

Irish Paediatric Acute Transport Service

Clinical Guideline

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Related Documents:	
<p>The Irish Paediatric Acute Transport Service (IPATS) has produced this clinical guideline. It has been designed for nurses, doctors and ambulance staff to refer to in the emergency care of critically ill children.</p> <p>This guideline represents the views of IPATS and was produced after careful consideration of available evidence in conjunction with clinical expertise and experience. The guidance does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient.</p>	

- The LTV 1000/1200 is a lightweight ventilator capable of pressure and volume controlled ventilator of children & adults
- Minimum weight 5Kg and minimum tidal volume is 50ml. Not recommended for *lung protective ventilation* in infants < 7Kg

“Knobology”

There are 3 types of controls on this ventilator

1. Variable controls

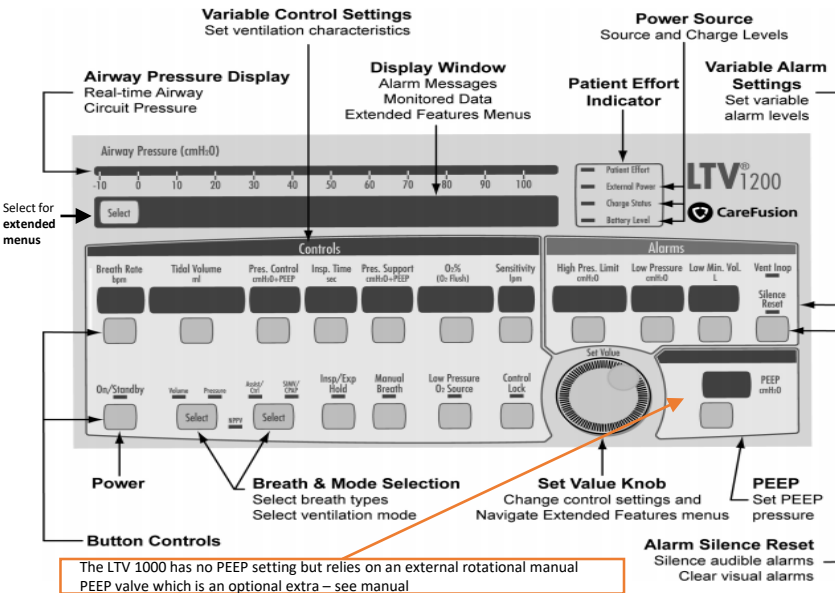
Controls & alarms with front panel displays. Select a control by pressing the associated button & change value by rotating the set value knob. Deselect the control by waiting 5sec/pushing the selected button again to confirm setting/selecting another control or locking the machine.

2. Buttons

These either turn a feature on/off, toggle between two features ie Vol/Pressure control or perform a function ie manual breath. For ventilator mode buttons – a confirmatory second push is required to start new mode

3. Set Value Knob

Used to dial in a desired value & navigate extended menus



Alarms & Monitoring

- Flashing Controls** – Variable controls and alarms will be displayed as solid or flashing lights. A flashing controls means one of the following:
 - If you are changing a control setting and it flashes – you have reached the limit value for the control
 - If an alarm display flashes- an alarm is occurring – push silence/reset for 60min silence, twice to cancel alarm. Can also push button to pre-emptively silence alarms if required. Visual alarm will still be active during this 60sec
 - If the control lock flashes when you try to change a setting it means the screen is locked – press the lock button to unlock
- Dashes** – If a control display is set to “- -” it indicates that control is turned off or is not available in the current mode
- Using the ‘select button’** –
 - **To interrogate display window** - The display window will scroll through monitored data but can be stopped and manually reviewed by pushing the ‘select’ button. Pushing it once will stop the display on the current data. Each time it is then pushed once the next data item will appear. To resume scanning mode push the button twice.
 - **To enter extended menus** – Push and hold select for 3 seconds. First menu item is ‘Alarm op’. To view the next item use the set value knob to move back and forwards. To select a menu item press the select button. To exit a menu turn the value knob until the EXIT option is displayed and push the select button to exit.

Recommended Modes of paediatric ventilation with the LTV1200/1000

- We recommend using either Pressure or Volume in Assist mode. This mode is activated by activating the trigger sensitivity button and giving it a number between 1-9 (lower number = inc sensitivity). If the sensitivity reads “- -” the ventilator is in Control Mode and any spontaneous breaths will not be supported.
- Ensure if Volume mode is selected that a suitable high pressure limit is set and if Pressure mode is selected, that the Tidal Volumes achieved are closely followed in the display window.

Setting the Ventilator – Pressure or Volume A/C

- Turn ventilator on - ventilator will complete self test
- Push mode select button twice to toggle between Volume & Pressure modes. Do the same for the Assist/SIMV button and choose assist/control. Note you **MUST** select a sensitivity level to turn on the assist mode.
- Choose required Breath Rate, Pressure Control (above PEEP) or Tidal Volume (depending on mode desired) and i Time – note I:E ratio is a product of Ti & RR and is displayed in display window when ventilation starts – we recommend a 1:2 ratio for most children
- Set the desired FiO₂ %
- Set sensitivity between 1-9
- Set High & Low Pressure alarms and the PEEP (if using LTV 1000 with external PEEP Valve, set display window to display PEEP and rotate valve to adjust PEEP to desired setting). PEEP will be added to the pressure control chosen (i.e PEEP 5cmH₂O + PC of 20 = PIP of 25) Ensure Max pressure limits are set above this value to ensure delivery of desired pressures.

Common indications for intubation in the acute setting

It is often prudent to pre-emptively intubate a deteriorating child in advance of collapse – contact the PICU referral line for advice – 1800 222378

- **Airway protection/patency**
- **Respiratory Failure** – Progressive hypoxaemia/hypercarbia or respiratory muscle failure
- **Cardiovascular Support** - congenital heart disease/myocarditis (*discuss with PICU prior to intubation – can be ++Risk*) or impending cardiovascular collapse i.e. Severe Sepsis
- **Neuroprotection** – to facilitate scanning/optimize pCO₂ and reduce cerebral metabolic O₂ demands
- **Facilitate a procedure** i.e. Central Venous Access / Chest drain insertion

Pre-Intubation Considerations

1. **Location** – Aim to move child as little as possible as this can cause significant delays - bring equipment/staff to the child where possible i.e. Resus/HDU bay
2. **Equipment Selection** – Use intubation/airway guide @ <http://www.nasccrs.ie/IPATS/Guidelines/Respiratory/Intubation-and-Airway-guide-1-.pdf> as an aide memoire if required
3. **Induction agents** – Ketamine 2mg/kg + Rocuronium 1mg/kg IV is a cardio-stable and reliable induction combination for most children. For older haemodynamically stable children, propofol + muscle relaxation is generally well tolerated. Atropine can be a useful adjunct in the ill neonate at risk of vagal stimulation and bradycardia.
4. **Pre intubation checklist / team huddle** – We recommend printing & using the 'pre intubation checklist' to ensure all monitoring/ equipment and team dynamics have been discussed prior to intubation.
<http://www.nasccrs.ie/IPATS/Guidelines/Respiratory/intube.pdf>

Post Intubation Checklist

ETT Confirmation: Auscultation + ETCO₂ waveform Capnography + **CXR** (**Chest X Ray is mandatory before transfer**). **Naso/Oro gastric tube placement is required in all ventilated children – on free drainage for transfer**

Ongoing sedation: Young/unstable children – Morphine 20mcg/kg/hr (10-40mcg/kg/hr) + Midazolam 2mcg/kg/min (1-5mcg/kg/min). Older stable children can be sedated with Propofol infusion. We recommend intermittent muscle relaxation in all ventilated patients for transfer. Urinary catheterisation of all paralysed patients is recommended.

Blood Gas: Any blood source (cap/ven/art) is acceptable in paediatrics. Perform **at least one gas** on transport ventilator prior to departure - ideally after approx. 10min of stable ventilator settings. Correlate with ETCO₂ for ambulance journey.

Suggested Starting Ventilator Settings

Patient	Peak Pressures <small>Start at lowest pressure to achieve chest rise</small>	Tidal Vol	PEEP	Rate	I Time	I:E ratio	Target Sats
Infant	15-25	5-7ml/kg/min is a safe tidal volume target for most infants and children. Peak pressures should be weaned to target this volume to limit barotrauma whenever possible	5	35	0.5	1:2	>94%
Young child	15-30		5	25-30	0.7	1:2	>94%
Adolescent			5	15-20	1	1:2	>94%
+Asthma			To move chest	0-5	12-20	1	1:2-1:4
+ARDS	To move chest		5-15	15-20	1	1:1.5 -1:2	>88%

Troubleshooting Ventilation

- D**isplaced ETT Ensure ETCO₂ reading, auscultate chest, check ETT depth at lips
- O**bstructed ETT Suction ETT with largest possible catheter, **saline lavage can be very helpful** (1ml/kg up to 10ml per lavage)
- P**neumothorax Check trachea is midline/look + auscultate, CXR if unsure / trans illuminate if neonate
- E**quipment Check ventilator settings and circuit. Higher pressure may be required to ventilate children on T/port vents
- S**tomach Ensure NG/OG is open and aspirate to ensure diaphragm splinting is not occurring

Deadspace – This can be difficult to manage in small infants on transport ventilators. If PcO₂ is difficult to clear - ensure rate is optimised & breath stacking is not occurring; consider cutting ETT (leave 4cm); Ensure appropriate sized circuit is in use. Contact PICU 180022237 for further advice if these measures are ineffective. **Do NOT remove the HME filter or ETCO₂**