Titration protocol reference guide
# Titration protocol reference guide

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**IMPORTANT:** The suggested guidelines are intended to serve only as a reference. They should be used only in conjunction with the instructions and/or protocol(s) set forth by the physician and institution in which the assist device is being used. The guidelines are not intended to supersede established medical protocols.

These protocols are recommended for adult patients only.
General Titration Protocol Goals

The goals should be individualized to meet the needs of each patient.

1. Keep the airway open (airway management)
2. Stabilize breathing patterns by monitoring the patient’s response to therapy
3. Adjust user set parameters as needed for optimal therapy efficacy and adherence
4. Ensure proper mask fit to enhance comfort and acceptance and to minimize leaks
5. Have patient lie down and breathe on the designated therapy device at the basic settings described with each protocol
6. Recheck mask fit, assure patient comfort and acceptance
7. Adjust flex features to patient comfort
CPAP
Suggested titration protocol for CPAP

- Set CPAP at 4 cm H₂O
- Set C-Flex or C-Flex+ to patient comfort

**Observe for Obstructive Events**

- If ≥ 2 obstructive apneas, or
- If ≥ 3 hypopneas, or
- If ≥ 5 RERAs, or
- If ≥ 3 min of loud, definite snoring

**Optimal Pressure Reached**

- Increase CPAP by 1 cm H₂O
- Wait 5 minutes
- Repeat as needed

**YES**

- If the patient cannot tolerate pressure increase, or the pressure threshold of 15 cm H₂O is reached, switch patient to BiPAP S protocol

**NO**

- Establish initial settings as indicated or as ordered by physician
- Initial CPAP settings may be adjusted to patient condition or severity
- C-Flex or C-Flex+ may be adjusted to patient comfort
- If central apneas are observed consider decreasing pressure for 20 minutes; if still present consider switching to BiPAP autoSV Advanced protocol

Note:

- Establish initial settings as indicated or as ordered by physician
- Initial CPAP settings may be adjusted to patient condition or severity
- C-Flex or C-Flex+ may be adjusted to patient comfort
- If central apneas are observed consider decreasing pressure for 20 minutes; if still present consider switching to BiPAP autoSV Advanced protocol

Obstructive Event:
- ≥ 2 obstructive apneas, or
- ≥ 3 hypopneas, or
- ≥ 5 RERAs, or
- ≥ 3 min of loud, definite snoring

auto CPAP
**Suggested titration protocol for Auto CPAP**

**Patient on CPAP changed to Auto CPAP**

- **CPAP at ≤ 10 cm H₂O**
  - Set AutoMin at 4 cm H₂O or patient comfort
  - Set AutoMax to 20 cm H₂O
  - Set A-Flex to patient comfort

- **CPAP at > 10 cm H₂O**
  - Set AutoMin at 6 to 8 cm H₂O or patient comfort
  - Set AutoMax to 20 cm H₂O
  - Set A-Flex to patient comfort

**Note:**
- Establish initial settings as indicated or as ordered by physician
- Initial Auto CPAP settings may be adjusted to patient condition or severity
- A-Flex may be adjusted to patient comfort
- If central apneas are observed consider switching to BiPAP autoSV Advanced Protocol

*If multiple obstructive events are observed at the beginning of the study use a higher AutoMin*
Suggested titration protocol for BiPAP S

**Changing from CPAP therapy to BiPAP S**

**NO**
- Set IPAP at 8 cm H\(_2\)O
- Set EPAP at 4 cm H\(_2\)O
- Set Bi-Flex to patient comfort

**YES**
- Set IPAP at CPAP level
- Set EPAP at 4 cm H\(_2\)O below the IPAP level
- Set Bi-Flex to patient comfort

**Observe for Events**

**Obstructive Apneas**
- Increase EPAP by 1 cm H\(_2\)O
- Maintain IPAP and EPAP differential
- Wait 5 minutes

**Other Events**
- Increase IPAP by 1 cm H\(_2\)O
- Wait 5 minutes

**Optimal Pressure Reached**

**Note:**
- Establish initial settings as indicated or as ordered by physician
- Initial BiPAP S settings may be adjusted to patient condition or severity
- Bi-Flex may be adjusted to patient comfort
- If central apneas are observed consider decreasing pressure for 20 minutes; if still present consider switching to BiPAP autoSV Advanced protocol

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*aObstructive Event:
≥ 2 obstructive apneas,*

**Other:
≥ 3 hypopneas, or
≥ 5 RERAs, or
≥ 3 min of loud, definite snoring*"
BiPAP Auto

OSA

CPAP
Auto CPAP
BiPAP Auto
BiPAP S

Restrictive disorders
(e.g., kyphosis or fibrosis)

Neuromuscular disorders and SDB

COPD

Obesity hypoventilation

BiPAP ASV Advanced
Opioid-induced sleep apnea

BiPAP AVAPS
BiPAP S/T

BiPAP ASV Advanced
Cheyne-Stokes respiration

BiPAP AVAPS
BiPAP S/T

Obesity hypoventilation

BiPAP ASV Advanced
Complex sleep apnea

BiPAP ASV Advanced

Cheyne-Stokes respiration

BiPAP AVAPS
BiPAP S/T

Obesity hypoventilation

BiPAP ASV Advanced
Complex sleep apnea

BiPAP ASV Advanced

Cheyne-Stokes respiration
Suggested titration protocol for BiPAP Auto

**Patient on CPAP changed to BiPAP Auto**

- **CPAP at ≤ 10 cm H₂O**
  - Set MinEPAP at 4 cm H₂O
  - Set PSmin at 4 cm H₂O or patient comfort
  - Set MaxIPAP to 25 cm H₂O
  - Set PSm to 8 cm H₂O
  - Set Bi-Flex to patient comfort

- **CPAP at > 10 cm H₂O**
  - Set MinEPAP at 6 to 8 cm H₂O
  - Set PSmin at 4 cm H₂O or patient comfort
  - Set MaxIPAP to 25 cm H₂O
  - Set PSm to 8 cm H₂O
  - Set Bi-Flex to patient comfort

**Note:**
- Establish initial settings as indicated or as ordered by physician
- Initial BiPAP Auto settings may be adjusted to patient condition or severity
- Bi-Flex may be adjusted to patient comfort
- If central apneas are observed consider switching to BiPAP autoSV Advanced protocol

*If multiple obstructive events are observed at the beginning of the study use a higher MinEPAP*
BiPAP autoSV Advanced
Suggested titration protocol for BiPAP autoSV Advanced

Patient on CPAP changed to BiPAP autoSV Advanced

- **CPAP at ≤ 10 cm H₂O**
  - Set EPAPmin at 4 cm H₂O or patient comfort
  - Set EPAPmax 20 cm H₂O
  - PSmin at 0 cm H₂O or at patient comfort
  - Set PSmax to 20 cm H₂O
  - Set Max pressure to 25 cm H₂O
  - Rate to Auto
  - Set Bi-Flex to patient comfort

- **CPAP at > 10 cm H₂O**
  - Set EPAPmin at 6 to 8 cm H₂O or patient comfort
  - Set EPAPmax at highest level attainable, PSmin at 0 cm H₂O or at patient comfort
  - Set PSmax at highest level attainable
  - Set Max pressure to 25 cm H₂O
  - Rate to Auto
  - Set Bi-Flex to patient comfort

Note:
- Establish initial settings as indicated or as ordered by physician
- Initial BiPAP autoSV Advanced settings may be adjusted to patient condition or severity
- Bi-Flex may be adjusted to patient comfort
- If numerous hypopneas are noted, maintain PS > 4 cm H₂O

*If multiple obstructive events are observed at the beginning of the study use a higher EPAPmin*
BiPAP S/T

- **OSA**
  - CPAP
  - Auto CPAP
  - BiPAP Auto
  - BiPAP S

- **Obesity hypoventilation**
  - BiPAP AVAPS
  - BiPAP S/T

- **Restrictive disorders (e.g., kyphosis or fibrosis)**
  - BiPAP AVAPS
  - BiPAP S/T

- **Neuromuscular disorders and SDB**
  - BiPAP AVAPS
  - BiPAP S/T

- **COPD**
  - BiPAP AVAPS
  - BiPAP S/T

- **Obesity hypoventilation**
  - BiPAP ASV
    - Advanced
    - Complex sleep apnea

- **Opioid-induced sleep apnea**
  - BiPAP ASV
    - Advanced

- **Cheyne-Stokes respiration**
  - BiPAP ASV
    - Advanced
Suggested titration protocol for BiPAP S/T

- Set IPAP at 8 cm H₂O
- Set EPAP at 4 cm H₂O
- Set Rate at 8-10 BPM or 2 BPM below the patient's spontaneous rate
- Set I-Time at 1.5 seconds or patient comfort
- Set Rise time at 2 or 3 patient comfort

Observe for Events*

NO

Obstructive Apneas*
- Increase EPAP by 1 cm H₂O
- Maintain IPAP and EPAP differential
- Wait 5 minutes

Other Events**
- Increase IPAP by 1 cm H₂O
- Wait 5 minutes

Optimal Pressure Reached

Note:
- Establish initial settings as indicated or as ordered by physician
- Initial BiPAP S/T settings may be adjusted to patient condition or severity
- I-Time may be adjusted to patient comfort
- Consider supplemental O₂ if SpO₂ <88% or <90% at optimal PS and RR for 5 min

*Obstructive Event:
≥ 2 obstructive apneas,
**Other
≥ 3 hypopneas, or
≥ 5 RERAs, or
≥ 3 min of loud, definite snoring
***Respiratory Event:
Appearance of or worsening of hypoventilation during sleep

BiPAP AVAPS

- Restrictive disorders (e.g., kyphosis or fibrosis)
- Obesity hypoventilation
- CPAP
  - Auto CPAP
  - BiPAP Auto
  - BiPAP S
- COPD
- BiPAP ASV
  - Advanced
- Opioid-induced sleep apnea
- BiPAP AVAPS
  - BiPAP S/T
- Neuromuscular disorders and SDB
- OSA
- BiPAP ASV
  - Advanced
- Complex sleep apnea
- BiPAP AVAPS
  - BiPAP S/T
- Obesity

BiPAP AVAPS
Suggested titration protocol for BiPAP AVAPS

Set Tidal Volume target*
Set IPAP min at 8 cm H₂O
Set IPAP max at 25 cm H₂O
Set EPAP at 4 cm H₂O
Set Rate at 8-10 BPM or 2 BPM below the patient’s spontaneous rate
Set I-Time at 1.5 seconds or patient comfort
Set Rise time at 2 or 3 or patient comfort

Observe for Events

YES

Obstructive Events**
  • Increase EPAP by 1 cm H₂O

Respiratory Events***
  • Inadequate Tidal Volume –
    Increase the Tidal Volume target
  • Inadequate Respiratory Rate
    – Increase RR by 2 BPM
  • Inadequate Oxygenation –
    Increase EPAP
  • Wait 5 minutes

NO

Optimal Pressure Reached

*3 ways to choose a starting tidal volume with AVAPS:
1. MD suggestion
2. Patient comfort
3. Ideal body weight: 8 ml/kg*

*AVAPS suggested tidal volume settings based on height and ideal weight.

<table>
<thead>
<tr>
<th>height</th>
<th>59&quot;</th>
<th>61&quot;</th>
<th>63&quot;</th>
<th>65&quot;</th>
<th>67&quot;</th>
<th>69&quot;</th>
<th>71&quot;</th>
<th>73&quot;</th>
<th>75&quot;</th>
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<tr>
<td>ideal weight</td>
<td>52.0 kg</td>
<td>55.5 kg</td>
<td>59.0 kg</td>
<td>62.5 kg</td>
<td>66.5 kg</td>
<td>70.5 kg</td>
<td>74.5 kg</td>
<td>78.5 kg</td>
<td>83.0 kg</td>
</tr>
<tr>
<td>8 ml/kg V̇</td>
<td>420 ml</td>
<td>440 ml</td>
<td>470 ml</td>
<td>500 ml</td>
<td>530 ml</td>
<td>560 ml</td>
<td>600 ml</td>
<td>630 ml</td>
<td>660 ml</td>
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Note:
- Establish initial settings as indicated or as ordered by physician
- Initial BiPAP AVAPS settings may be adjusted to patient condition or severity
- I-Time may be adjusted to patient comfort
- Consider supplemental O₂ if SpO₂ <88% or <90% at optimal PS and RR for 5 min.

**Obstructive Event:
> 2 obstructive apneas,
> 3 hypopneas, or
> 5 RERAs, or
> 3 min of loud, definite snoring

***Respiratory Event:
Appearance or worsening of hypoventilation during sleep
Sample prescriptions

**System One CPAP**

- _____ cm H₂O with Encore Anywhere/SleepMapper
- □ Heated Humidifier □ Heated Tube
- DISPENSE AS WRITTEN/DO NOT SUBSTITUTE

**System One CPAP**

**REMstar Auto**

- C-Flex C-Flex+ A-Flex: 1 2 3
- Auto Pressure: Min: _____ cm H₂O Max: _____ cm H₂O
- □ Encore Anywhere/SleepMapper
- □ Heated Humidifier □ Heated Tube
- DISPENSE AS WRITTEN/DO NOT SUBSTITUTE

**System One CPAP**

- _____ cm H₂O with Flex
- □ EncoreAnywhere/SleepMapper
- □ Heated Humidifier □ Heated Tube
- Convert to System One BiPAP Auto after 60 days if non-compliant
- DISPENSE AS WRITTEN/DO NOT SUBSTITUTE

**BiPAP Auto SV Advanced**

- EPAPmin: _____ cm H₂O (4 cm – 25 cm)
- EPAPmax: _____ cm H₂O (4 cm – 25 cm)
- PSmax: _____ cm H₂O (0 cm – 21 cm)
- PSmin: _____ cm H₂O (0 cm – 21 cm)
- Max Pressure: _____ cm H₂O (25 cm)
- Rate: _____ BPM (auto, 4 -30, off)
- Bi-flex setting: _____ (1,2,3)
- □ Encore Anywhere/SleepMapper
- □ Heated Humidifier □ Heated Tube
- DISPENSE AS WRITTEN/DO NOT SUBSTITUTE

**BiPAP S/T AVAPS**

- EPAP: _____ cm H₂O (4 cm – 25 cm)
- IPAP max: _____ cm H₂O
- IPAP min: _____ cm H₂O
- Max Pressure: _____ cm H₂O (30 cm)
- Rate: _____ BPM (4 -30)
- Tidal Volume _____ ml (200-1500 ml)
- □ Heated Humidifier □ Heated Tube
- DISPENSE AS WRITTEN/DO NOT SUBSTITUTE

**System One**

**REMstar Pro / REMstar Auto**

- C-Flex C-Flex+ A-Flex: 1 2 3
- CPAP Check Pressure: _____ cm H₂O (±3 cm)
- Auto Pressure: Min: _____ cm H₂O Max: _____ cm H₂O
- Auto Trial Duration _____ days then 90% pressure (±3 cm)
- □ Encore Anywhere/SleepMapper
- □ Heated Humidifier □ Heated Tube
- DISPENSE AS WRITTEN/DO NOT SUBSTITUTE