to 5.0 %
EtHal/Enf/Iso Low :0 to (high limit - 0.2)%
FiHal/Enf/Iso High:(low limit + 0.2) to 5.0 %
FiHal/Enf/Iso Low :0 to (high limit - 0.2)%
Increments of 0.1%

BIS (Bispectral Index) monitoring
Measured parameters: EEG
BIS: 0~100
Sweep speed: 6.25 mm/s, 12.5 mm/s, 25 mm/s or 50 mm/s

Input Impedance: >50 Mohm

Noise (RTI): <0.3uV (0.25 - 50 Hz)

Input Signal Range: +/- 1mV