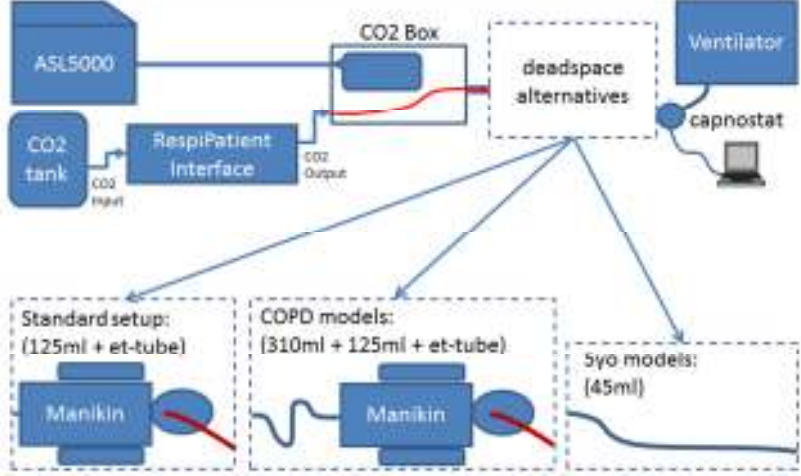

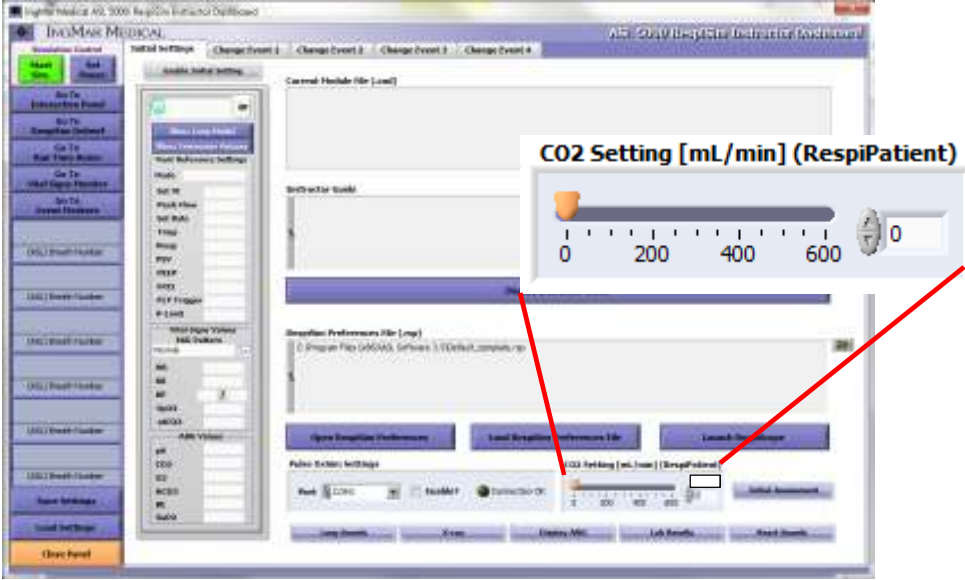
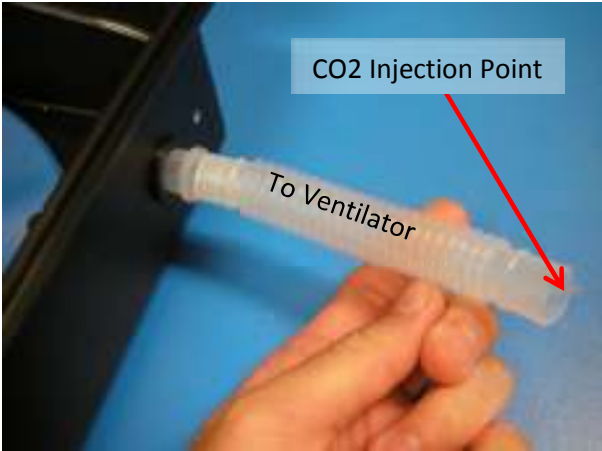
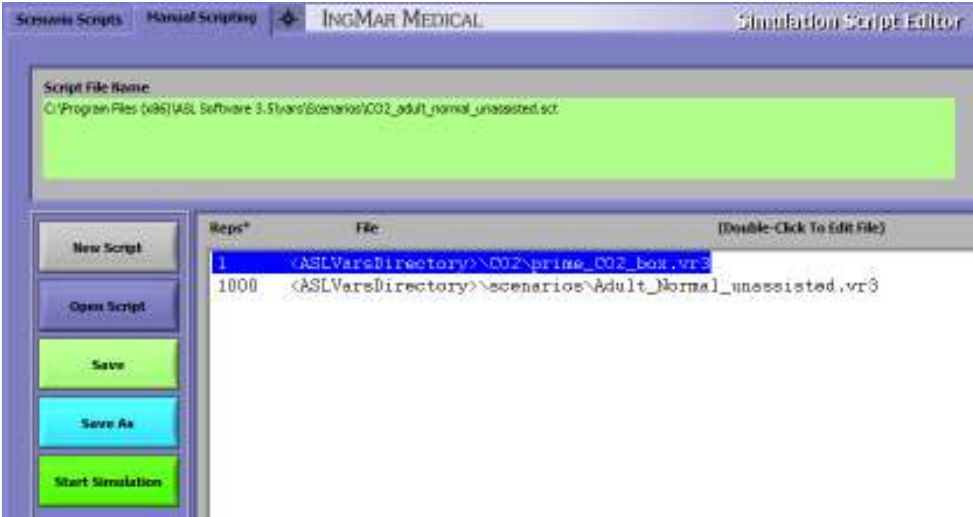


Setup Instructions for using the RespiPatient CO2 Box

Prerequisites	RespiSim System with RespiPatient Manikin and RespiPatient Interface Box
CO2 Setup	<p>1) The general setup is shown in the following block diagram</p>  <p>NOTE: Most of the IngMar Medical patient models provide realistic ETCO₂ waveforms using the standard setup. If simulating a COPD patient, please use, in addition to the standard setup, the tube labeled 310 mL (COPD). If simulating any of the 5 year old models, please use the tube labeled 5yo 45ml Dead Space and NO MANIKIN.</p>
	<p>2) The CO₂ Box works as an intermediary lung. The ASL 5000 ventilates a balloon inside the CO₂ Box. This, in turn, helps to mix the CO₂ with the gases coming from an external device (e.g. Ventilator). The box includes check-valves which open when pressures exceed ~70cmH₂O in either direction. Connect the ASL, CO₂ line, and ventilator line as shown in the image below.</p> 

<p>Controlling CO2</p>	<p>3) CO2 Injection</p>
	<p>The CO2 injection is controlled from the RespiSim Dashboard where the user can select a CO2 output ranging from 0 to 600mL/min flow. The RespiPatient Interface Box provides a constant CO2 flow via a small tube connected to the CO2 Box. The inhaled air is mixed inside the box to provide realistic ETCO2 waveforms when connected to a capnostat.</p>  

<p>Preparation for Running CO2 Simulations</p>	<p>3) In order to provide proper mixing of the CO2 gas with the ambient gas, the CO2 Box works like a “bag in a bottle” concept. This means that the ASL 5000 circuit is connected to balloon inside the CO2 box. In order to prepare the ASL 5000 to work with a ventilator, it is necessary to prime or inflate the balloon using a specified .vr3 file before each CO2-based simulation. Thus, for every script created for a CO2 simulation, the prime_CO2_box.vr3 should be used for a single breath followed by the patient model chosen by the user.</p> <p>The prime_CO2_box.vr3 is a volume pump model that first completely deflates the balloon and then inflates the balloon to approximately 1.5L. When the ASL patient model makes a spontaneous breath or a ventilator provides a breath, the pressure inside the CO2 box will force the balloon to inflate or deflate while mixing the CO2 gas. For example, if running an unassisted adult patient model (Adult_Normal_unassisted.vr3), the script file will look like the image below:</p>  <p>The prime_CO2_box.vr3 should be placed in the \vars\CO2\ folder within the ASL software directories. When running in the RespiSim environment, only a single breath script is needed to prime the CO2 box. Once this is complete, the user can select the different patient models within the RespiSim tabs.</p> <p>NOTE: When not working with a CO2 simulation, please remove the CO2 Box and connect the ASL 5000 directly to the RespiPatient manikin.</p>
<p>Ideal Model ETCO2 Setup Parameters and ETCO2 waveforms</p>	<p>4) 18 Patient models from the IngMar Medical Scenarios library have been validated with the CO2 box as shown in the table and images below. It is important to note the “Model Adjustment” field as these are changes required to the patient model in order to reach the desired MV and ETCO2 waveform. For example, the adult_normal.vr3 model uses a Resistance of 6 cmH2O/L/s. When running with the CO2 Box, the resistance should be changed to 3cmH2O/L/s.</p>

Application Note

RespiPatient CO2 Box

Model Parameters		CO2 Parameters				Ventilation			Model Adjustment		
Scenario Name	Assisted / Unassisted (A/U)	Dead space (RP/no manikin)	Dashboard CO2	Ideal EtCO2	EtCO2	MV	V _t	bpm	Final R _t In	Final R _t Out	Final P _{mus}
		ml	ml/min	mmHg	mmHg	ml/min	mL	1/min	cmH2O /L/s	cmH2O /L/s	cmH2O
Adult_Apnea	A	RP - 125	190	30-40	35.4	5640	470	12			
Adult_ChBronchitis	A	RP - 125	190	30-40	36.3	5616	312	18			
Adult_Emphysema	A	RP - 125	190	30-40	35	5967	351	17			
Adult_Normal	A	RP - 125	190	30-40	38.6	6135	409	15	3	3	
Adult_Normal_unassisted	U	RP - 125	190	30-40	32.8	7725	515	15			23
Adult_Passive	A	RP - 125	190	30-40	39.8	5910	394	15	3	3	
Adult_ARDS	A	RP - 125	190	30-40	42.6	6250	250	25			
Adult_COPD	A	RP - 125 + 310	190	30-40	45.2	11700	650	18	13	15	
Adult_COPD_unassisted	U	RP - 125 + 310	190	30-40	42.6	13440	672	20	4	17	
Adult_Asthma	A	RP - 125	190	30-40	41.7	5874	267	22			
Adult_CF	A	RP - 125	190	30-40	35.2	5984	272	22			
Pediatric5yo_Asthma	A	no manikin - 45	90	35	24	4760	170	28	11	71	
Pediatric5yo_Normal	A	no manikin - 45	90	35	33.9	3800	190	20	11	11	
Pediatric6-12yo_Normal	A	no manikin - 45	120		29.8	5192	236	22			
Adolescent_Normal	A	RP - 125	160		28.5	7260	484	15	7	7	
Kussmauls1_unassisted	U	RP - 125	190	30-40	32.7	7794	433	18			
Kussmauls2_unassisted	U	RP - 125	190	30-40	22.6	12000	480	25			
Kussmauls3_unassisted	U	RP - 125	190	30-40	15.4	17600	440	40			

