

WATO EX-65 Pro

Anesthesia Workstation

Physical Specifications

Dimensions and Weight

Height	1370 mm
Width	780 mm (not including breathing system) 945 mm (including breathing system)
Depth	690 mm
Weight	<145 kg (without vaporizers and cylinders)

Top Shelf

Weight limit	30 kg
Width	305 mm
Length	545 mm

Work Surface

Height	850 mm
Area	1635 cm ²

Drawer (3Xdrawers, Internal Dimension)

Height	130 mm
Width	415 mm
Depth	320 mm

Bag Arm

Height	1150 mm
Length	312 mm
Connection	ISO 22mm OD, 15mm ID

Casters

Diameter	125 mm
Brakes	Centre brake system with Lock / Unlock icons

Ventilator Specifications

Modes of Ventilation

Manual/Spontaneous Ventilation/Bypass
Volume Control Ventilation (VCV) with PLV function
Pressure Control Ventilation (PCV) with/without volume guarantee (VG)
Synchronized Intermittent Mandatory Ventilation (SIMV-Volume Controlled and SIMV-Pressure Controlled)
Pressure Support Ventilation (PS) with apnea backup
Synchronized Intermittent Mandatory Ventilation Volume Guarantee (SIMV-VG)
Continuous Positive Airway Pressure/Pressure Support Ventilation (CPAP/PS)

Compensation

Circuit gas leakage compensation and automatic compliance compensation

Ventilation Parameters Range

Patient Size	Adult, Pediatric, Infant
Tidal volume	20~1500 mL ((Volume Mode) (increments of 1 mL) 5~1500 mL (Pressure Mode)
Pinsp	5~70 cmH ₂ O (increments of 1 cmH ₂ O)
Plimit	10~100 cmH ₂ O (increments of 1 cmH ₂ O)
ΔPsupp	3~60 cmH ₂ O (increments of 1 cmH ₂ O)



Rate	0, 3~60 cmH ₂ O (CPAP/PS)
I:E	4~100 bpm (increments of 1 bpm)
Inspiratory pause (Tip:Ti)	4:1 - 1:8 (increments of 0.5)
Inspiratory time (Tinsp)	OFF, 5% - 60% (increments of 1%)
Trigger window	0.2 - 10.0 s (increments of 0.1 s)
Flow trigger	5% - 90% (increments of 5%)
Pressure trigger	0.2 ~ 15 L/min (increments of 0.1L/min)
Expiration termination level	-20 ~ -1 cmH ₂ O (increments of 1 cmH ₂ O)
Minimum Rate	5% - 80% (increments of 1%)
Tslope	2 - 60 bpm (increments of 1 bpm)
Apnea I: E	0.0 - 2.0 s (increments of 0.1 s)
ΔPapnea	4:1~1:8 (increments of 0.5)
	3 - 60 cmH ₂ O (increments of 1 cmH ₂ O)

Positive End Expiratory Pressure (PEEP)

Type	Integrated, electronic controlled
Range	OFF, 3~30 cmH ₂ O (increments of 1 cm H ₂ O)

Ventilator Performance

Driving pressure	280 kPa to 600 kPa
Peak gas flow	120 L/min + Fresh Gas Flow

Monitoring Parameters

Minute volume	0 ~ 100 L/min
Tidal volume	0~3000 ml
Inspired oxygen (FiO ₂)	18% ~ 100%
Peak airway pressure	-20 ~ 120 cmH ₂ O
Mean pressure	-20 ~ 120 cmH ₂ O
Plateau pressure	-20 ~ 120 cmH ₂ O
I:E	4:1 ~ 1:10
Rate	0 ~ 120 bpm
PEEP	0 ~ 70 cmH ₂ O
Resistance (R)	0 ~ 600 cmH ₂ O/(L/s)
Compliance (C)	0 ~ 300 ml/cmH ₂ O

Control Accuracy

Volume delivery	20 mL to 60 mL: ±10 mL 60 mL to 210 mL: ±15 mL 210 mL to 1500 mL: ± 7% of the set value
Pinsp	± 2.5 cmH ₂ O or ± 7% of the set value, whichever is greater
Plimit	± 2.5 cmH ₂ O or ± 7% of the set value, whichever is greater
ΔPsupp	± 2.5 cmH ₂ O or ± 7% of the set value, whichever is greater
ΔPapnea	± 2.5 cmH ₂ O or ± 7% of the set value, whichever is greater
PEEP	OFF: ± 3.0 cmH ₂ O 3 to 30 cmH ₂ O: ± 2.0 cmH ₂ O, or ± 8% of the set value, whichever is greater
Rate	± 1bpm or ± 10% of the set value, whichever is greater
I:E	2:1 to 1:4: ± 10% of the set value

	Other range: $\pm 25\%$ of the set value
Tip:Ti	$\pm 8\%$
Tinsp	$\pm 0.2s$
Trigger Window	$\pm 10\%$
Flow Trigger	$\pm 1L/min$
Pressure Trigger	$\pm 2cmH_2O$
Exp%	$\pm 10\%$

Monitoring Accuracy

Volume monitoring	0 mL to 60 mL: ± 10 mL 60 mL to 210 mL: ± 15 mL 210 mL to 1500 mL: $\pm 7\%$ of the set value
Pressure monitoring	± 2.0 cmH ₂ O or $\pm 4\%$ of the reading, whichever is greater
Rate	± 1 bpm or $\pm 5\%$ of the reading, whichever is greater
I:E	2:1 to 1:4: $\pm 10\%$ of the reading Other range: $\pm 25\%$ of the reading
MV	$\pm 0.1L/min$ or $\pm 8\%$ of the reading, whichever is greater

Trend Graph

Continuous trend information with time discrete events for the latest 48 hours

Trend Table

Continuous trend information together with time discrete events for the latest 48 hours

Alarm Log Book

500 events storage, first in first out

Alarm setting

Tidal volume	Low: 0 ~ 1595 ml High: 5 ~ 1600 ml
Minute volume	Low: 0 ~ 99 L/min High: 0.2 ~ 100 L/min
Inspired oxygen	Low: 18% ~ 98% High: OFF, 20% ~ 100%
Apnea alarm	VT _e < 10ml measured in 20s Paw < (PEEP + 3) cmH ₂ O in 20s
Airway pressure low	0 ~98 cmH ₂ O
Airway pressure high	2 ~100 cmH ₂ O
Sustained airway pressure alarm:	15s
Subatmospheric pressure alarm:	Paw < -10 cmH ₂ O
Alarm silence countdown timer:	120 to 0 seconds

Lung Recruitment Tool

Increasing PEEP progressively (with a maximum of 7 stages)

Ventilator Components

Flow Sensor

Type	Variable orifice flow sensor
Location	Inspiratory and expiratory port

Oxygen Sensor

Type	Galvanic fuel cell
FiO ₂ displayed	18% to 100%
Accuracy	\pm (volume fraction of 2.5 % +2.5 % gas level)
Response Time	≤ 20 seconds

Ventilator Screen

Display type	Color active matrix TFT touch screen
Display size	15 in diagonal
Pixel format	1024 x 768
Brightness	Adjustable

Screen display	configurable
Display parameters	All setting and alarm parameters (including Breath rate, I/E ratio, Tidal volume, Minute volume, PEEP, MEAN, PEAK, PLAT, and O ₂ concentration, EtCO ₂ , N ₂ O, Aesthesia gas concentration, BIS)
Display waveforms	P-T, F-T, V-T, CO ₂ , BIS, O ₂ , Anesthetic gas, N ₂ O
Spirometry loops	P-V, F-V and F-P
Timer	On screen timer

Communication Ports

One RS-232C connector and one DB9 connector
Ethernet (RJ-45)
USB
VGA

Vaporizers

Vaporizer	Mindray V60 Anesthetic Vaporizer or Penlon Sigma Delta Anesthetic Vaporizer
Support agents	Halothane, Enflurane, Isoflurane, Sevoflurane
Position	MAX.2
Mounting mode	Selectatec [®] , with interlocking function Plug-in [®] , with interlocking function

Modules

Anesthesia Gas (AG) Module

Monitor gases	CO ₂ , N ₂ O, Halothane, Enflurane, Isoflurane, Sevoflurane, Desflurane, MAC, Paramagnetic O ₂ (optional)
Warm-up time	45 s (ISO accuracy mode) 10min (full accuracy mode)
Sample rate	Adu/Ped: 150, 180, 200 ml/min Neo: 100, 110, 120 ml/min
Accuracy	± 10 mL/min or $\pm 10\%$ of the set value, whichever is greater
Range	CO ₂ : 0% ~ 10% Des: 0% ~ 18% Sev: 0% ~ 8% Enf, Iso, Hal: 0% ~ 5% O ₂ /N ₂ O: 0% ~ 100%

Carbon Dioxide (CO₂) Modules

Method	Infrared absorption
Module type	Mindray side-stream Capnostat mainstream Oridion micro-stream (optional)
Work mode	Standby or measurement
Displayed numerics	EtCO ₂ , FiCO ₂
Waveform	Capnography

Side-Stream Carbon Dioxide (CO₂) Module

Measurement range	0 ~ 99 mmHg
Accuracy	± 2 mmHg (0 ~ 40 mmHg) $\pm 5\%$ of the reading (41 ~ 76 mmHg) $\pm 10\%$ of the reading (77 ~ 99 mmHg)
Resolution	1 mmHg
Sampling rate	Neonatal: 100 mL/min and 120 mL/min optional Adult/children: 120 mL/min and 150 mL/min optional
Sampling rate accuracy:	$\pm 15\%$ of the set value or ± 15 mL/min, whichever is greater
Warming-up time	< 1 min, enter the ISO accuracy mode After 1 min, enters the full accuracy mode

Response time	<4.5 s@100 mL/min <4.5 s@120 mL/min Measured by using neonatal watertrap and 2.5 m neonatal sampling line <5.5 s@120 mL/min <5 s@150 mL/min Measured by using adult watertrap and 2.5 m adult sampling line	whichever is greater
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Capnostat Mainstream CO₂ Module

Measurement range	0 ~ 150 mmHg
Accuracy	± 2 mmHg (0 ~ 40 mmHg) ± 5% of the reading (41 ~ 70 mmHg) ± 8% of the reading (71 ~ 100 mmHg) ± 10% of the reading (101 ~ 150 mmHg)
Resolution	1 mmHg
Rise time	<60 ms
Response time	<2 s
Alarm limit	EtCO ₂ High: OFF, 2 ~ 150 mmHg EtCO ₂ Low: OFF, 0 ~ 148 mmHg FiCO ₂ High: OFF, 1 ~ 150 mmHg

Micro-stream CO₂ Module

Measurement range	0 ~ 99 mmHg
Accuracy	0 ~ 38 mmHg: ± 2 mmHg 39 ~ 99 mmHg: ± (5 % of the reading + 0.08 % of (the reading minus 38 mmHg))
Sampling rate	50 ml/min
Sampling accuracy	-7.5 ml/min ~ + 15 ml/min
Initialization time	30s
Response time	2.9s
Rising time	< 190 ms
Delay time	2.7s
Alarm range	EtCO ₂ High: OFF, 2 ~ 99 mmHg EtCO ₂ Low: OFF, 0 ~ 97 mmHg FiCO ₂ High: OFF, 1 ~ 99 mmHg

BIS Module

Measured parameters	EEG
BIS/BIS L, BIS R	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)	< 0.3 uV (0.25 ~ 50 Hz)
Input signal range	± 1 mv
EEG bandwidth	0.25 ~ 100 Hz
Patient leakage current	< 10 uA
Alarm limit	BIS high: 2 ~ 100 BIS low: 0 ~ 98
Calculated parameters	SQI/SQI L, SQI R; EMG/EMG L, EMG R; SR/SR L, SR R; SEF/SEF L, SEF R; TP/TP L, TP R; BC/BC L, BC R; sBIS L, sBIS R; sEMG L, sEMG R; ASYM
Impedance range	0 ~ 999 Kohm

Agent Consumption Calculation

Calculation range	0 to 3000 ml
Accuracy	± 2 mL, or ± 15% of the reading, whichever is larger

Agent consumption speed

Anesthetic agents	Desflurane, Enflurane, Isoflurane, Sevoflurane and Halothane
Consumption speed	Desflurane: 0 ~ 900 ml/h Sevoflurane: 0 ~ 450 ml/h Enflurane, Isoflurane and Halothane: 0 ~ 250 ml/h
Accuracy	± 2ml/h or ±15% of the displayed value,

Electrical Specifications

Current Leakage

100 ~ 240V	< 500 µA
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Power And Battery Backup

Power input	220-240 Vac, 50/60 Hz, 6A 100-120 Vac, 50/60 Hz, 7A 100-240 Vac, 50/60 Hz, 7A
Auxiliary electrical outlets	Up to 4 outlets (3A for each, total 5A)
Battery backup	150 minutes for 2 standard pieces of battery (powered by new fully-charged batteries with 25°C ambient temperature)
Battery type	Build-in Li-ion battery, 11.1 VDC, 4500 mAh
Safety feature	In case of electricity and battery failure, manual ventilation, gas delivery and agent delivery are possible

Pneumatic Specifications

ACGO (Auxiliary Common Gas Outlet, Integrated)

Connector	ISO 22 mm OD and 15 mm ID
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Pipeline Supply

Gas type	O ₂ , N ₂ O and Air
Pipeline input range	280 to 600 kPa
Pipeline connections	DISS or NIST

Pipeline Supply Pressure Gauges

Display type	Electronical or Mechanical
Ranges	0 to 1000kPa
Accuracy	± (4% of the full scale reading + 8% of the actual reading)

Cylinder Supply

Cylinder Supply	E Cylinder (American style or UK style)
O ₂ Input Range	6.9 to 20 MPa
N ₂ O Input Range	4.2 to 6 MPa
Air Input Range	6.9 to 20 MPa
Cylinder Connections	Pin-Index Safety System (PISS)
Yoke Configuration	O ₂ , N ₂ O, Air

Cylinder Supply Pressure Gauges

Display type	Electronical or Mechanical
Air Range	0 to 25 MPa
O ₂ Range	0 to 25 MPa
N ₂ O Range	0 to 10 MPa
Accuracy	± (4% of the full scale reading+8% of the actual reading)

O₂ Controls

Method	N ₂ O shut off with loss of O ₂ pressure
Supply failure alarm	≤ 220.6 kPa
O ₂ Flush	25 ~ 75 L/min

Auxiliary O₂ Flowmeter

Range	0 ~ 15 L/min
Indicator	Flow tube

Electronic Flow control system (Electronic Mixer)

Direct Flow Control Mode

O ₂ flow range	0 to 15 L/min
Air flow range	0 to 15 L/min
N ₂ O flow range	0 to 12 L/min
O ₂ flow accuracy	± 50 ml/min or ± 5% of setting value,

Balance gas (Air/N₂O) flow accuracy
 whichever is greater
 ± 50 ml/min or ±5% of setting value,
 whichever is greater

Total Flow Control Mode

Total flow range 0.2 to 18 L/min
 Total flow accuracy ± 100 ml/min or ± 5% of setting value,
 whichever is greater

O₂ concentration

Range 21% to 100% (The balance gas is Air) or 26%
 to 100% (The balance gas is N₂O)
 Accuracy ± 5% V/V for flows < 1 L/min or 5% setting
 for flows ≥ 1 L/min

Environmental Specifications

Operating

Temperature 10 ~ 40°C
 Relative humidity 15% ~ 95% (noncondensing)
 Barometric (Kpa) 70 ~ 106 kPa

Storage

Temperature -20 ~ 60°C for main unit,
 -20 ~ 50°C for O₂ sensor
 Relative humidity 10% ~ 95% (noncondensing)
 Barometric 50 ~ 106 kPa

Electromagnetic Compatibility

Immunity Complies with all requirements of IEC
 60601-1-2
 Emissions Complies with all requirements of IEC
 60601-1-2

Breathing System Specification

Breathing system volume (Pre-pak)

Automatic ventilation 2850 ml
 Manual ventilation 1800 ml

Breathing system volume (Non Pre-pak)

Automatic ventilation 2600 ml
 Manual ventilation 1800 ml

System Components

Carbon dioxide absorbent canister
 Absorbent capacity: 1500 mL
 Integrated expiratory limb water trap
 Capacity: 6 mL

Breathing Circuit Parameters

Compliance ≤4 mL/100Pa (bag mode)
 Automatically compensates for
 compression losses within the breathing
 circuit in mechanical mode
 Expiration resistance < 6.0 cm H₂O @60 L/min
 Inspiration resistance < 6.0 cm H₂O @60 L/min

System Pressure Gauge

Range -20 ~ 100 cmH₂O
 Accuracy ± (2% of the full scale reading + 4% of the

actual reading)

Ports and Connectors

Exhalation 22 mm OD / 15 mm ID conical
 Inhalation 22 mm OD /15 mm ID conical
 Manual bag port 22 mm OD /15 mm ID conical

Bag-to-Ventilator Switch

Type Bi-stable
 Control Switch between manual and mechanical
 ventilation

Integrated Adjustable Pressure Limiting (APL) Valve

Range SP, 5 ~ 75 cmH₂O
 Tactile knob indication at above 30 cmH₂O
 Accuracy ± 3 cmH₂O or ± 15% of the setting value,
 which is greater, but is not more than + 10
 cmH₂O

Anesthetic Gas Scavenging System (AGSS)

Size (H x W x D) 430 x 132 x 114 mm
 Type of disposal system
 Active: High-flow or Low-flow
 Passive
 Applicable standard ISO 80601-2-13
 Pump rate 75 ~ 105 L/min (High-flow)
 25 ~ 50 L/min (Low-flow)

Pressure relief device: Pressure compensation opening to the air
 State indication of the disposal system: The float falls below the "MIN"
 mark on the sight glass when the disposal system does not work or
 the pump rate is lower than 25 L/min (Low-flow) or 75 L/min
 (high-flow).

Connector of the disposal system: ISO 9170-2

Materials

All materials in contact with exhaled patient gases are autoclavable,
 except flow sensors (being not capable of being autoclaved), O₂
 sensor, and mechanical pressure gauge.
 All materials in contact with patient gas are latex free.

Suction Device

Venturi Suction Regulator

Gas source Air, from system gas source
 Minimum flow 20 L/min
 Maximum vacuum ≥72 kPa at supply gas pressure of 280 kPa;
 ≥73 kPa at supply gas pressure of 600 kPa

Continuous Suction Regulator

Supply Negative Pressure Suction
 Maximum vacuum 517.5 mmHg to 540 mmHg (69 kPa to 72
 kPa) with external vacuum applied of 540
 mmHg and 40 L/min free flow
 Maximum flow 39 L/min to 40 L/min with external vacuum
 applied of 540mmHg and 40 L/min free flow
 Minimum flow 20 L/min

Please contact your local Mindray sales representative for the most
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 P/N: ENG-WATO EX-65 Pro datasheet-210285X4P-20180122

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