



# Flow-c Anesthesia System

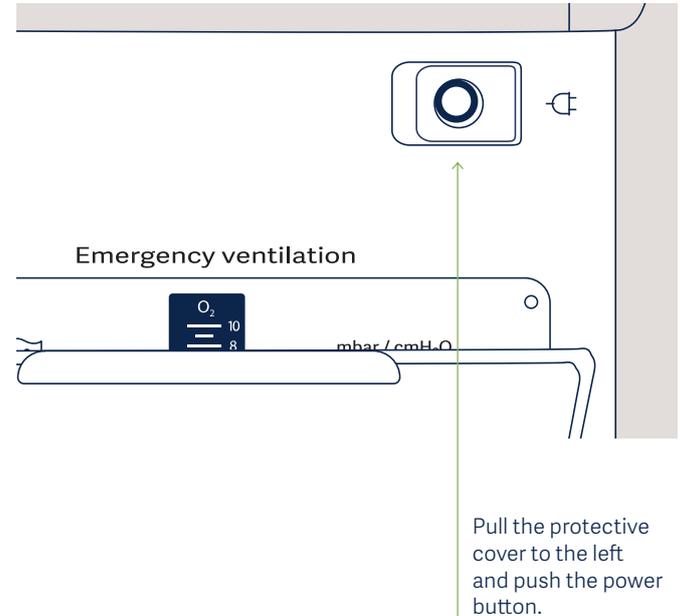
## Short guide

## Introduction

This Short guide may function as a complement to the User Manual. The User Manual shall still be referred to for full information of the Flow-c anesthesia system.

The Flow-c anesthesia system shall always be used in combination with vital signs monitoring and clinical evaluation of the patient status.

## Starting the system



## Starting a system checkout (SCO):



A prompt to start the System checkout procedure is automatically displayed at system startup:  
Press Start in the System checkout window to begin the procedure.  
Follow the on-screen instructions.

## Navigating the screen

There are several ways of navigating the screen and setting values, using the touch screen, or using the rotary knob.

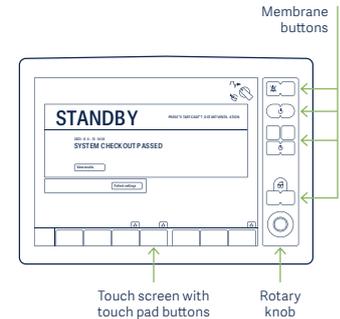
### Using the touch screen

- Press the required touch pad. The touch pad becomes active, which is indicated by a blue highlight.
- Turn the Rotary knob to the required value.
- Press the touch pad (or rotary knob) to confirm the setting.

### Using the rotary knob

- Turn the Rotary knob to move between the touch pads on the screen. The selected touch pad is indicated by a blue frame.
- On required touch pad, press the rotary knob to activate the touch pad. This will highlight the touch pad in blue.
- Turn the Rotary knob to the required value.
- Press the Rotary knob (or the touch pad) to confirm setting.

The screen

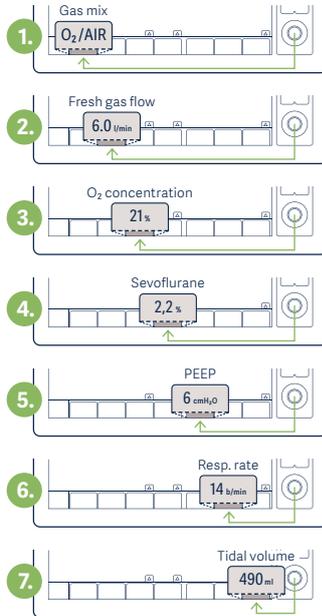


The rotary knob

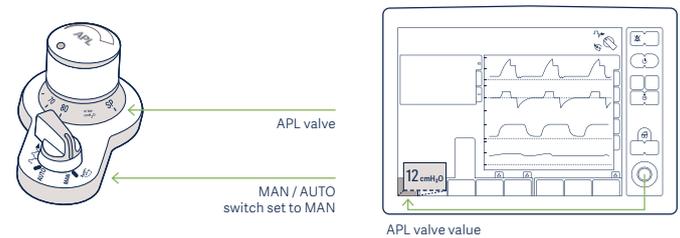


## Setting parameters

1. Selection of gas mixture
2. Adjusts the fresh gas flow (FGF)
3. Adjusts the FGF O<sub>2</sub> concentration
4. Setting anesthesia agent concentration
5. Adjusts PEEP
6. Adjusts the breathing frequency
7. Depending on the chosen mode of ventilation and configuration, this adjusts any of the following:
  - Tidal Volume
  - Minute Volume
  - PC above PEEP

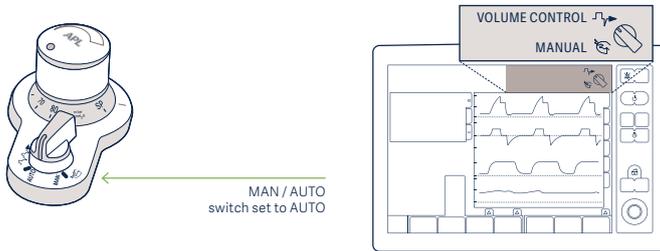


## Setting the APL valve



The APL value is an electronically controlled parameter, manually adjusted using the APL valve.

## MAN/AUTO ventilation switch

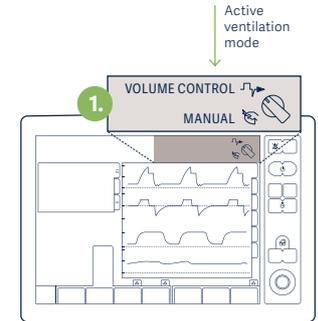


MAN / AUTO  
switch set to AUTO

Ventilation can be switched between automatic- and manual/ spontaneous ventilation using the MAN/AUTO switch.

## Selecting automatic ventilation mode

1. Press the ventilation mode text (Volume Control in the illustration) to produce the "Select automatic mode" window
2. Select the desired ventilation mode from the list of available (installed) ventilation modes.
3. Set the required ventilation parameters and press accept to activate the selected ventilation mode.



## Start case



Starts a new patient case and activates the preset gas and ventilation settings depending on the setting of the AUTO/MAN ventilation switch.

## End case



Provides various options for completing a patient case.

### **Go to Standby**

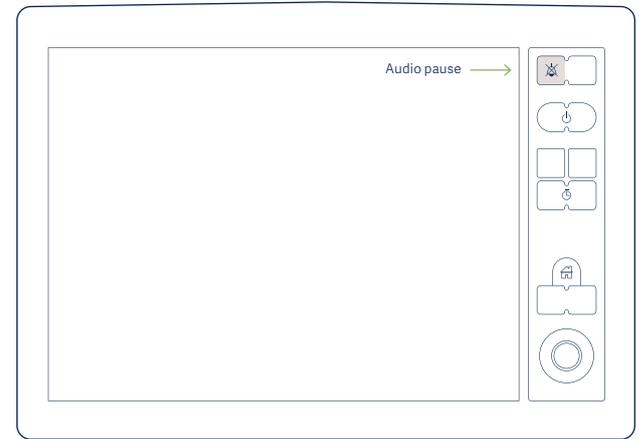
1. Retrive settings from startup configuration.
2. Keep current settings.
3. Save patient trends and clinical logs to USB memory.
4. Delete patient trends and clinical logs.

## Alarm profile



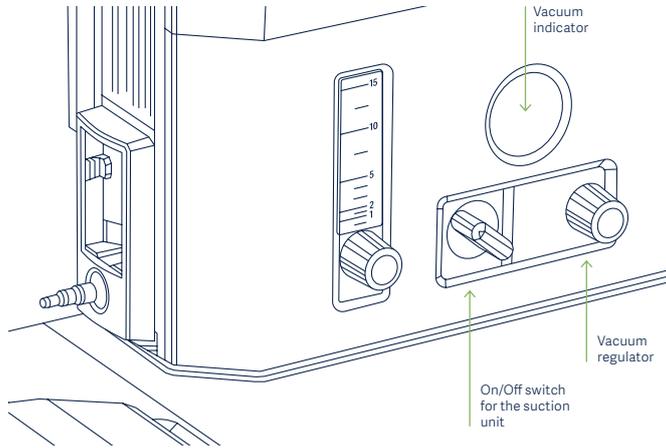
Shows all applicable alarms for the currently selected ventilation mode (MAN or AUTO) along with their set upper and lower limits.

## Audio pause



- Mutes active alarm sound signals for two minutes
- Pre-mutes alarms activated within a two minute period.
- Mutes some alarms until the alarm condition resolves. This action must be confirmed via a dialog window.

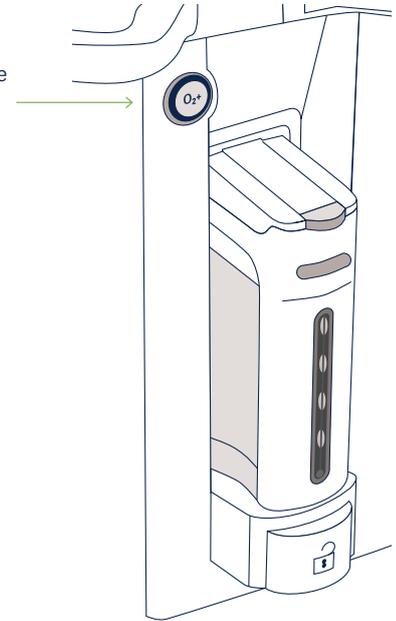
## Auxiliary O<sub>2</sub> and suction module



The suction pressure is regulated by means of the On/Off switch and the vacuum regulator. Turn the regulator counter-clockwise to increase the suction pressure. The vacuum indicator shows the current suction pressure.

## O<sub>2</sub> flush

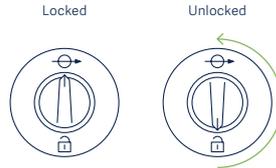
The O<sub>2</sub> flush is located above the vaporizer slots on the front of the system.



## Remove CO<sub>2</sub> absorber

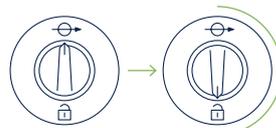
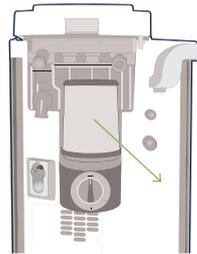
The CO<sub>2</sub> absorber switch can be in two separate positions:

1. Locked: In this position, the expired gas flows through the CO<sub>2</sub> absorber, i.e. normal position.
2. Unlocked: In this position, the absorber can be mounted or dismantled from the system.



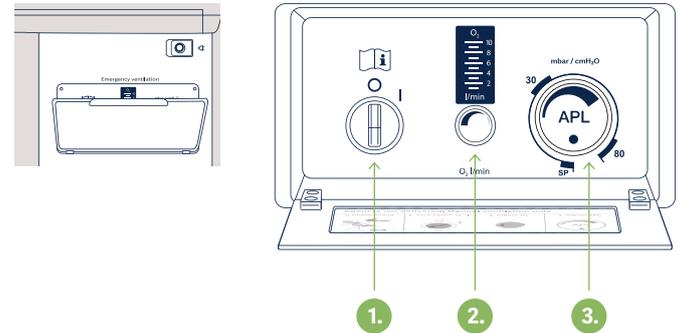
Turn counter clockwise to reconnect to the breathing system

Remove the absorber



Locked to unlocked

## Emergency ventilation



In case of a total power (mains power and battery) or other electronic failures, the built-in emergency ventilation system can be used.

Open the cover to access the emergency ventilation system and follow the step-by-step instructions pasted on the inside of the cover.

1. Activate the emergency ventilation by flipping the ON/OFF switch to "ON".
2. Adjust the O<sub>2</sub> flow to 10 l/min.
3. Adjust the pressure level with the mechanical APL valve.

### Note:

The machine cannot deliver anesthesia agent if emergency ventilation is used.

## O<sub>2</sub>Guard

### Safety functions to avoid potential hypoxia

To prevent the oxygen concentration in the breathing circuit from becoming too low and potentially causing hypoxia, the Flow-c system has two features: the O<sub>2</sub>Guard and the safety flush.

#### O<sub>2</sub>Guard

If the system detects an inspiratory oxygen concentration below a certain level (mostly 20,5% depending on the alarm settings) it will initiate several actions to mitigate the situation. The gas mix is set to Air/O<sub>2</sub> and the fresh gas flow and oxygen concentration are both adjusted. A dialog window about the alterations appears. The changes remain in effect until new settings are made. The trigger level is always lower than the relevant alarm, FiO<sub>2</sub>: Low, thus avoiding interference.

#### Safety flush

If the inspiratory oxygen concentration falls even lower, (mostly 17,5% depending on the alarm settings) possibly due to gas delivery malfunction, then the system performs a safety flush replacing the entire breathing circuit volume with gas containing a high oxygen concentration. In addition, the fresh gas flow and O<sub>2</sub> concentration are increased to predefined values. These actions are accompanied by a dialog window informing of the changes.

## MAC Brain

The MAC Brain value is an estimation of the development of the partial pressure of a volatile anesthetic agent in the brain. If two volatile agents (or one volatile agent and N<sub>2</sub>O) are detected by the gas analyzer, the integrated MAC value in the brain for both gases is presented. MAC Brain uses an age dependent patient model based on normal physiological data.

### Requirements

The MAC Brain value is available both in manual and controlled ventilation modes. To get a valid MAC Brain value displayed on the screen, there are some requirements that need to be fulfilled.

- MAC Brain value should be enabled in the Start-up configuration.
- The patients' age must be more than 1 year.
- The EtCO<sub>2</sub> must be more than 1.7% for more than three consecutive breaths. During the use of the Pause function or Inspiratory/Expiratory hold function, or a disconnection lasting less than 40 seconds, the MAC Brain value will be paused during that time.

### Incidences of invalid data

Why does the MAC Brain value become invalid? (Displayed as "\*\*\*")

- If the first three consecutive breaths measured by the system have a MAC value of more than 0.3 MAC<sub>age</sub>.
- If the patient's age is altered during a case and volatile agent is being delivered.
- If the EtCO<sub>2</sub> – FiCO<sub>2</sub> difference is less than 1.6%.
- If no breaths are detected for 60 sec.

If any of the four above mentioned incidences occurs, the system will consider the MAC Brain invalid for the time it would take for alveolar/brain equilibrium to occur, which is approximately 10 minutes for the anesthetic agents used by the system.

## AGC — general description

The AGC function (Automatic Gas Control) automatically adjusts the fresh gas flow and gas concentrations to reach target values set by the clinician for inspired  $O_2$  and end-tidal agent concentration.

AGC is thus defined by setting the Target  $FiO_2$  and Target EtAA. Unless manually altered, these are maintained during a patient case regardless of ventilation mode switches or changes in ventilation settings.

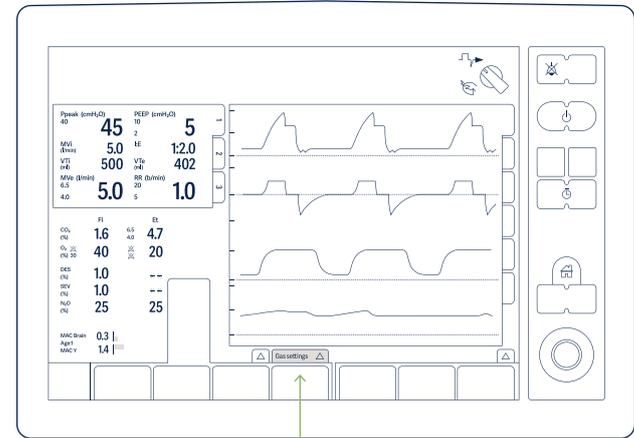
AGC is available in all controlled and supported ventilation modes.

### Prerequisites

Installed AGC cannot be activated if one of the following conditions apply:

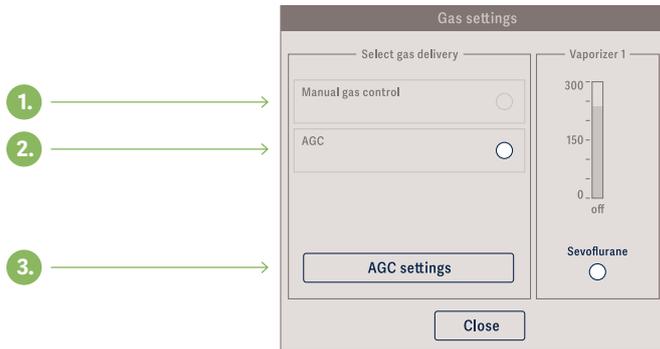
- The system hasn't passed a system checkout.
- More than 24 hours have passed since the last system checkout.
- The active vaporizer has been replaced with a new unchecked vaporizer.

## Starting AGC



Press "Gas settings" tab to access the gas settings and AGC menu.

## Gas settings menu



1. Manual gas control
2. AGC
3. AGC settings (or Manual gas control settings)
  - Select "AGC" and press "Accept" If desired, press "AGC settings" to access the AGC settings window.
  - Select AGC to activate AGC as fresh gas mode.
  - Select "AGC settings" to access the AGC parameters.

## AGC parameter menu



1. Target FiO<sub>2</sub>
  2. Target EtAA (in vol. percent)
  3. Speed
  4. Graphic repr. of the speed setting
  5. Estimated MACage for the set target EtAA and N<sub>2</sub>O conc.
  6. Min FGF: minimum fresh gas flow that AGC is allowed to deliver
  7. Max FiAA: maximum inspiratory agent concentration that AGC is allowed to deliver
  8. Gas mix
- Press "Accept" when satisfied with the AGC settings.

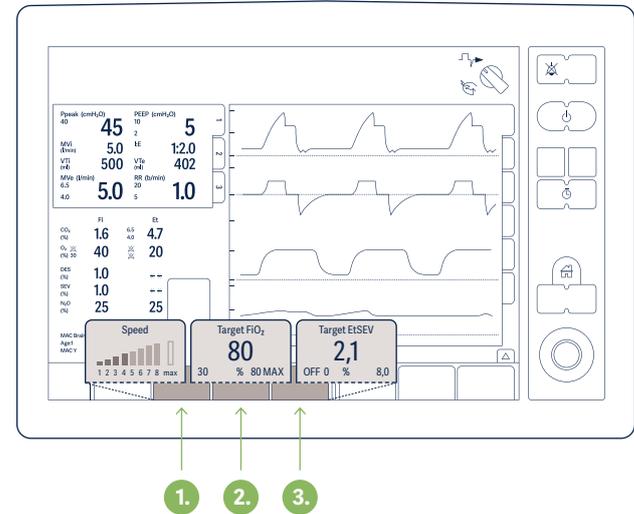
## AGC user interface

When AGC is activated, sections of the control panel user interface change in appearance and functionality:

- Direct access settings
- Waveform area
- Gas measurement area

Active (or preset) AGC is indicated in the ventilation mode area.

## AGC direct access settings

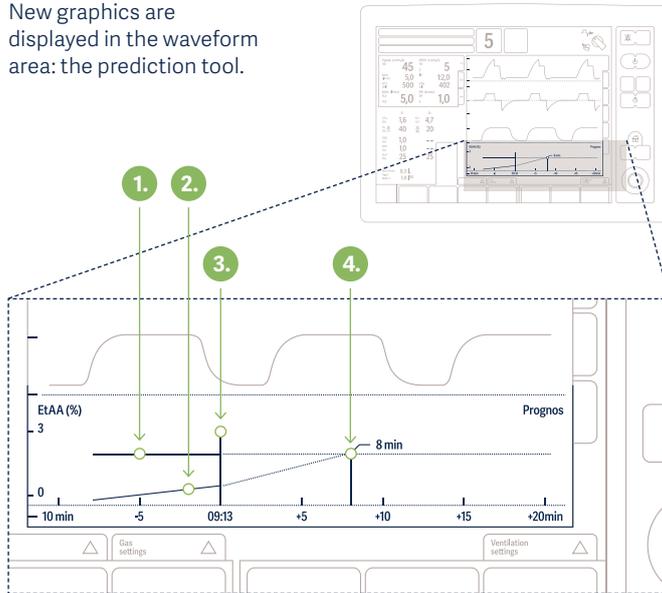


Three direct access parameters are replaced as follows:

1. "Fresh gas flow" is replaced with "Speed"
2. "O<sub>2</sub> conc." is replaced with "Target FiO<sub>2</sub>"
3. "Agent" is replaced with "Target EtAA"

## Waveform area

New graphics are displayed in the waveform area: the prediction tool.

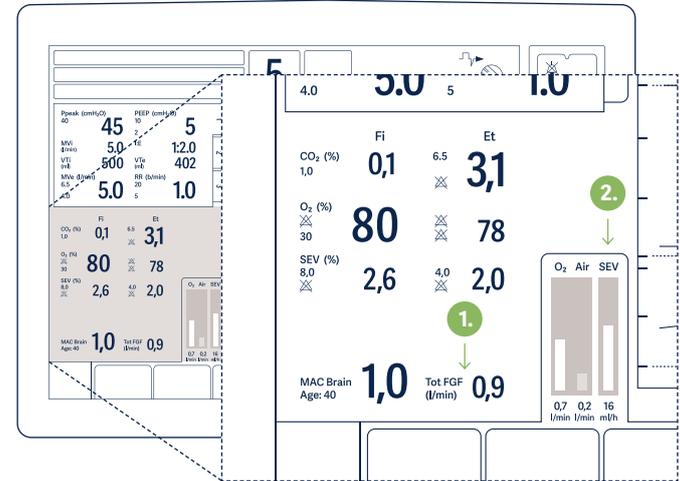


1. Set target EtAA concentration
2. Measured EtAA concentration
3. Current time
4. Predicted EtAA concentration

Current time is indicated with a vertical white line. The set EtAA concentration is shown as a dotted gray line.

The predicted time (in minutes) until the end tidal agent concentration reaches the set EtAA is shown at the intersection of the two lines.

## Gas measurement area

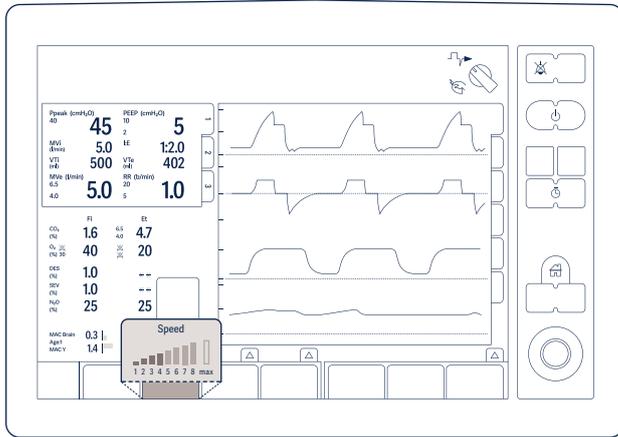


Two additional measurements are displayed:

1. Total fresh gas flow, "Tot FGF", in l/min
2. Current anesthetic agent delivery (ml/h)

Anesthetic agent delivery is graphically represented above its numerical value.

## AGC direct access settings



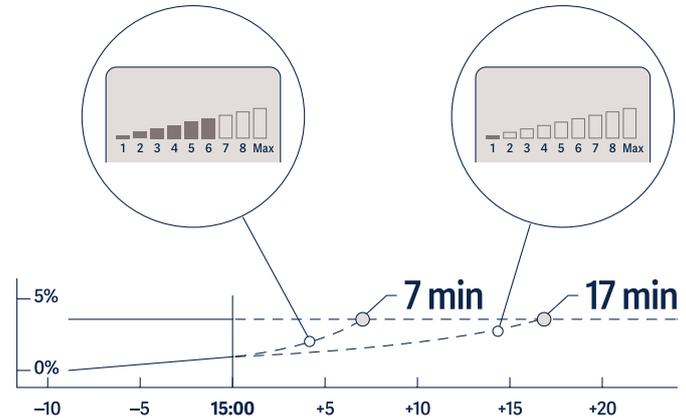
By adjusting the “Speed” parameter, the time from current “EtAA” to “Target EtAA”, can be controlled. This is true for increases and decreases in the set target end-tidal agent concentration.

Possible settings include speed level (slow) to 8 (fast), and “MAX”.

With “MAX” speed in effect, the system fresh gas flow is increased to its highest allowable value, eventually matching the inspiratory minute volume. This results in a non-rebreathing system, and lasts until the “MAX” setting is changed.

Using “MAX” speed during emergence eliminates rebreathing and maximizes the speed of wake up.

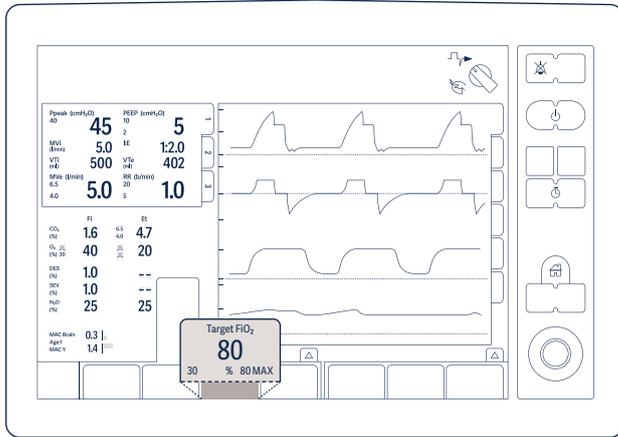
## Adjusting speed



Press the speed touch pad and use the rotary knob to change the current speed setting. Increases or decreases are displayed in the prediction tool. Press the touch pad or rotary knob again to confirm the new setting.

At any chosen speed setting, the predicted time to reach target end-tidal agent concentration is displayed in the prediction tool.

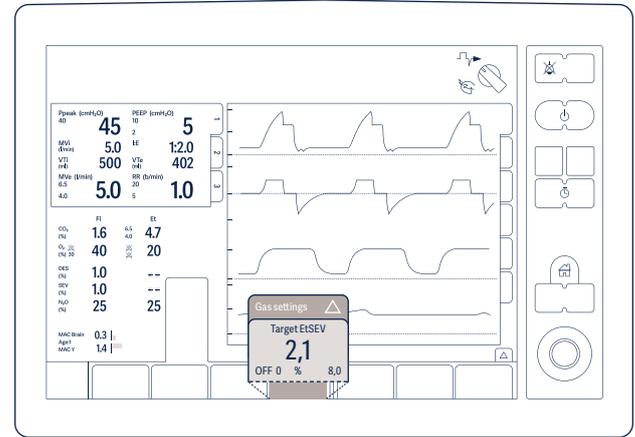
## Target FiO<sub>2</sub>



Sets the target inspiratory oxygen concentration. Setting range is between 30% to 80%, and "MAX". Default value is 40%.

The speed to reach target FiO<sub>2</sub> is automatically controlled and unaffected by the "Speed" parameter.

## Target EtAA



Sets the target end-tidal anesthetic agent concentration. Possible parameter settings include "OFF", "0%", and the range from 0.3% to X%. "X" is the equivalent concentration to 2.0 MAC<sub>age</sub> for the anesthetic agent currently in use.

## Additional settings

To access the additional AGC settings, press the “Gas settings” tab located above the direct access settings. Select “AGC” and press “Additional settings” in the gas settings window.

### Min FGF

Sets the lowest allowable fresh gas flow when the system operates under AGC.

### Max FiAA

Sets the limit for maximum inhaled agent concentration, FiAA.

### Gas mix

Select between O<sub>2</sub>/Air or O<sub>2</sub>/N<sub>2</sub>O.

## During AGC ventilation

### Changing anesthetic agent

When a new vaporizer containing another agent type is selected, the EtAA level for the new agent is automatically suggested to maintain the MAC<sub>age</sub> determined by the previous EtAA level setting.

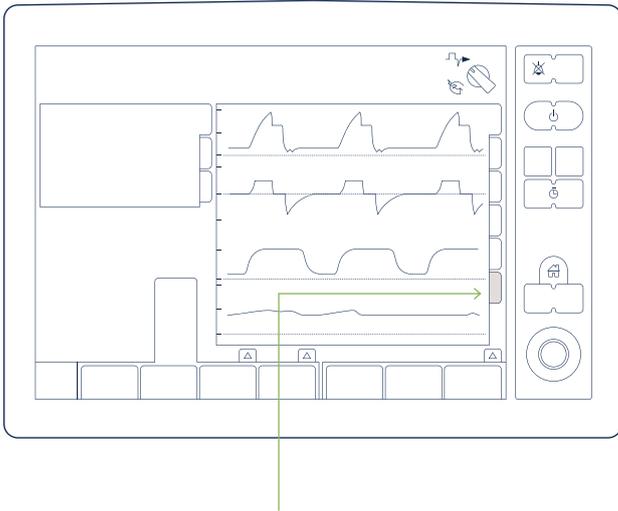
### Emergence

Anesthetic agent can be washed out by either one of two methods:

1. Target EtAA to “0”  
The “speed” function can be used to control the time until the patient is clear of agent.
2. Target EtAA to “OFF”  
Agent concentration in the patient decreases passively as a function of flow through the lungs, i.e. coasting.

## Recruitment Maneuvers

The Recruitment Maneuvers option provides an automatic stepwise recruitment maneuver as well as a breath-by-breath presentation of relevant breathing parameters in order to facilitate lung recruitment maneuvers. If the option is installed, an extra tab, Recruitment, appears at the bottom of the screen's tab area.



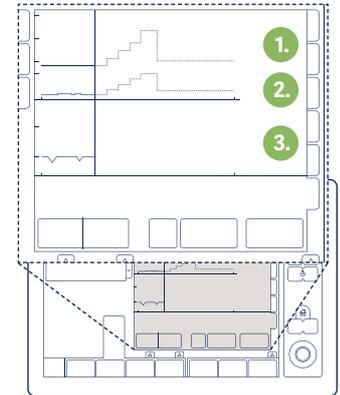
Press the Recruitment tab to open the automatic recruitment (Auto RM) function. The automatic recruitment (Auto RM) function is only available in Pressure Control mode.

The measured parameters monitored on a breath-by-breath basis are:

1. End inspiratory pressure, EIP
2. Positive end expiratory pressure, PEEP
3. Dynamic compliance, Cdyn

The following information is also displayed:

- The maximum EIP and PEEP values applied during the Auto RM and the settings used after the Auto RM are displayed on the relevant curve.
- The time taken by the recruitment maneuver is displayed just below the PEEP curve.



Press RM settings to access the Auto RM settings window, which visualizes the entire planned recruitment, shows how long it will take and allows the recruitment settings to be adjusted.

If settings are adjusted, they must be accepted before starting the recruitment maneuver.

Press Start RM to begin the automatic recruitment when satisfied that the settings are adequate.

Once started, an automatic recruitment can be stopped by pressing Stop RM.

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