Evone Control Unit

1. Touch screen
2. Area to place the Evone Cartridge
3. Release-button to release Evone Cartridge from control unit

Additional materials

1. Evone Cartridge – to be inserted into the control unit as depicted
2. Evone Airway Adapter
3. Humid-Vent Filter Pedi straight (HME Filter)
4. Evone Conventional Tube Adapter (CTA)
5. Conventional adult endotracheal tube (≥5 mm ID)

Assembly of the breathing circuit

Installation and set up
1. Switch on Evone and perform Startup checks successfully.

The settings have to be adjusted according to the following situations:

A. Start FCV® (patient was not on other mechanical ventilator)
   - EEP: min. 10 mbar, Peak 25 mbar (driving pressure 15 mbar), 
   - FiO₂ min. 80%, Flow start at 14 L/min.
B. Switch from VCV to FCV®: Use same PEEP value of VCV for FCV®, use Plateau pressure for Peak FCV® (not mean pressure!).
C. Switch from PCV to FCV®: use same P(EEP) and Peak pressures.

3. Check and if required adapt alarm limits.
   Note: Setting alarm limits towards extreme values may render the alarm system useless.

Start FCV® ventilation

A. In case patient is not yet mechanically ventilated:
   1. Induce anesthesia (TIVA).
   2. Intubate patient as usual with tube of choice (ID ≥ 5mm).
   3. Oxygenate patient as preferred to allow deepening of anesthesia.
   4. Connect tube to CTA of Evone when anesthesia is deepened.
   5. Recommended settings: FiO₂ min. 80%, Flow start at 14 L/min, 
      Peak 25 mbar, PEEP 10 mbar.

B. In case patient has been ventilated in VCV mode:
   1. Connect CTA to endotracheal tube.
   2. Recommended settings: FiO₂ min. 80%, Flow start at 14 L/min, 
      Peak as Pplat during VCV (not Pmean!), PEEP same as during VCV.

C. In case patient has been ventilated in PCV mode:
   1. Connect CTA to endotracheal tube.
   2. Recommended settings: FiO₂ min. 80%, Flow start at 14 L/min, 
      Peak and PEEP same as during PCV.

Adjust according to blood gas values.
A triangular pressure curve appears on the screen.

If needed adapt ventilation settings:
- FiO₂ as preferred
- EEP as preferred
- Peak to adjust Tidal Volume
- Inspiratory Flow to adjust Minute Volume.

Note: The achievable minute volume of Evone is limited to maximally 9 L/min.
Optional: Individual optimization of FCV® ventilation based on patient compliance

**Note:** These optimization steps have shown beneficial effects in individual patients and in a porcine study\(^1\),\(^2\), but have not yet been validated in randomized controlled trials.

1. **Find ‘Best PEEP’**
   - Increase both PEEP and Peak stepwise by 1-2 mbar; keeping driving pressure (Peak – PEEP) constant.
   - Monitor tidal volume (VT): Increased VT indicates increased respiratory system compliance (Crs) and improved ventilation.
   - Choose PEEP setting resulting in highest VT; for similar VT, choose lowest PEEP for circulatory reasons.

   **Note:** Do not change settings too rapidly. Adequate application of the following steps requires equilibration periods of at least 30-60 seconds.

2. **Find ‘Best driving pressure’**
   - Increase Peak pressure stepwise by 1-2 mbar.
   - Monitor VT:
     - Per mbar increase of driving pressure, VT is expected to increase with value of Crs.
     - If VT increases over-proportionally, Crs will increase -> improved ventilation;
     - If VT increases under-proportionally, Crs will decrease -> ventilation not further improved.
   - Choose Peak setting resulting in highest Crs.

   **Note:** This step might lead to the application of higher tidal volumes than generally advised by common guidelines.

3. **Find ‘Best flow’**
   - Adjust flow depending on measured etCO\(_2\).
   - To reduce etCO\(_2\): increase inspiratory flow
     - Results in higher frequency with same VT and higher minute volume.
   - To increase etCO\(_2\): decrease inspiratory flow
     - Results in lower frequency with same VT and lower minute volume.

**Sedation, relaxation, and weaning**

Because of the small lumen (high resistance) of the breathing circuit, coughing may result in tube dislocation.

**Note that spontaneous breathing is not possible when the CTA is connected to the conventional adult endotracheal tube.**

In case of light anesthesia (indicated by e.g. irregular pressure curves, increased/decreased compliance, coughing, BIS>60, TOF>90%):
- Disconnect CTA.
- Use alternative means of oxygenation if preferred.
- Deepen anesthesia.
- Reconnect CTA when anesthesia is deepened and continue FCV® ventilation.

For weaning the patient:
- Set FiO\(_2\) as preferred.
- Disconnect CTA from tube to allow waking up using preferred method of oxygenation.

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**References:**

2. Spraider P et al. *Improved ventilation and lung recruitment in flow-controlled ventilation (FCV) compared to pressure-controlled ventilation (PCV) – A prospective, randomized porcine study.* Abstract presented ESICM 2019 and AIC 2019

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