Innocor[™] software user manual



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1 INTRODUCTION AND APPLICABILITY OF THIS MANUAL

1.1 APPLICABILITY OF THIS MANUAL

This Software User Manual provides information about how to use the software on the Innocor. The information is more detailed than the one given in the Instruction for Use (COR-MAN-0000-001-IN) in various languages. Information on the Innocor hardware and service & calibration can be found in the Innocor Service Manual (COR-MAN-0000-002-IN). This manual is applicable for the software version 5.07.

Section 1:

Section 1.2 gives a short introduction to the Innocor. Differences between models are summarised in section 1.3. Section 1.4 lists the history of this document and section 1.5 lists the software changes. Section 1.6 defines the different symbols used in the Innocor software.

Section 2 gives a general description of the Innocor software.

Section 3 gives a more detailed description of the Innocor software.

In the following all functions and options of **Innocor** are described. Some of the functions described or shown may not be available on the device you are using.

1.2 INTRODUCTION TO INNOCOR

1.2.1 Intended use

Innocor is a compact point-of-care device intended to be used for non-invasive measurement of cardiac output and related cardiopulmonary parameters. Cardiac output (CO) is defined as the volume of blood pumped by the heart per unit of time (blood flow in litre per minute). The measurement is non-invasive (i.e. does not necessitate catheterisation or any other penetration through a body orifice or the body surface) in that it is based on a pulmonary gas exchange method called inert gas rebreathing (IGR).

The operating principle of **Innocor** is to let the patient breathe minute quantities of a blood soluble and an insoluble gas in a closed breathing assembly for a short period. The blood flowing through the lungs (effective pulmonary blood flow, PBF) absorbs the blood soluble gas and therefore the disappearance rate is proportional to the blood flow. Other factors affecting the distribution of the blood soluble gas are accounted for by also measuring the blood insoluble gas.

The spontaneously breathing patient puts on a nose clip and breathes into a respiratory valve via a mouthpiece and bacterial filter. At the end of expiration the valve is activated so that the patient will breathe in and out (rebreathe) from a rubber bag for a period of 10-20 seconds. The patient is asked to empty the bag during each inspiration and breathe with a slightly increased respiration rate. After this period the patient is switched back to ambient air and the test is terminated. The bag is prefilled with an oxygen (O_2) enriched mixture containing two foreign gases; typically 0.5% nitrous oxide (N_2O) and 0.1% sulphur hexafluoride (SF₆). These gases and CO₂ are measured continuously and simultaneously at the mouthpiece by a photoacoustic gas analyser inside **Innocor**.

 N_2O is soluble in blood and is therefore absorbed during the blood's passage of the lungs at a rate, which is proportional to the blood flow. So, the higher the cardiac output the higher the disappearance rate (slope of measured gas curve). SF_6 is insoluble in blood and therefore stays in the gas phase and is used to determine the lung volume from which the soluble gas is removed.

The rebreathing test can be performed as a single test at rest or at a given exercise level using e.g. a bicycle ergometer or a treadmill in a stand-alone configuration. Alternatively it can be performed as a part of an exercise protocol where the rebreathing manoeuvres are done at pre-programmed intervals/workloads.

By using a pulse oximeter the heart rate (HR) can be measured during the test and used to derive the stroke volume (SV) etc. The arterial oxygen saturation (SpO_2) indicates whether the oxygenation is normal and thus if there is a significant intrapulmonary shunt $(SpO_2 < 95\%)$.

An oscillometric non-invasive blood pressure (BP) measuring system is also included as an option. It is designed to take blood pressure measurements including systolic (SYS), diastolic (DIA) and mean arterial pressures (MAP). By combining CO and MAP the systemic vascular resistance (SVR) can be determined.

The BBB (Breath-by-Breath) option provides measurements of gas exchange parameters including oxygen uptake, carbon dioxide excretion, ventilation and end-tidal concentrations plus a number of derived parameters. These parameters are determined by simultaneous measurements of the respiratory flow and gas concentrations when breathing ambient air. The respiratory flow is measured by means of a differential pressure type flowmeter (pneumotachometer) placed between the respiratory valve unit and the patient. The gas exchange calculations are carried out on-line for each breath between the rebreathing tests. This gives the opportunity to perform an incremental exercise test on a bicycle ergometer or treadmill and measure the progress of cardiac function, pulmonary function and gas exchange at the same time.

Innocor runs under the Windows XP Embedded operating system on an integrated single-board computer. However, knowledge of Windows is not required to operate the device. The device is operated via a simple touch screen interface. Simply touch/press the buttons on the screen to invoke the desired functions. There is no significant warm-up time required for use of **Innocor**.

1.2.2 Intended applications and patient population

Innocor can be used in a variety of medical fields where knowledge of cardiac output and gas exchange is important, e.g. cardiac exercise stress testing, heart failure, cardiac surgery, hypertension, pulmonary hypertension, haemodialysis and pacemaker programming. It can be used both in rest and exercise e.g. with patients who have no symptoms in rest or light exercise. The method involves no risk or pain to the patient. The only requirement is that the patient is capable of understanding the instructions from the operator and performing the manoeuvre well.

1.2.3 Intended operators and environment

Unspecialised nurses and paramedics in all parts of the health care system can use **Innocor**. However, qualified medical personnel should always supervise the user.

1.3 INNOCOR MODELS

Innocor is produced in different models. An overview of the models is given in the table below.

Model	Oxygen sensor	Blood pressure sensor	Breath-by-Breath
INN0050			
INN0100	\checkmark		
INN0200		\checkmark	
INN0300	\checkmark	\checkmark	
INN0400	\checkmark		
INN0500			

1.4 SUMMARY OF REVISION CHANGES

A/4	18.05.04	First issue for software version 3.02
A/5	20.10.04	Updated to software version 4.00
A/6	31.03.05	Updated version
A/7	16.03.07	Updated with Breath-by-Breath for software version 5.07

1.5 SOFTWARE CHANGES

5.07	01.11.06	Script Support for updating system files (*.ini)
5.06	22.06.06	Bug in controlling a manual treadmill protocol corrected
5.05	22.05.06	Faster preparation of rebreathing bag
		Service interval reminder
		Native country
5.04	02.05.06	Updates for the US market
		Breath-by-Breath updates
		New Export facilities
		Support for HR & BP from exercise devices
		Faster preparation of rebreathing bag
5.03	01.12.05	Support for variable flow zero calibration interval
5.02	01.09.05	Printout to Microsoft EMF files (Enhanced Metafile)
5.01	12.08.05	Support for bolus concentration up to 50%
5.00	02.06.05	Breath-by-Breath gas exchange calculation
		Improved regression lines in Data View
		New symbols
		Improved exercise protocol
		Scandisk in case of unauthorized power down
4.01	17.12.04	Bug in O2-adjust corrected
4.00	23.09.04	Exercise protocol
		Calculation of SVRI changed
		Calculation of SVO2 changed
		New handling of calculation warnings
		Standby of gas supply
		Improved bottle pressure handling
		Improved script handling
		Improved service menu
		Improved handling of databases in case of off-nominal shut down
3.02	19.04.04	New trend function with support for display of parameters in tables and XY-plots
		Support for manual entering of HR, SpO ₂ , Load, Speed, Slope
		Support for User defined parameters
		Support for calculated parameters based on database values
		Support for rebreathing bag volume down to 0.5 litre

		Improved on-line detection to avoid bag opening in the shift from inspiration to expiration.						
		A test is always saved - also in case of errors - in order to display the data to						
		determine the reason for the error.						
		Support for deleting a gas cylinder from the Gas Cylinder list						
		New exit / close down of Innocor						
		New database format (3.02 will automatically convert existing format)						
		Innocor software can run as an offline viewer on a memory key						
		New help pages						
3.01	28.10.03	Support for setting of default printers						
3.00	19.09.03	Innocor software running under Windows XP embedded						
2.02	12.09.03	Estimation of bag volume to 40% of VC						
		Automatic stop after 3 breaths after good mixing						
		Support for beep during rebreathing						
		Support for manual entering of blood pressure						
		New parameters: Vo2/kg & A-V O2 diff.						
		Support for script execution (Copy, Move, Delete etc.)						
2.01	13.03.03	Gas bottle identification implemented						
2.00	26.11.02	Support for different languages implemented						

1.6 INNOCOR SYMBOLS

The Innocor software contains different groups of parameters and in order to distinguish between the parameters the following set of symbols is used:

×	Parameters related to the subject: weight, height etc.
•	Rebreathing parameters: CO, VL, SvO ₂ , Vo ₂ etc.
B-B	Breath-by-Breath parameters: V _E , Vo ₂ , Vco ₂ etc.
Σ	1 minutes averaged Breath-by-Breath parameters prior to a rebreathing
	Calculated parameters
2	User defined parameters

2 SOFTWARE DESCRIPTION

The main menu of the Innocor is displayed at power on:



- Press **Measurement** to make a test on a patient.
- Press Setup to prepare general setup of the Innocor. Parameters that require alterations from test to test can be accessed directly from Measurement. Other setups like ambient conditions and language must be accessed through Setup.
- Data Management is used to export data from the Innocor into text files and to execute script files in order to move/copy files from one media to another.
- Blood Pressure is a stand-alone measurement of the blood pressure.
- Press Exit to shut Innocor down.

2.1 ENTERING PATIENT DATA

When entering the measurement a patient must be selected before a test can be performed. The first time the patient is on the Innocor, the patient data must be entered. Next time the patient can be selected from the database.

Choose New Pt (Pt=Patient) or Edit to enter the patient database section of the program.

Press New Pt to enter data for a new patient.

The following screen appears:

Innovision

Patient		<u>Comments</u>	
I.D.	4565959100	This subject has been tested in	Clear All
Last Name	Vision	INNOVISION's Lab.	
First Name(s)	Inno		
Date of Birth	01-06-1995		
Sex	Female -		
Height [cm]	180		Help
Weight [kg]	62		
			Cancel
			ок
1 2	3 4 5	67890+	← Del
Tab Q W	ert	yuiopå"	
Caps a s	d f g	h j k l æ ø	
Home < Z	XCV		PgUp † PgDn
Ling Ait Of			

Enter relevant data for the patient or test subject by pointing at the appropriate entry field using the alphanumeric keyboard. Press Select Male or Female from the selection list or type M or F on the keyboard to select the patient's sex.

Instead of entering new data it is also possible to search a patient already appearing in the database. Use the **Search** button for this feature. The following screen appears:

Enter search specifications, and press search								
	I.D.	Sex 🔽			Search			
Ŀ	ast Name		Hei	ght [cm]	(>=)		-	Show All
First	t Name(s)		We	ight [kg]				
Dat	e of Birth							
I.D.	Last Name	First Name(s)	Sex	Date of Birth	Height [cm]	Weight [kg]	~	
1000	Andersen	Hans Christian	Male	02-04-1805	180	76	_	Help
123123	Hansen	Jens	Female	12-12-1980	150	50		
4565959100	Vision	Inno	Female	01-06-1985	180	62		Cancel
777	Hansen	Soren	Male	28-11-1957	181	76		
							•	ОК
1	2 3	4 5	6	7 8	9	0	+	🔶 Del
Tab q	w e	r t y				på		
Caps	s d	fg	h	j k		82 9		
Home	zx	C V	b		m .		- Pg	jUp 🕇 PgDn
End	Alt Gr							-+-

Enter one or more search criteria and press **Filter** to start the search process. Press **Show All** to disable all search criteria and display all patients. The wildcard '*' is supported. After having entered or chosen the patient data, press the **OK** button.

2.2 MAKING A SINGLE MEASUREMENT

After a patient is selected the following screen appears. Results from the latest / previous test are shown if available.



Check that the bottle pressure is adequate (i.e. > 10 bar), and check that the rebreathing port is closed / inflated.

Various data can be entered manually via the **Pt. Data** menu before or after the rebreathing test. See section 2.4.9 for further details.

Press **Test** to prepare a new measurement. Enter or verify the patient data.

Normal values for haemoglobin (Hb) concentration:

Male =	8-11 mmol/l
Female =	7-10 mmol/l

When the patient data is entered, the user can select between a Single RB test and different protocols (option). After selecting the Single RB test the next screen appears:



The device automatically prepares the rebreathing bag by emptying (using automatic detection of when the bag is empty) and filling it with the desired volume of gas. A mixture of air and gas from the cylinder is filled into the bag.

Option: It is a good idea to start a blood pressure (BP) measurement during the bag filling (the **Start NIBP** button), because it can be difficult to keep the arm quiet during the rebreathing manoeuvre. When the BP measurement is started, the current cuff pressure is shown in the status bar in the lower right corner of the main test window.



When the bag is filled, the following screen appears, showing gas concentrations, gas curves and the flow or airway pressure curve:



End-tidal

Note the end-tidal value of N_2O and SF_6 . The N_2O must be below 0.002% and SF_6 below 0.001% in order to be able to ignore the effect of recirculation from the previous test. In other words: allow sufficient time for washout of inert gases between repeated tests on the same patient. At rest 5 minutes is generally adequate. During exercise 2 minutes is recommended.

Option: The BP measurement can be stopped / aborted (the **Stop NIBP** button) and restarted again under the test. Only the last measured values are saved in the database.

Option: When the BP measurement is finished the resulting Systolic / Diastolic pressures are shown for 20 s in the status bar.



Put on the pulse oximeter finger clip sensor. Don't use the arm where the BP cuff is positioned, if the measurements are done simultaneously.

Connect to the mouthpiece and use a nose clip.

Warning: Always remember to use a new disposable single patient use bacterial/viral filter with the mouthpiece.

When the patient starts breathing into the mouthpiece, the Innocor starts calculating the breathing frequency. When a certain number of breaths have been detected (defined by "Pre-rebreathing breaths" in the setup, see section 2.5.2.1) the **start** button is enabled. Without the Breath-by-Breath option: If the mouthpiece pressure is very low the Innocor can not detect the breathing pattern, and the **Start** button will not be enabled. If this is the case mount the flexible flow restrictor on the RVU, see section 8 RVU description in the Instructions for Use. The status of the breathing can be checked in the lower left corner of the screen: It shall show "inspiration" during inspiration, "expiration" during expiration, and "--" at no flow.

Press **Start** to start the rebreathing test. **Start** can be pressed during any phase of the breathing cycle. The device will open to the rebreathing bag at the end of the actual or subsequent expiration.

When the valve shifts the patient should hold the breath for approximately 1 second to allow the valve to switch completely.



The following screen appears:

When breathing, try to follow the speed indicator. Breathe faster if the indicator is to the right of **OK**. Breathe slower if the indicator is to the left of **OK**. However an accurate breathing frequency is not critical for the calculations, but a too slow breathing can result in a too low O_2 concentration or too high CO_2 concentration in which case the test will be aborted before the planned stop, see section 2.5.1 for further details.

It is essential that the rebreathing bag is being emptied completely during the first and the subsequent inspirations. The program shifts the valve on an end inspiration before the last expiration. The test is completed some seconds later (when the curves are not updated anymore).

Option: If the BP measurement has not finished when the rebreathing test is finished, a message is shown to wait for the BP measurement. If the BP measurement is aborted by the **Stop NIBP** the RB test result will still be saved in the patient database.



The results are calculated and saved automatically in the experiment database. A raw data file containing the gas and mouthpiece signal is saved too – one file for each measurement. The results are shown immediately on the following screen (**Results** tab), see section 2.4.4.

2.3 PROTOCOL / EXERCISE EXECUTION

Option: If the Innocor software is an exercise or Breath-by-Breath version, the user can select an exercise protocol, which controls the progress of the exercise level and controls a series of predefined rebreathing tests with respect to bag volume and bolus concentration.

2.3.1 Starting a protocol

Starting a protocol is similar to starting a single rebreathing test:

- 1) Select Measurement
- 2) Select a patient
- 3) Press Test
- 4) Enter patient data (if any)

The user will then be prompted to select a protocol, see section 2.5.7 for details on how to define a protocol. In the same menu the user can also change / select the exercise device, if controlled by the Innocor. At the moment the following exercise devices are supported, but more will come:

- Elmed EGT 1000 ergometer
- Ergoline VarioBike 550 ergometer
- Ergoline 800&900 ergometers
- Ergoline ergoselect ergometers
- Lode Examiner ergometer
- Lode Excalibur ergometer
- Monark 839 ergometer
- HP Cosmos Series treadmill

The exercise devices are controlled via a USB/serial line. The USB to serial converter must be

connected to the Innocor when powered on, otherwise the connection will fail. See section 3.14.

CAUTION:

The USB shall not be used under normal clinical conditions within the patient zone but only during service and occasionally for data exchange.

Peripheral equipment connected to these interfaces must be certified according to the respective European standards (e.g. EN 60950 for data processing equipment and EN 60601-1 for medical equipment).

Furthermore, all configurations shall comply with the system standard EN 60601-1-1. Everybody who connects additional equipment to the signal input part configures a medical system, and is therefore responsible that the system complies with the requirements of the system standard EN 60601-1-1.

The following 3 protocols are standard built-in protocols, which can not be changed by the user.

- Auto Bicycle: A bicycle ergometer protocol where all settings are set to automatic and only a minimum is defined by the user just prior to the test.
- Auto Treadmill: A treadmill protocol where all settings are set to automatic and only a minimum is defined by the user just prior to the test.
- Single RB: A single rebreathing test without a protocol.



When the protocol is selected an additional setup menu appears if any of the protocol fields are set to auto. The user checks / changes these auto fields and presses OK to start the protocol.

Edit and set limits for Treadmill protocol						
Inc. slope	0.5	%	Inc. Speed 1 km/h	Default		
Min. slope	0.0	%	Min. speed ⁵ km/h			
Time in step	5	min	Steps between RB 🔋 👤			
Min bag vol.	1.8	I	Steps between NIBP 🛛 👤			
Max bag vol.	3.1	1	7 8 9 +			
Initial RB freq.	25	/min	4 5 6 Del	ОК		
			1 2 3 -			
				Cancel		

Edit and set limits for Bicycle protocol				
Inc. load	25.0 Watt	Steps between RB	Default	
Min. load	0.0 Watt	Steps between NIBP 🛛 单		
Time in step	5 min	7 8 9 +		
Min bag vol.	1.8	4 5 6 Del		
Max bag vol.	3.1 I	1 2 3 -	ОК	
Initial RB freq.	25 /min		Cancel	

Inc. load,	Incremental exercise level for each step in a protocol. The resulting exercise					
Inc. slope,	level is incremented by the value for each step starting with the minimum					
Inc. speed	exercise level.					
Min. load,	The exercise level used for the first step in a protocol.					
Min. slope,						
Min. speed						
Time in step	The duration of each step in minutes. The duration of each step is identical, but					
	can be changed during the protocol execution.					
Min bag vol.,	The minimum / maximum bag volume allowed. The bag volume to be used					
Max bag vol.	during the protocol is automatically adapted according to the specified exercise					
	level, but the Min and Max bag vol. sets the limits of the volume. The default					
	Min. / Max. bag vol. is 44% / 75% of the predicted vital capacity of the subject.					
	If the actual breathing frequency exceeds 30 /min the actual max bag volume					
	will be reduced to "Max bag vol • 30 / Freq".					
Initial RB freq.:	The guiding rebreathing frequency of the first step.					
Steps between	The number indicates how often a rebreathing shall be performed.					
RB	0: never.					
	1: every step					
	2: on every second step, etc.					
Steps between	The number indicates how often a NIBP measurement shall be performed.					
NIBP	Since the NIBP measurement must be done together with a rebreathing					
	measurement, the number must be a multiple of "steps between RB".					

2.3.2 Running a protocol

When a protocol is started the user can select between 2 or 4 screens using the Show... button:



2.3.2.1 Protocol screen

The protocol screen lists the protocol in table form with only the active step highlighted - the other steps are dimmed. When a step is performed, it is marked with $\sqrt{}$ in the step column. In user defined protocols the complete number of fields is shown, whereas the automatic protocols only show the next step to be performed. The content of an auto field is first defined when it is the next step to be performed, because the prediction of the values are based on the results from the previous step.

The Innocor S/W makes a pre-estimation of the maximum CO₂ and the minimum O₂ level for all the

steps in a user defined protocol, and if a value is outside the specified limits, a red exclamation mark is shown in the step/action column. As the protocol progresses the estimations become better, but if a limit violation still exists on the next step to be performed, the user is prompted with the warning. Normally the user does not need to enter the protocol setup. However the protocol setup can be used to view the progress of the protocol or to change the protocol on-line.



2.3.2.1.1 Changing protocol parameters on-line

The user can change the individual parameters of the protocol prior to the bag preparation (1 minute after the last rebreathing procedure). When the bag preparation starts, the parameters of the active step are locked while the step is performed. To change a parameter the user presses first the field, then the "+" or "-" buttons to increment or decrement the value. Note the value in the actual step and all subsequent steps are increased or decreased by the same amount.

The following increments are used:

Load	± 5 watt
Slope	±1%
Speed	\pm 0.5 mph or km/h
Time/Duration	\pm 10 seconds
Bag volume	± 0.1 litre
Bolus fraction	±1%
RB. frequency	± 1 /min

Normally the protocol automatically progresses through all steps, however pressing the "**Go to step**" button can change the active step both forward and backwards. By using this feature, steps can be both skipped and repeated. When a new step is selected, the protocol progress starts from this position and the time to rebreathing is reset.

If the parameter editor (blue field) is positioned on the active step, the "**Go to step**" button changes to a "**Start rebreathing**" button. Pressing this button immediately starts/completes a bag preparation followed by a rebreathing test. This can be useful if the subject is close to the maximum exercise level and is not able to complete the step within the planned duration.

The "**RB on/off**" button is used to turn on/off the rebreathing related to the step. Similarly with the "**NIBP on/off**" button. However, the NIBP can only be on if the RB is on.

2.3.2.1.2 Protocol estimation

The Innocor S/W uses different formulae in order to estimate the correct bag volume and bolus fraction. The prediction of oxygen uptake (Vo₂) uses the following formulae:

Vo ₂ (rest)	= 0.0035 • Weight
Vo ₂ (bicycle)	= 0.0035 • Weight + 0.01 • Load
Vo₂ (treadmill-walk) (Speed < 7 km/h)	= 0.00332•Weight•[2.3+0.32•(Speed-2.5) ^{1.65} +Slope•(0.2+0.07(Speed-2.5))]
Vo ₂ (treadmill-run) (Speed > 7 km/h)	= 0.00332•(E+0.47•(900-E))•(1+Slope/100) E = Weight•[2.3+0.32•(Speed-2.5) ^{1.65} +Slope•(0.2+0.07(Speed-2.5))]

where

 $Vo_2 = I/min$ Weight = kg Load = watt Speed = km/h Slope = %

The formulae for the Vo₂ estimation on the treadmill is from "Predicting metabolic energy cost, by Baruch Givoni and Ralph F. GoldMan, Journal of applied Physiology, vol. 30, No 3, March 1971",

The prediction formulae of the Vo_2 on a bicycle is relatively independent of the subject, whereas the prediction on the treadmill is more subject dependent due to different walking & running efficiency.

The estimation of Vo_2 is automatically adapted during a protocol using the actual measurement on the previous step, and the prediction formulae thereby become less sensitive to subject variations:

 $Vo_{2.estimation} = Vo_2(previous) + \Delta Vo_{2.estimation}(change in exercise level)$

The Vo₂ estimation is used to calculate the needed oxygen contents of the rebreathing bag. During the estimation of the bag volume / bolus fraction the Innocor S/W first tries to increase the bolus fraction in order to get enough oxygen (the bolus gas contains 94% O_2). If this is not enough the bag volume is increased too.

The Innocor S/W contains an estimation of the maximal CO_2 concentration in the bag at the end of a test. This is also taken into account when the bag volume is estimated.

A third factor affecting the bag volume is the length of the time breathing in and out of the bag. The time is determined by the breathing frequency and the number of breaths to achieve 3 good breaths. The estimation starts up assuming 5 breaths to achieve 3 good breaths, but uses thereafter the actual breathing frequency and number of breaths found in the previous test.

2 sets of typical estimations of the bag volume based on the O_2 and CO_2 requirements are shown below. The recommended minimum bag volume (44% of Vital Capacity) and maximum bag volume (75% of Vital Capacity) are shown as 2 horizontal lines.

Weight	70kg
BolusFraction	10%
CO _{2,max}	8%
O _{2,min}	13%
Freq	20 - 30





The relatively slow increase in V_{bag} due to the O_2 requirement in the mid range is caused by the increased breathing frequency and a reduced number of breaths (from 5 to 4) typical in this range.

Weight	70kg
Bolus Fraction	10%
CO _{2,max}	10%
O _{2,min}	13%
Freq	20 - 30



It is seen that the CO_2 requirement is dominating with 8% maximum CO_2 , and the O_2 requirement is dominating with 10% maximum CO_2 . The subject can reach 250 watt / 39 ml/min/kg using the last setup. If the subject can perform more, one of the following parameters must be increased:

- The bolus fraction,
- the bag volume or
- the breathing frequency

2.3.2.1.3 Bag preparation

During a protocol execution the rebreathing bag is prepared in advance in order to be ready for the timed rebreathings. A rebreathing test can also be started manually at any time during an exercise test by pressing the **Start Rebreathing** button.

The following rules apply to preparation of the rebreathing bag:

- The bag preparation is initiated 1 minute after the last rebreathing test.
 This gives the user the possibility to change settings during the first minute. Thereafter the user can only make minor changes to the bolus and bag volume.
- The bag volume is filled up to the target volume except 200 ml, where the target volume is the highest of the following volumes:
 - 44% of the Vital Capacity
 - Vt during the last 5 breaths measured during Breath-by-Breath
 - Volume required to fulfil the max CO_2 limit and min O_2 limit.

The bag volume is however limited by the max volume predicted as 75% of the Vital Capacity. The bag volume is pre-filled to the target volume except 200 ml in order to be able to increase the bolus concentration a little.

- The Vt and bag requirements are checked continuously during an exercise test, and if the target bag volume is increased more than 0.25 litre compared to the bag volume already filled, the extra bag volume is added.
- A rebreathing test can be added to a step in the protocol, independently of the present of a RB in the protocol setup. However only one RB can be performed on each step. If a rebreathing test is added manually, the protocol will remain on the same step after the test until the time of the step is exceeded.
- If the protocol contains a RB in one of the future steps the pre-fill of the bag will be initiated. If the protocol does not contain a RB, the bag preparation will not be initiated, but it will still be possible to insert a RB test. (It will however take some extra time before the test can be started, since the complete bag must be filled).
- If the rebreathing test is ready to be performed, and it is cancelled, the volume will remain in the bag and can be used later in the exercise protocol.



Examples of the rebreathing bag preparation:

Top: The rebreathing tests are following a pre-programmed protocol, and the Innocor S/W version prepares the bag in advance, i.e. 1 minute after the last RB.

Middle: The first RB is following the protocol. The second RB is defined to be later, but the bag is already prepared 1 minute after the first RB. Due to increased exercise level, it is found that the bag volume is insufficient, and 0.25 litres is added to the bag. The user decides to make a test at step 5.

Bottom: The same as above, but note that the manually inserted RB is not affecting the length of the step.

2.3.2.2 Result screen

The result screen is similar to the normal result screen, except that the button panel is replaced by buttons & information needed for the protocol execution. The user can evaluate the last tests of the subject while the protocol is running. The tabs: **Results**, **Details**, **Graphs**, **Data Table**, **DataView 1-4** & **DataView 5-8** are all active during protocol execution, which means that the user can toggle between the different displays on-line. The user can however not change the setup of the displays on-line. The panel to the right contains the following information / buttons:

Protocol	Name of the protocol.			
Test time	Total elapsed time since the protocol was started.			
Time to	Time until the next rebreathing.			
rebreathing				
Show	Button to go to the protocol, BBB, results or raw data screen.			
Hold/Resume	Button to make a temporary pause in a protocol.			
protocol				
Stop protocol	Button to stop the protocol.			
Actual load,	Actual exercise level returned from a bicycle ergometer or a treadmill. If no			
slope & speed	read back is available, the commanded value is displayed.			



2.3.3 Breath-by-Breath on-line screen

The BBB calculation of gas exchange parameters starts after a 1 minute warm-up period when the exercise protocol is selected and continues until the protocol is finished - only interrupted by the rebreathings. The results of the BBB calculation are displayed in the table to the left and as graphics to the right.



The content of the table can be modified using the **Table Setup**. Up to 8 parameters are supported.





The content of the graphics can be configured in 1, 2 or 3 plots using the **Graph Setup**.

2.3.4 On-line raw data screen

The on-line raw data screen displays the gas curves and the flow or volume curve. The gas curves are displayed on the left y-axis, and the flow or volume is displayed on the right y-axis. The volume curve is an integration of the flow without correction for ATP and BTPS, and will therefore typically drift upwards. The numerical values of the gases and flow or volume are a 1 second average. The y-axis of the gas display can be changed by pressing the + or - button. When the flow signal is zero adjusted the flow value is set to 100 l/s, which is used to identify the offset periods, where the flow signal can not be used for the Breath-by-Breath calculations.



2.3.5 Cool down period

The system switches to a cool down period, when the protocol finishes, or when the protocol is manually terminated. The exercise level of the cool down period is set to the value of the first step with an exercise level > 0. I.e. a protocol with 0, 25, 50, 75, 100 watts will have a cool down load of 25 watts. The duration of the cool down period is 5 minutes or until the user terminates the state.

The cool down period is skipped if the last activated exercise level is equal to the cool down exercise level.

2.4 EVALUATING RESULTS

The exercise results are displayed in different ways depending on where the focus is set in the Date/Time list: a complete exercise test or a single rebreathing test. The focus is set on an exercise test by selecting a line in bold with name **Ex. n**., see below. Selecting a line named n:1, n:2 etc will set the focus on a single rebreathing test.

		Date	Time		
ſ	Ex. 1	07-03-2005	12:03:56	←	A complete exercise test
ſ	1:1	07-03-2005	12:07:42	٦	
	1:2	07-03-2005	12:10:51		
	1:3	07-03-2005	12:13:58	}	Single rebreathing tests
	1:4	07-03-2005	12:17:00		
	1:5	07-03-2005	12:20:02	J	

The display of results are organised in the following views:

Tab \ Focus	Exercise test	Single rebreathing test		
Results	Main results of the rebreathing:	Main results of a rebreathing: CO, CI,		
	Selected parameters at rest, AT and	Vo ₂ /kg, SV, A-V O ₂ diff		
	max exercise.			
Details	Table display of BBB parameters	Detailed results of a rebreathing		
	versus time			
Graphs	Graphic display of BBB parameters in	Rebreathing curves for evaluation of		
	up to 3x3 plots	the quality of the test		
Data Table	Table display of rebreathing and BBB results for one or more rebreathings /			
	exercise tests			
Data View 1-4	Graphic display of rebreathing and BBB results for one or more rebreathings /			
Data View 5-8	exercise tests			

2.4.1 Exercise test results

Set the focus on an exercise test and press the **Results** tab. This will display selected BBB parameters at Rest, at AT (Anaerobic Threshold) and at Max exercise level. The list can be configured by pressing the **Setup** button.

Protocol:				
Auto Bicycle		RC	point lound	,
	Rest	AT	Max.	
VO2/kg [ml/min/kg]	4.4	14.8	23.3	
VO2 [l/min]	0.444	1.493	2.332	
Hr [/min]	65	88	111	
Ve [l/min]	18.6	40.9	77.3	
Load [watts]	0.0	101.5	199.4	
R	0.84	0.80	0.97	
FO2et [%]	15.56	14.36	15.25	
FC02et [%]	4.47	5.31	5.22	
Ve/V02	44.2	27.7	33.2	
Ve/VCO2	52.4	34.5	34.1	

2.4.2 Exercise test details

Pressing the **Details** tab will display selected BBB parameters in a table. In **Setup** the time step can be configured to 15, 30, 60, 90, 120 seconds, every breath or default (the average filter used when displaying the graphs). The content of the table can be configured in the **Setup** menu. The table can be printed directly using **File.. – Print**, or exported to a file using **File.. – Export to file**. Note that only the selected parameters will be printed / exported.

Time	Load	Hr	Resp.Freq.	Ve	VC02	V02	R
	B-B watts	B-B /min	8-8 /min	8-8 I/min	8-8 I/min	8-8 I/min	B-B
2:00 min	0.0	0	14.2	17.3	0.377	0.447	0.84
3:00 min	0.0	25	13.8	17.2	0.359	0.432	0.83
4:00 min	0.0	65	16.4	17.9	0.392	0.457	0.86
5:00 min	51.2	78	15.6	31.6	0.810	0.849	0.97
6:00 min	51.3	79	18.0	24.6	0.687	0.891	0.72
7:00 min	51.4	77	17.0	29.9	0.792	1.076	0.74
8:00 min	100.4	79	23.7	40.1	1.010	1.128	0.89
9:00 min	101.4	87	21.0	39.9	1.163	1.455	0.80
10:00 min	100.7	86	21.8	42.0	1.206	1.445	0.83
11:00 min	146.4	92	27.1	57.9	1.556	1.566	0.99
12:00 min	148.7	98	25.3	53.7	1.536	1.749	0.88
13:00 min	150.4	99	28.2	63.3	1.751	1.872	0.94
14:00 min	199.6	105	30.5	78.1	2.126	2.131	1.00
15:00 min	197.1	110	28.6	70.6	2.115	2.216	0.95
16:00 min	198.3	112	29.2	73.6	2.214	2.324	0.95

2.4.3 Exercise test graphs

When the Graph tab is selected all graphs are displayed, see below.



A graph can be zoomed by pressing the actual graph to zoom.

The Rest, AT, RC and Max indications are shown on all graphs.

	Period	Line
Rest	Defined as the last 1 minute before exercise, i.e. when load or speed > 0	At the end of the period
AT	Anaerobic Threshold. A 30 seconds interval around the AT point either found by the V-slope method or set manually in the Vo ₂ versus Vco ₂ graph	In the middle of the period
RC	Respiratory compensation point. A 30 seconds interval around the RC point either found by the V-slope method or set manually in the Vco_2 versus V_E graph	In the middle of the period
Max	A 30 seconds interval where the Vo ₂ is maximal	At the end of the period

If e.g. graph 3 (Vo₂-Vco₂ versus time) is pressed the screen below will be displayed. The Rest, AT and Max points are indicated by vertical lines. In this case the RC point is not found, and therefore not displayed. The Rest, AT and Max points can be moved manually one at a time using the \leftarrow and \rightarrow buttons below the graph. The active line is indicated with a yellow rectangle - use the \updownarrow button below the graph to change the active line. A line can also be moved by pressing the yellow rectangle at the top of the line and then dragging it to the new position. Note that the AT point can only be moved if the AT is set to manual.



Below the graph are located up to 9 tabs, which are shortcuts to the other zoomed graphs. The last tab 1-9 is a shortcut to a full screen display of all graphs, see below.



2.4.3.1 AT and RC detection

When the AT graph (Vco₂ versus Vo₂) or RC graph (V_E versus Vco₂) is displayed the calculation area is shown. The minimum and maximum of the calculation area can be moved manually. As default the minimum of the area is found as 1 minute after the rest. The default maximum of the calculation area is as default set to the max point. However if a RC point is detected, this will be the upper limit for the calculation area in the AT graph. The AT and RC points are found by the V-slope* method in auto mode. The AT graph contains a 45° assistance line, which is an alternative way to check the AT point. Under normal conditions the data points after the AT shall be above the 45° assistance line.

* Beaver WL, Wassermann K, Whipp BJ (1986) "A new method for detecting anaerobic threshold by gas exchange" J Appl Physiol 60:2020-2027



2.4.3.2 Deleting Breath-by-Breath results

The user can delete one or more results from the Breath-by-Breath results. The function is available when a graph is zoomed. Press the \updownarrow button to enter **Edit** mode, where data can be deleted. In **Edit** mode the results are shown without the average filter. When toggling back to **View** mode the average filter is applied again.



Use the touch screen to make a rectangle around the data to remove (press the upper left corner of the rectangle and keep it down while moving the finger to the lower right corner). Press the X button to delete the data within the rectangle. An alternative way of deleting is to first press the X button – a default rectangle will then appear on the screen. The rectangle can then be moved (press inside the rectangle and drag it to the data to remove).

It is possible to undo the last deletion by pressing the undo button, and all by the undo all button.



Delete

Undo last delete

Undo all deletes

2.4.3.3 Breath-by-Breath graph setup

Enter **Symbols** under **Graph setup** or **Dataview Setup** to configure the format of a signal. A signal can be displayed using one of the following three formats:

- Symbols
- Lines
- Symbols and lines



2.4.4 Rebreathing results

The Results screen displays the main parameters of the test.

I.D.		290353	Inno, Vision	14/03/2007 14:18:21						
Date		Time		Patient						
1:3	1:3 08/04/2005		CO 4.3 //min							
Ex. 2	18/05/20	005 15:40:27		Pt Data						
2:1	18/05/200	15:44:23								
2:2	18/05/200	15:47:35		Test Param						
2:3	18/05/200	15:50:44		Testraram.						
2:4	18/05/200	15:53:47	VO ₂ /kg 2.0 ml/min/kg							
Ех. З	20/05/20	005 16:07:37		Test						
3:1	20/05/200	05 16:11:00								
4	02/03/20	007 07:16:58	SV 56 ml	Demo						
5	02/03/2	007 07:20:13								
	A-V O ₂ diff. 15 %									
Test:	Test: 10 out of 10 Rest									
	Delete									
T	Help									
Res	sults	Details	Graphs Data Table DataView 1-4 DataView 5-8	Exit Meas						
		Cylinder ³⁹ bar	HR 55 SpO ₂ 94 Cuff mmHg							

The user can enter specific comments to the measurement in the comments field. On the left side the user can select previous tests, and have the results displayed. The **Delete** button will erase a test from the database, as well as erasing the corresponding raw data file from the hard disk.

2.4.5 Rebreathing details

Pressing the **Details** tab will display all the parameters on the screen.

I.D.		290353		Inno, Vision					14/03/2007 14:18:40
	Date		Time						
	Date lime		1	co	4.3	l/min	CI	2.4 1/min/m2	Patient
1:3	3 08/04/2005		15:39:26	SV	56	mi	SI	31.0 ml/m2	
Ех. 2	18/05/2	005	15:40:27	V02	0.137	1/min	VO₂/kq	2.0 ml/min/kg	Pt. Data
2:1	18/05/2005		15:44:23	HB	77	bom	V	181	
2:2	18/05/200	05	15:47:35			opm	L.	1.0 1	Test Dorom
2:3	18/05/2005		15:50:44	SpO ₂	97	%	A-V O2diff	15 %	Test Param.
2:4	18/05/200	05	15:53:47	SvO2	82	%	Shunt	6 %	
Ех. З	20/05/2	005	16:07:37						Test
3:1	20/05/200	J5	16:11:00	SYS	115	mmHg	SVR	18.3 <u>mmriq</u> (I/min)	
4	02/03/2	007	07:16:58	MAP	84	mmHg	SVRI	33.3	Dama
5	02/03/2	007	07:20:13	DIA	69	mmHg			Demo
				Height	176	cm	Hb	15.0 g/dl	Cotup
Test: 10 out of 10				Weight	67	ka	BSA	1.82 m2	
									Print Prev
	Dele	ete					~		
				Load:		Watt	Slope	%	
							Speed	— — грт	Help
Res	ults	Details		Graphs	Data	Table	DataView 1-4	DataView 5-8	Exit Meas
		Cylir	nder ³⁹ bar	HR 58	SpO	2 96	Cuff	mmHg	

If a parameter is not measured, it is dimmed (--).

2.4.6 Rebreathing graphics

The graphics page gives a graphic view of the gas signals. The main page displays 4 small plots that can be expanded by pointing inside the plot.



If the test contains a warning an exclamation mark will be shown at the top of the graphic display. If the user presses the exclamation mark (!), a message box with the warning message will appear. If no warning is present a $\sqrt{}$ is shown instead.





2.4.6.1 Normal plot

The upper left plot displays the signals without any normalisations.





The red vertical line indicates the "time zero" in the first inspiration. It is defined by the "Zero position in first inspiration" in the hidden parameter setup, see section 2.5.2. The parameter is as default set to 50%, which means that the line is in the middle of the first inspiration.

The dashed vertical green line indicates the time of maximum concentration of N_2O in the first inspiration. The software uses an average of 5 samples of N_2O to determine this point.

The vertical blue rectangles indicate the data area used for the calculations. The default setup is defined to use expiration, which means that the rectangles must be positioned in the expiration periods of the signal, i.e. in the tops on the CO_2 curve and in the bottoms on the O_2 curve. At least 2 expirations must be used for the calculation, but it is highly recommended to have 3 or more expirations. If too few expirations are present the patient must breathe faster or the max rebreathing time must be increased, see section 2.5.2.

The content of the normal plot is defined in the Graphics menu. The colour of the curves can also be changed in the menu.



The normal plot can be zoomed by pointing out a rectangle on the screen:

- Point the upper left corner of the rectangle
- While keeping pressure on the screen, move the finger to the right bottom corner of the rectangle to zoom in on.

• Release finger from screen, and the plot will be zoomed.

Note that it is only possible to zoom on the normal screen.

Zooming out to the previous display is possible by the reverse operation:

- Point anywhere on the plot.
- While keeping pressure on the screen, move the finger up and to the left.
- Release the finger from the screen, and the plot will zoom out.

The normal plot is useful in troubleshooting, since all signals can be displayed and zoomed.



2.4.6.2 Normalised Oxygen

The oxygen plot displays the reduction in oxygen due to oxygen uptake by the patient. A steep curve indicates a high Vo_2 .

Example:

 $\begin{array}{lll} \text{Vo}_2 = & 0.3 \text{ I/min} \approx 50 \text{ ml} \text{ / 10 sec} \\ \Delta O_2 = & 50 \text{ ml} \text{ / (1500 ml} + 2000 \text{ ml}) * 100\% = 1.4\% \\ \text{I.e. the } O_2 \text{ drops } 1.4\% \text{ within a 10 seconds period.} \\ \text{(Note! The above calculations are not altered for STPD & ATP)} \end{array}$

The oxygen display is normalised using the insoluble gas in order to correct for incomplete mixing. Using a 10% bolus will result in approx. 28% O_2 in the bag (The bolus gas contains 94% O_2). When the O_2 signal is normalised the first inspiration will be reduced to a value corresponding to an immediate mixing between the bag and the lungs.

Example:


2.4.6.3 Normalised soluble gas (N₂O)

The soluble gas (N_2O) display is normalised using the insoluble gas in order to correct for incomplete mixing and displayed in a semi-logarithmic plot. The soluble gas is absorbed during the blood's passage of the lungs at a rate, which is proportional to the blood flow. The disappearance curve of the soluble gas is expected to be exponentially decreasing, and by displaying the soluble gas in the semi-logarithmic plot, the disappearance will be linear. The slope of the measured curve is directly proportional to the pulmonary blood flow.



2.4.6.4 Insoluble gas (SF₆)

 SF_6 is insoluble in blood and therefore stays in the gas phase. The display of the insoluble gas is starting with the bag concentration during the first inspiration. After some breaths the insoluble gas is mixed in the lungs and stabilises. The number of breaths until stabilisation is an indication of how fast the mixing is achieved. A slow mixing can be due to slow mixing of the lungs or that the bag is

not emptied properly during the rebreathing. The software is looking at the SF₆ in order to determine when a good mixing is achieved (and thereby when the blue rectangles shall start). The software compares the maximum and minimum values within a breath and calculates a mixing value as the difference divided by the average ((max-min)/(max+min)/2). The mixing threshold is defined by the value Mixing Threshold in the setup (default 15%), see section 2.5.2.1. The ratio between the bag concentration (found as the max during the first inspiration) and the mixed concentration (back-extrapolation of the line to time "zero") is used to determinate the lung volume (V_L).

Example:

Vbag = 1.5 litre FRC = 2.0 litre SF_{6,bag} = 0.1% SF_{6,mix} = (1.5 * 0.1) / (1.5 + 2.0) = 0.043%(Note! The above calculations are not altered for BTPS & ATP)

At rest the slope of the insoluble curve is nearly zero, but during higher exercise the insoluble curve increases during the manoeuvre. This is due to a relatively high oxygen uptake; at the same time as the carbon dioxide output is limited due to the increasing CO_2 in the bag.

2.4.7 Data Table

Pressing the **Data Table** Tab will display the results in a tabular form for the selected tests.

The selected tests will be allocated a number starting from 1. Unselecting a test will however not reallocate the numbers. Selecting a test will only reallocate the numbers if needed.

The table can be printed directly using **File.. – Print**, or exported to a file using **File.. – Export to file**.

I.D. 091063		1063	Pedersen, Knud					08-03-2007 13:40:56			
	Date		Time		Load Vatt	∨O2	CO	HR • bom	SV ♥ m	Ve Σ I/min	Patient
Ex. Ex.	13-07	-2006 -2006	15:41:28 15:09:52	1:1	0.0	0.269	4.5	69	65	15.0	
Ex.	21-12	-2006	16:18:43	1:2	43.3	1.001	9.4	78	120	29.4	Pt. Data
Ex. 2	04-01	-2007	15:23:52	1:3	129.4	2.084	13.6	100	136	50.2	
2:1	04-01-2	2007	15:29:59	1:4	213.0	2.756	16.7	121	138	81.2	Test Param.
2:2	04-01-2	2007	15:35:10	1:5	305.4	3.735	19.0	150	127	111.3	
2:3	04-01-2	2007	15:40:17	2:1	0.0	0.191	2.9	63	45	13.5	Test
2:4	04-01-2	2007	15:45:25	2:2	100.0	1.308	10.4	83	125	41.6	
2:5	04-01-2	2007	15:50:33	2:3	200.0	2.287	14.9	106	141	71.4	Demo
2:6	04-01-2	2007	15:55:39	2:4	230.0	2.612	16.2	118	137	82.8	Denito
Ех. З	15-02	-2007	14:22:01	2:5	260.0	3.118	17.9	130	137	91.3	
				2:6	290.0	3.621	19.1	145	132	110.9	Table
Selected: 14 / 142 Select/ UnSelect All										File	
Ĩ			ľ							>	Help
Res				Grap	ihs [Data Tabl	e Data	View 1-4		v 5-8	Exit Meas
	Cylinder bar										

	Table	e Setup
• •	Load	Set order
v •	V02	
v v	CO	+ +
V	HR	
V V	SV	
¥Σ	Ve	Defeut
- •	VL	Derault
- •	Sv02	3
- •	SpO2	
- •	AVDiff	
- •	Shunt	
- •	Speed	
•	НЬ	
	Weight	
•	CI	
•	VO2/Kg	
Market 1	Height	Calculated
- •	PBF	Paralli.
- •	SYS	
- •	DIA	Canaal
- •	MAP	Cancel
- •	Slope	
- •	Bag Vol.	ок
- •	SVR	
U 🗸	SI	

The **Table Setup** is used to configure the number of parameters to display, and in which order.

2.4.7.1 Calculated parameters

In the **Table Setup** menu, the **Calculated Parm.** can be used to define a new parameter based on existing parameters. The calculated parameters can be used to e.g. calculate new derived parameters like O_2 -pulse as VO_2 /HR, or predicted values for CO based on VO_2 . (Example: Predicted CO = $VO2^*5.6+3.7$).

Press New to create a new formulae or Press a field to edit					
Formulae name	Unit	Formulae	New		
O2_pulse	ml	[♥VO2]/[♥HR]*1000			
copred	l/min	[♥VO2]*5.6+3.7			
			Cancel		
			ОК		

Press **New** to make a new formula or press the actual field to edit it. The following standard operators can be used:

- + addition
- subtraction
- * multiplication
- / division
- Sqrt() square root
- Exp() exponential function, $exp(x) = e^{x}$
- Ln() natural logarithm
- ^ power function, $x^a = x^a$

A parameter can be used in the formulae by finding it in the list and then pressing the enter key.

Innovision



2.4.8 Data View

Pressing the Data View Tabs will display the results in XY plots for the selected tests.



Pressing on one of the XY-plots will zoom in on the selected plot.



Innovision

The vertical dashed line in the plot indicates the data corresponding to the highlighted test at the time-date list. Pressing a data point on the plot will move the focus to the actual test at the time-date list.

The data view can be configured via the **Dataview Setup**. Both the X-axis and the Y-axis can be defined with respect to what to display, grid and min/max on axes. Up to 5 parameters can be selected on the y-axes. Each parameter can be assigned to the left or right y-axis, and a 1st or 2nd order regression line can be fitted to the data. The **Set Views** button is used to select the number of XY-plots: 1, 2 or 4.



The regression lines can be based on all selected data, or only on the data belonging to each exercise test (**1. ord grp** or **2. ord grp**). This facility determinates a separate regression line for each exercise test. If 2 exercise tests are selected the regression lines for the 2 tests can be compared. When pressing the field with the result of the slope and intercept, the results will toggle between the selected exercise tests.



The Symbols contains a menu for the setup of symbols.

A signal can be displayed using one of the following three formats:

- Symbols
- Lines
- Symbols and lines



2.4.9 Patient data

The patient data (**Pt. Data**) gives access to a reduced menu for editing the patient data before or after a rebreathing test. Use the \uparrow key to select between entering of data for the next test or a test already performed.



The haemoglobin (Hb) can be entered in g/dl or mmol/l. The HR and SpO_2 can only be entered after the test. Weight and Height can be adjusted. If a parameter is changed after a test, the **Update** button must be pressed in order to update the values and possible derived parameters stored in the data base.

The following 3 displays show the other tabs for manual entering after a test.

Patient data related to test: Date: 12/12/2003 Time: 15:14:0)9	\$
MAP 0 mmHg SYS 0 mmHg DIA 0 mmHg Norm NIBP Exercise User	7 8 9 ← 4 5 6 Del 1 2 3 - 0 . ← →	Cancel Update

The systolic and diastolic blood pressure can be entered manually before or after the test, if the internal or connected blood pressure device is not used. The MAP is calculated as 1/3*SYS + 2/3*DIA.

Patient data related to test: Date: 14/09/2003 Time: 17:21:5	50	•
Load Watt Speed km/h v Slope %	7 8 9 ← 4 5 6 Del 1 2 3 - 0 . ← →	Cancel Update

The Load field is designed for entering the workload on a bicycle ergometer, and the Speed and Slope for the setting on a treadmill. They are automatically updated running an exercise protocol.

Patient Date:	data related to test: 12/12/2003 Time: 15:14	:09
User1 User2 User3 User4 User5	x m cm	7 8 9 + 4 5 6 Del 1 2 3 - 0 . + + Cancel
Norm	NIBP Exercise User	Update

2.4.10 Prints

Printing out a report of the data is supported via the **Print Prev.** First a preview of the data is shown on the screen, and the user can as default select between different layouts via the tabs. The **Print** will print out the actual page. The print layout is defined in the file PrintSetup.Ini, see sections 3.5.5 & 3.9.2, 3.9.3 & 3.9.4. **Printers** can be used to delete print jobs or select another printer.

Below is shown an example of each of the default print previews.











2.5 SETUP

2.5.1 Test Parameters

The setup is entered from the main menu or directly from the measurement menu.



The **Bag volume** is the total amount to fill into the rebreathing bag. The Bag volume is calculated automatically based on 44% of the predicted value for the vital capacity (VC) of the patient (*E. Berglund et al., Acta Medica Scandinavica. Vol. 173, fasc. 2, 1963*). Note, the bag volume is only calculated when a patient is selected. If the user changes the bag volume, the bag volume is not changed automatically – not until the patient is selected again.

The prediction of the VC is based on the following formulae:

Male:

VC = Exp(2.512+0.4395*ln(Age)-0.01525*Age-340.80/Height) Female: VC = Exp(3.077+0.2667*ln(Age)-0.01472*Age-366.40/Height)



The figure below shows the predicted bag volume for males at different age and height:

Figure 2.5.1–1 Predicted bag volume for males.

When entering the setup menu before a patient is selected, the **Bag volume** is dimmed, because the patient data needed for the prediction of VC / bag volume is not known.

When setting the bag volume the following points shall be taken into consideration:

- The patient shall be able to inspire the complete volume during the first inspiration
- The patient must not make a too big effort to empty the bag
- The bag shall contain enough gas to give good quality of the signals after mixing
- The bag must contain enough oxygen for the exercise level
- The volume must not exceed the maximum capacity of the bag (default 3 litre)

Normally a volume between 1.5 and 2 litre is suitable during rest.

The **Initial NIBP pressure** defines the pressure from where the NIBP module starts measuring. The Initial NIBP pressure must be set higher than the expected systolic pressure of the subject. Default value is 160 mmHg.

Pressing the ▼ button will show more setup parameters.

Setup				29/08/2003 13:48:03
Estimated: Maximal Bag volume Initial NIBP pressure Bolus Fraction Rebreathing freq. Max CO2 limit Min O2 limit Insp./Exp. Beep	VO2: I/min 160 mm 10.00 % 20 pr. 8.00 % 13.00 % Short •	Maximal Load: 7 8 1 7 1 2 min	- Watt 9 ← 6 Del 3 - Default Undo	Ambient Graphics Date Language Gas Cylinder O2Adjust Service Help
				Exit Setup

The rebreathing bag is filled prior to a test with an oxygen (O_2) enriched mixture containing two foreign gases; typically 0.5% nitrous oxide (N_2O) and 0.1% sulphur hexafluoride (SF₆). The filling is done in two steps:

- A bolus part is filled from the gas bottle containing 94% O₂, 5% N₂O and 1% SF₆.
- The rest is coming from air via an air pump.

Under normal resting conditions it is recommended to use 10% bolus and 90% air, which gives a mixture of:

- O₂ = 28.3%
- $N_2O = 0.5\%$
- $SF_6 = 0.1\%$

The **Bolus fraction** is the amount of gas coming from the gas bottle, and the following points must be taken into consideration:

- The bolus fraction must be between 7.5% and 20% of the total bag volume (can be increased to 50%, see GasSystem.ini in section 3.5.10).
- The bag must contain enough oxygen for the exercise level. (O₂ > 13% at the end of the test). Higher bolus → more oxygen.

It is recommended to set the bolus to 10% of the total bag volume during rest, and higher at higher exercise level (>150 watt). When the bag volume, bolus fraction and patient data is known, the software estimates the maximal Vo_2 and maximal work load, which is possible with the given settings.

See section 2.3.2.1.2 for details on recommended bag volumes at different exercise level.

The **Rebreathing frequency** is the frequency that the patient is guided to follow during the test. The rebreathing frequency should be set in the range 20 to 30 breaths per min. It is recommended to use a higher breathing frequency than the natural respiration rate under rest, but at exercise the natural respiration rate can be used. If the breathing frequency is low, it will take relatively long time to get enough respiration cycles, and the risk of re-circulation increases.

The **Max CO2 limit** is the threshold, where the rebreathing automatically stops if it sees a CO_2 concentration exceeding the limit. The default value is 8%, but if the patient can tolerate a higher concentration for a short period the limit can be increased. 10% is normally an acceptable value.

Similarly with the **Min O2 limit**, which is the threshold, where the rebreathing stops if it sees an O_2 concentration below the limit. The minimum value for **Min O2 limit** is 13% - having values lower than that can result in wrong calculation of Vo₂, because it can not be assumed that the oxygen is fully saturated in blood below 100 Torr. The **Min O2 limit** is used in the estimation of the maximum Vo₂.

The estimation of the maximal Vo_2 and maximal exercise load is based on the current setup of bag volume, bolus fraction, min. O_2 limit and patient weight:

$$\operatorname{Max} \operatorname{Vo}_{2} = \left(\frac{20.95 - \operatorname{Min} \operatorname{O}_{2}}{100} \bullet \frac{100 - \operatorname{Bolus} \operatorname{Fraction}}{100} + \frac{94 - \operatorname{Min} \operatorname{O}_{2}}{100} \bullet \frac{\operatorname{Bolus} \operatorname{Fraction}}{100}\right) \bullet \operatorname{V}_{\text{bag}} \bullet \frac{\operatorname{Re} \operatorname{breathing} \operatorname{Freq}}{\operatorname{Good} \operatorname{Breaths} + 1.5}$$
$$\operatorname{Max} \operatorname{Load} = \frac{\operatorname{Max} \operatorname{Vo}_{2} - 0.0035 \bullet \operatorname{Weight}}{0.0103}$$

Insp./Exp. Beep defines the mode of the sound guiding during rebreathing. The following 3 modes are supported:

- Off No sound
- Short A short beep is given at the beginning of each expiration and inspiration
- Long A high continuous tone is present at each expiration, and a lower continuous tone is present under each inspiration.

2.5.2 Hidden Manoeuvre / Calculation Parameters

Additional manoeuvre and calculation parameters are hidden from the normal user, and the parameters are normally not necessary to change. The menu of the manoeuvre / calculation parameters is entered by pressing the lower left corner and the lower right corner of the bottom menu – see below.

Setup				29/08/2003 13:48:03
Estimated: Maximal VO2 Bag volume Initial NIBP pressure Bolus Fraction Rebreathing freq. Max CO2 limit Min O2 limit Insp./Exp. Beep Sho	- Vmin Iitre 160 mmHg 10.00 % 20 pr. min 8.00 % 13.00 %	Maximal Load: 7 8 4 5 1 2 0 .	- Watt 9 + 6 Del 3 - + + Default Undo	Ambient Graphics Date Language Gas Cylinder O2Adjust Service
				Help
1			2	Exit Setup

Setup		22/03/2007 15:00:27
Estimated: Maximal VO2: I/min Maximal Max. rebreathing time 25 sec. Mixing threshold 15.00 % Breath-holding Time 200 msec. Pre-rebreathing breaths 3 sec. Breaths after mixing. 3 sec. Normal Manoeuvre Calculation Hardware	il Load:	Ambient Date User Params Language Protocol setup Gas Cylinder O2Adjust Service Help
		Exit Setup

2.5.2.1 Manoeuvre parameters

The **Max Rebreathing time** is the maximal total time breathing in/out of the rebreathing bag. Normally the test is stopped before the **Max Rebreathing Time**, but if the patient cannot achieve good mixing, the test will stop when the time expires. The rebreathing time must not be too long to avoid re-circulation. The time for re-circulation is not an exact time, but in the order of 20-25 seconds at rest and lower at increasing blood flow.

The **Mixing threshold** is used on the insoluble gas to determine when the gas mixing is sufficient to start calculation. The default / recommended value is 15%. See the description of **Insoluble gas** (SF_6) in section 2.4.6.4.

Breath-holding time defines the delay between activating the valves/balloons in the RVU. First the port to ambient air is closed, and then a small waiting period before the port to the rebreathing bag is opened. The small delay is necessary because the ports are not responding immediately. In order to avoid open circuit from the bag to ambient air the delay is needed. Default value is 0 ms for an Innovision valve and 500 ms for a Hans Rudolph valve.

The **Pre-rebreathing breaths** sets the number of breaths the Innocor shall detect before the start of the rebreathing is enabled. The value is used to ensure some stability of the patient before starting.

The **Breaths after mixing** defines the number of breaths - after good mixing is achieved - before the rebreathing is stopped. The default / recommended value is 3 and defines also the number of breaths that shall be used for the calculation of rebreathing parameters.

2.5.2.2 Calculation parameters

Setup			22/03/2007 15:35:27
Estimated: Maximal VO2: -	— I/min M	aximal Load: — Watt	Ambient
All or Expiration	Exp. points -	7 8 9 ← 4 5 6 Del	Date
Calculation on insoluble	Reg. line 🔻		User Params
Vti in CO calculation	Fixed -		Language
Fixed Vti value Bag dead-space	0 mi	Default	Protocol setup
Valve dead-space	0 mi		Gas Cylinder
Skip at end of exp. Skip at start of exp.	15 % 30 %		Calibrate
Zero Position in first insp.	50 %		Service
Solubility coef. for tissue Solubility coef. for blood	0.407		
Normal Manoeuvre Calcu	Help		
			Exit Setup

All or Expiration defines if the calculation shall use all samples or only the expiration parts. Default / recommended setting is **Expiration**.

Expiration based on is used to determine which gas signal the software shall base the detection of the inspiration / expiration periods on. Both the O_2 and the CO_2 can be used. The O_2 is set as default, if the oxygen module is implemented.

Calculation on insoluble can be set to regression line or average. If set to regression line the insoluble curve is fitted with a regression line within the calculation period, and the mix value is found by extrapolation back to time zero. If set to average the mix value is found as a simple mean. The default / recommended setting is regression line.

Vti in CO calculation defines whether the actual calculated Vti or a fixed Vti shall be used in the calculation formulae for determination of the Cardiac Output. The calculation of the Vti is not as accurate as the other parameters, and the default / recommended setting is therefore to use a fixed value of Vti.

Fixed Vti value is the value used in case of using a fixed Vti in the calculation of the CO, see above. The default value is 600 ml.

Bag dead-space defines the small volume present in the bag after evacuation. The value for the standard Innocor RVU is 13 ml. See picture below.

Valve dead-space is the volume of the RVU from the mouthpiece connection to the bag port. The value for the standard Innocor RVU is 102 ml. See picture below.

Skip at end of exp. is used to skip the last part of the expiration in order to remove the transition phase from expiration to inspiration. Default / recommended skip value is 15%.

Skip at start of exp. is used to skip the first part of the expiration in order to remove the transition phase from inspiration to expiration. Default / recommended skip value is 30%.

Zero position in first insp. defines where time zero is positioned in the first inspiration. Time zero is used in the determination of the mix value when interpolating back on the regression line on the insoluble curve. Further the time zero is used in the calculation of the Vti. Valid range is 0 to 100%. A value of 0% means at the start of the first inspiration, and 100% means at the end of the first

inspiration. Default / recommended value is 50%.

Solubility coef. for tissue should for N_2O be set to 0.412.

Solubility coef. for blood should for N_2O be set to 0.407.



2.5.2.3 Breath-by-Breath setup

Setup	01/06/2005 14:08:12
Estimated: Maximal VO2: Umin Maximal Load:	Ambient Date User Params Language Gas Cylinder Calibrate Service
Normal Manoeuvre Calculation BBB	Help
	Exit Setup

The Breath-by-Breath data can be averaged during on-line and off-line display by the **BBB Filter Time**. The filter is a moving average filter.

O2 flow to gas delay is the delay time of the O_2 gas signal compared to the flow found during the flow gas delay calibration, see section 2.5.9.3. Similar with **CO2 flow to gas delay**, which is the delay time of the CO₂ gas signal compared to the flow. Both delays are typically in the range 1400 to 1700 ms. The values should not be entered manually, but measured by the flow gas delay calibration.

Valve to Mouth dead space is the volume of the respiratory valve unit from the inlet to the mouth. The default value is 120 ml for a valve connected with mouthpiece and bacterial filter (PALL). If a flexible tube is used the value 172 ml shall be used instead. The Valve to Mouth dead space is

subtracted from the calculated fowler dead space in order to get the real Vd (anatomical dead space) of the subject.



2.5.2.4 Hardware setup

Press the **Hardware** tab. The default setup is shown below where all data are collected from the internal units of Innocor: Nonin (Hr & SpO₂) and SunTech (Blood pressure). But the Innocor S/W can also get heart rate and blood pressure data from external exercise devices.

Hr driver	Nonin
SPO2 drive	r Nonin 🔽
BP driver	SunTech 🔽
Hardware	
Normal	Manoeuvre Calculation BBB

Example: If the HR & Blood pressure shall be collected from the Ergoline ergometer the setup shall be:

Hr driver	Ergoline_BIKE	•
SPO2 driver	Nonin	•
BP driver	Ergoline_BIKE	-

2.5.3 Ambient

The ambient menu is used to set the actual ambient conditions with respect to temperature, humidity and pressure.

Temperat	ure 25 deg C 💌	
Pressure	760 mmHg 💌	
Rel. humi	dity 50 [%]	
7	8 9 +	Ok
4	5 6 Del	
1	2 3 +	Cancel
0		

Limits:

Temperature:	0-50 °C / 32-122 °F
Pressure:	525-800 mmHg / 700-1066 mbar
Humidity:	0-100%

2.5.4 Date

In the **Date** menu the actual time and date can be adjusted. Different date formats are supported.

Set System Time and Format.					
Year 2003 Month 8 Day 29	Hour 12 Minute 49 AM/PM	dd/MM/yyyy M d yyyy MM dd yyyy yyyy MM dd			
4 5 6 Du 1 2 3 - 0 . +	el → Set	d M yyyy dd MM yyyy dd MMM yyyy	Exit		

2.5.5 User defined parameters

The Innocor software supports up to 5 user defined parameters (numbers). The parameters are defined in the **User Params**. The name of the user defined parameters are limited to standard characters [a..z,A..Z,0..9,_]. A user defined parameter is deleted by deleting the name of the parameter. A user defined parameter can be renamed without loosing the data corresponding to the field.

User defined parameters are manually entered before or after a test, see section 2.4.9.

ress New to create a new parameter or ress a field to edit		
Name	Unit	New
User1	x	
User2	m	
User3		
User4	cm	
		Cancel
		ОК

2.5.6 Language

From the Language menu the user can select which language to use. Pressing OK will immediately change the language of all text without the need for restarting the Innocor. The number of supported languages can vary.



2.5.7 Protocol setup

The **protocol setup** is used to make user defined protocols. (If the protocol setup is not present in the setup menu the software is running in a basic version without the support for exercise protocols).

A treadmill protocol is defined through the following table:

Edit protocol							
Protocol n	ame: tread	Imill					Auto
Steps: 7		Тур	e: O Bic	ycle (Treadmill		
Step/Action	Slope (%)	Speed	Time (min.)	Bag (litre)	Bolus (%)	RB. freq.	RB/NIBP
1 💦	0.0	5.0	5.0	2.0	10.0	20.0	
2 🦨	1.0	5.0	5.0	2.0	10.0	22.0	
3 🦨	1.0	6.0	4.0	2.0	10.0	24.0	
4 🥐	2.0	6.0	4.0	2.5	10.0	26.0	
5 🥐	2.0	7.0	3.0	2.5	10.0	28.0	
6 🥐	3.0	7.0	3.0	3.0	15.0	30.0	Cancel
7 🥐	3.0	8.0	3.0	3.5	20.0	32.0	
		•					ОК
	2 3	4	5 6	7 8	9		= + Del
Tab q	w e	l i i	У	<u>u</u> i	o p		
Caps E	s d	f	g h	j k			
Home	Z	xc	V b		"].		PgUp 🕇 PgDn
End	Alt Gr						÷÷÷

The **protocol name** is the name of the protocol and is user defined. The protocol name is also used as the filename when saved in the folder C:\INNOCOR\PROTOCOL. The extension of the file is PRO.

The **type** can be either Bicycle or Treadmill. The bicycle type uses the load, whereas the treadmill uses the slope and speed for the exercise level.

The **Step/Action** field indicates the number of steps in the protocol, and what to do at each step. Each step can be one of the following modes:

- *****____ rebreathing test at the end of the step
- 🦓 🌭 rebreathing test and blood pressure measurement at the end of the step
 - continue with next step without doing anything

The RB /NIBP button is used to toggle between the modes.

Slope is the elevation of the treadmill in %. A higher slope will increase the exercise level.

Speed is the running speed of the subject. The unit can be km/h or mph and is set in the measurement menu. See section 3.11.3. A higher speed will increase the exercise level.

Time is the duration of the step in minutes. If the exercise is relatively low it is recommended to have at least 5 minutes between each rebreathing step in order to avoid recirculation, but if the exercise level is higher the time can be decreased to 3 minutes. An incremental exercise test with a ramp increasing load can be programmed by changing the load in small steps every 0.5 minutes.

The field for the **bag** contains the volume of the rebreathing bag in litre. A higher exercise level requires a higher bag volume in order to have enough oxygen and to reduce the carbon dioxide

concentration at the end of the test. The bag can be set to a fixed volume or set to auto. In the auto mode the Innocor S/W estimates the volume based on the current exercise level and previous tests. See section 2.3.2.1.2 & 2.3.2.1.3.

The **bolus** is the fraction of bolus gas in the rebreathing bag. A higher bolus fraction will increase the amount of oxygen in the bag, which can be useful during high exercise level, where the bag volume cannot be increased anymore. If set to auto the Innocor S/W estimates the bolus fraction based on the current exercise level and previous tests in order to have enough oxygen in the bag. See section 2.3.2.1.2 & 2.3.2.1.3.

The target of the rebreathing frequency is entered in the **RB. freq.** in breaths per minute. The field can be fixed or auto. In auto mode the frequency is estimated to be equal to the actual breathing frequency in the previous test. A slow breathing frequency will increase the requirements to the bag volume due to a longer rebreathing time.

Recommendation:

It is recommended to use the auto mode for both the **Bag** and **Bolus** in order to have an optimal bag filling. The **RB. freq.** can also be set to auto, but if the patient does not breathe regularly, the bag filling will be over or under estimated, in which case a fixed **RB. freq.** is preferred. Use e.g. 20/min at low exercise, increasing to 25/min at middle range and 30/min at high exercise level.

An irregular breathing can result in the following case:

- During a test the patient breathes faster than normal.
- This higher breathing frequency will then be used for the estimation of the next bag volume / bolus.
- But during the next test, the patient is breathing normally again, i.e. the test is longer than expected, and there may be a risk of having a too high CO₂ or too low O₂ concentration.

Below is shown a protocol of the bicycle ergometer type.

In the bicycle ergometer type the exercise level is defined by the **Load** field - entered in watt. A higher load will increase the exercise level.

Edit protocol							
Protocol r	nam	ne: bagauto	I				Auto
Steps: !	5		Туре:	 Bicycle 	 Treadm 	ill	
Step/Action	n	Load (w att)	Time (min.)	Bag (litre)	Bolus (%)	RB. freq.	RB/NIBP
1 🦓 🕺	▶	0.0	5.0		10.0	20.0	
2		25.0	5.0		10.0	22.0	
3		50.0	4.0		10.0	24.0	
4		75.0	4.0		10.0	26.0	
5 🥐 🦻		100.0	3.0		10.0	28.0	
							Cancel
							OK
		2 3	4 5	6 7	8 9		
Tab q	J.	* e		y u	i	P [
Caps a S d f g h j k l ; ' #							
Home \							
End	Alt	Gr					+++

New line: A new line can be added to a protocol by first pressing a step in the Step/Action field (The complete line will then be highlighted). Then press the ENTER key, and an extra line will be added after the current step. The contents of the new line will be a copy of the current step.

Move line: A line can be moved up or down by first pressing the step to move in the Step/Action field (The complete line will then be highlighted). Then press the up or down arrow to move the line.

Delete line: A line can be deleted by first pressing the step to delete in the Step/Action field (The complete line will then be highlighted). Then press the Del key and the line will be removed.

2.5.7.1 Treadmill protocols

Different incremental treadmill protocols are used when testing patients. Some of them are given below:

2.5.7.1.1 Bruce protocol

Standard Bruce protocol:

Step	Speed		Slope	Time
	km/h	mph	%	min
1	2.74	1.7	10	3
2	4.02	2.5	12	3
3	5.47	3.4	14	3
4	6.76	4.2	16	3
5	8.05	5.0	18	3
6	8.85	5.5	20	3
7	9.65	6.0	22	3
8	10.46	6.5	24	3
9	11.26	7.0	26	3
10	12.07	7.5	28	3

Modified Bruce protocol for elderly or sedentary patients:

Step	Spe	eed	Slope	Time
	km/h	mph	%	min
1	2.74	1.7	0	3
2	2.74	1.7	5	3
3	2.74	1.7	10	3
4	4.02	2.5	12	3
5	5.47	3.4	14	3
6	6.76	4.2	16	3
7	8.05	5.0	18	3
8	8.85	5.5	20	3
9	9.65	6.0	22	3
10	10.46	6.5	24	3
11	11.26	7.0	26	3
12	12.07	7.5	28	3

2.5.7.1.2 Ellestad protocol

Ellestad protocol:

Step	Speed		Slope	Time
	km/h	mph	%	min
1	2.74	1.7	10	3
2	4.83	3.0	10	2
3	6.44	4.0	10	2
4	8.05	5.0	10	3
5	9.65	6.0	15	2
6	11.26	7.0	15	2
7	12.87	8.0	15	2

2.5.7.1.3 Naughton protocol

Naughton protocol – every second step is at rest:

Step	Spe	eed	Slope	Time
	km/h	mph	%	min
1	1.61	1	0	3
2	0	0	0	3
3	2.41	1.5	0	3
4	0	0	0	3
5	3.22	2	0	3
6	0	0	0	3
7	3.22	2	3.5	3
8	0	0	3.5	3
9	3.22	2	7.0	3
10	0	0	7.0	3
11	4.83	3	5.0	3
12	0	0	5.0	3
13	4.83	3	7.5	3
14	0	0	7.5	3
15	4.83	3	10.0	3
16	0	0	10.0	3
17	4.83	3	12.5	3
18	0	0	12.5	3
19	4.83	3	15.0	3

2.5.7.1.4 Astrand protocol

Astrand protocol:

Step	Speed		Slope	Time
	km/h	mph	%	min
1	8.05	5	0	3
2	8.05	5	2.5	2
3	8.05	5	5.0	2
4	8.05	5	7.5	2
5	8.05	5	10.0	2
6	8.05	5	12.5	2
7	8.05	5	15.0	2
8	8.05	5	17.5	2
9	8.05	5	20.0	2
10	8.05	5	22.5	2
11	8.05	5	25.0	2

2.5.7.1.5 Balke protocol

Balke protocol:

Step	Spe	Speed		Time
	km/h	mph	%	min
1	5.03	3.3	0	1
2	5.03	3.3	2	1
3	5.03	3.3	3	1
4	5.03	3.3	4	1
5	5.03	3.3	5	1
6	5.03	3.3	6	1
7	5.03	3.3	7	1
8	5.03	3.3	8	1
9	5.03	3.3	9	1
10	5.03	3.3	10	1
11	5.03	3.3	11	1
12	5.03	3.3	12	1
13	5.03	3.3	13	1
14	5.03	3.3	14	1
15	5.03	3.3	15	1
16	5.03	3.3	16	1
17	5.03	3.3	17	1
18	5.03	3.3	18	1
19	5.03	3.3	19	1
20	5.03	3.3	20	1
21	5.03	3.3	21	1
22	5.03	3.3	22	1
23	5.03	3.3	23	1
24	5.03	3.3	24	1
25	5.03	3.3	25	1
26	5.03	3.3	26	1
27	5.03	3.3	27	1
28	5.03	3.3	28	1
29	5.03	3.3	29	1
30	5.03	3.3	30	1

2.5.8 Gas cylinder

2.5.8.1 Gas Cylinder identification

Innocor Gas-Cylinders are given a **cylinder number**. The number is placed at the **bottom of the cylinder** with the following format:

030206 9152235

The first number is: year – month – date. The second number is a control number.

Note: a gas bottle expires 2 years after the date on the gas bottle. I.e. the Innocor S/W will return an invalid number if an expired gas bottle is used.

2.5.8.2 Entering a gas cylinder number

The gas cylinder numbers in use can always be seen from the **SETUP** menu by pressing the "**Gas-cylinder**" button. The Gas-cylinder window displays a list of known Gas Cylinders (upper table) and the Gas Cylinder in use. The following data is present for each Gas Cylinder:

Gas Cylinder No. = Rem. Volume [ml] =	The gas cylinder number The remaining volume in the gas cylinder estimated from the initial gas cylinder pressure and used gas during rebreathing tests. When a new gas cylinder is entered the remaining volume will be set to 18600 ml, (150 ml x 124 bar). In case of leakage the remaining volume will be higher than what is actually present in the gas cylinder
Performed Test =	The number of tests performed using the gas cylinder. Depending on the bolus and bag setting it is possible to perform approx. 75 tests.

The System Pressure shows the actual gas cylinder pressure in bar for the gas cylinder mounted.

Select an action	1		
Other known Ga	s Cylinders		
Gas Cylinder No.	Rem. Volume [ml]	Performed Test	Enter New
040304.4168396	4425	3	Cylinder No.
040611.9332217	12300	0	Delete
Data for Gas Cyl 031118.2166012	inder in use: 7206	25	Change Gas Cylinder
System pressu	re: 82		Exit

A new gas cylinder can be entered using the **Enter New Cylinder No.**, and the screen below will appear. The gas cylinder shall be screwed completely down, and if it is a new gas cylinder the system pressure shall be > 124 bar. The gas cylinder no on the bottle shall be entered, and when verified the gas cylinder is added to the list.

<u>New Cylinder</u>				
1. Wait for the	pressure to be sta	ble		
2. Select a Ga	s Cylinder no. from	the upper table		
or enter a ne	ew number.			
Other known Gas	Cylinders			
Gas Cylinder No.	Rem. Volume [ml]	Performed Test	Enter New	
040304.4168396	4425	3	Cylinder No.	
040611.9332217	12300	0	Delete	
			Dottie NO.	
		•	Change	
Data for Gas Cyli	Data for Gas Cylinder in use:			
031118.2166012	7206	25		
,	Enter new Cylind	er No.		
	7 8	9 + 32	6061	
	—			
	0.	+ + OK		
System pressure	e: 80		Exit	

If a gas cylinder shall be removed before connecting a new, the **Change Gas Cylinder** button shall be used, where the user first turns the gas cylinder 1½ turns counter-clockwise in order to close the main valve on the gas cylinder. The user then presses the **Pressure Release** button in order to release the internal pressure of Innocor (a small "click" can be heard from the gas supply when the pressure is released), and the gas cylinder can be removed completely. If the internal pressure is not released before the gas cylinder is removed the o-ring on the gas cylinder connection can come out of position. When a new gas cylinder is screwed down, the o-ring will be damaged and the system will not be gas tight.

Change Gas Cyli	nder			
1. Turn the Ga	s Cylinder 1½ turn	s counter-clockwise		
2. Press "Pres	s. Release"			
Wait for the	system pressure t	o drop below 10 bar		
Other known Gas	Cylinders			
Gas Cylinder No.	Rem. Volume [ml]	Performed Test		Enter New
040304.4168396	4425	3		
040611.9332217	12300	0		Delete
				Dottio NO.
			-	Change
Data for Gas Cyli	nder in use:			Gas Cylinder
031118.2166012	7206	25		Pressure
				Release
	.			
System pressure	e: 80			Cancel

A gas bottle is automatically removed from the list when the remaining volume drops to 0 or if the gas expires (2 years after the date on the bottle). A gas cylinder can be deleted from the list using the **Delete Bottle No**. This is helpful if a gas cylinder is e.g. empty and returned to Innovision or used on another Innocor, but the status of the gas cylinder in the gas cylinder list is not recognised

as empty. Note: when a gas cylinder is deleted from the list it can not be entered again – the software sets the status to empty when a gas cylinder is deleted.

2.5.8.3 Gas cylinder information

When the gas cylinder pressure drops below 10 bar the following message pops up to warn the user about a nearly empty gas cylinder:

Confirmation		
Gas Cylinder No.: 031118.2166012 The Gas Cylinder is nearly Empty		
ОК		

If the Innocor sees a gas cylinder with a lower pressure than expected, the user is first prompted:

2 Confirmation					
Gas Cylinder No.: 040611.9332217 Is the Gas Cylinder screwed down firmly ?					
Yes No					

If the user presses yes to confirm that the gas cylinder is screwed down, the following message appears:

Confirmation			
There might be a gas leakage!			
ок			

If the Innocor sees a gas cylinder with a higher pressure than expected, it is assumed that a new gas cylinder is connected, and the user is prompted:



After pressing OK the gas cylinder menu is shown and the user can enter the gas cylinder number.

The bottle pressure reading at the bottom of the screen changes colour to yellow when entering the "The Gas Cylinder is nearly Empty" mode (below 10 bars). When the bottle pressure gets below 2 bars the colour changes to red.



2.5.8.4 Standby of gas supply

When entering the main screen of the Innocor S/W all pneumatic valves are closed. This allows the user to disconnect the RVU when the main screen is shown. The user can replace the insert of the RVU without loosing gas.

2.5.9 Calibration

Enter Setup and select Calibration.



2.5.9.1 O₂ adjust

The O_2 adjust is used to make a single adjustment of the oxygen signal. The calibration requires ambient oxygen at standard 20.93%. The user must temporarily disconnect the inlet from the RVU or ensure that ambient conditions are present in the RVU. The calibration is a built-in 1-step calibration of the oxygen sensor module.



2.5.9.2 Flowmeter Calibration

The **Adjust Flowmeter** is used to adjust the flowmeter calibration (offset & gain) by applying a know volume to the flowmeter. It is recommended to make a daily calibration check of the flowmeter gain.

The flow is calculated as:

Flow = Gain • Table(raw signal – offset)

Where

Raw signal =	The output of the differential pressure sensor in volt
Offset =	The offset of the differential pressure sensor found by auto zeroing
Gain =	The day to day gain factor, which should be in the range [0.9 – 1.1]. Two gain
	factors are used – one for inspiration and one for expiration.
Table =	The Innocor has a built-in standard factory flowmeter calibration table based on
	a multi stroke calibration (Yeh et al. 1982).

2.5.9.2.1 Flowmeter Calibration procedure

Enter Setup and select Calibration – Adjust Flowmeter.

Calibration performed					
flow/vol	Fill	Empty	Syringe		
low	3.07553	3.04714	3 litre ₹		
low	3.08626	3.05415			
medium	3.08143	3.05946	Calibrate		
medium	3.03958	3.03842			
high	3.04203	3.03790			
Gain	Fill	Empty	OK		
Prev	1.00226	1.00000			
New	0.98102	0.98444	Exit		

- Connect a 1 litre or 3 litre calibration syringe to the RVU, and set the S/W switch accordingly (Syringe 1 litre or Syringe 3 litre).
- Empty the syringe
- Press **Calibrate** to start the calibration.
- Fill the syringe at a relatively low rate without "bumping" at the end.
- When the S/W is ready empty the syringe again at a low rate.
- Repeat the filling and emptying until 2x5 strokes have been applied, and the **OK** button is highlighted.
- Increase the flow rate at each of the 2x5 strokes in order to try to cover the physiological test range.
- Press **OK** if the new gain values are in the range 0.9 to 1.1, otherwise replace the flowmeter screen and repeat the calibration.

Note: The flowmeter is automatically offset adjusted prior to each stroke.

2.5.9.3 Gas delay calibration

The Breath-by-Breath calculation contains an integration of the product of flow and gas, and because the gas measurement is delayed through the sample line, it is necessary to correct for this delay. The delay is typically in the range 1400 to 1700 ms, but can vary from instrument to instrument. A change of the inlet sample line can also change the delay. A longer delay is normally caused by a reduced inlet sample flow, probably caused by a dirty particle filter on the inlet sample line. Make a visual inspection of the particle filter – if the inner material is grey or black it is time to replace it.

The flow gas delay is calibrated by looking at the gas and flow change during the shift from expiration to inspiration. The calculation is taking into account the dead space volume from the inlet out to ambient air, which is 45 ml for a standard configuration. In order to have an accurate flow gas delay calibration the inspiration must be fast / forced, and an average of up to 10 breaths is used to improve the determination.

The calibration of the flow-gas delay is critical – an error of 25 ms can give a 5% error on the Vo_2 and Vco_2 results!

It is recommended to perform the flow gas delay calibration every day.

When performing a Breath-by-Breath exercise test the flow gas delay is as default automatically adjusted when the exercise level exceeds a certain level – typically above 1/3 of the subjects maximum exercise level.

2.5.9.3.1 Gas delay calibration procedure

Enter **Setup** and select **Calibration** – **Calculate gas delay**. Wait 1 minute for warm up.



When warmed up the operator (not the subject) starts breathing in and out of the RVU. When ready the **Calibration** button is pressed. The operator must then make at least 11 slow expirations each followed by a very fast inspiration until the **OK** button is highlighted. The inspirations have to be fast in order to get a precise determination of the flow-gas delay. If one or two breaths fail the software will automatically filter these results. The delays should not vary more than 20-40 ms from day to day, if the same gas sample inlet is used.

Note:

- A gas cylinder must be connected in order to close the RB valve during the delay calibration.
- The BBB port on the RVU must not be connected to other devices during the delay calibration.

See section 3.5.10.6 for advanced setup of the gas delay calibration.

2.5.10 Service

The service is only intended for technical personnel. The service menu contains functions for troubleshooting and calibrations. Pressing the corners in the message box in a specific order gives access to the service menu:



A short description of the service functionality is given here; a more detailed description can be found in the Innocor Service Manual (COR-MAN-0000-002-IN).



2.5.10.1 Signals

In this menu the user specifies the channels to measure by pressing the channel name. When the background becomes coloured it is enabled; when the background is white the channel is disabled. The selected signal is displayed numerically in the upper left corner, and the graphical display can be adjusted using the **Offset** and **Scale** parameters. The **Find Signal** can be used to automatically adjust the **Offset** to display the signal in the middle of the screen.

The Log File can be used to record the signals in a file.

If a channel shall be used for SNR measurements in the **Signal Stat.** the text shall be written in italics. Select mode by pressing the channel name and the **Select Stat**.

Selected Signal: 0.056	PGA Reg. No.: 164	Dig	g. Oxygen: <mark>21.13%</mark>	
0.30 0	5 <u>2025</u> 30	35 40	45 50 55	Flow Pump OFF
				- Find Signal
0.15	a new state and a state of the st			Clear Graph
				Stop Graph
0.00				Print
Offset : Scale : 0.00 0.30	Offset Step Size	1.00	10 Samp. Int.: ms	Log File
Number of samples : 1000	_	Mean S	D. Mean/SD	Start
7 8 9 🔶	Dig 02	21.124 0.0	1266 795	Reset PGA
4 5 6 Del		21.124 0.0	130	Oxigraf Status
1 2 3 -				
	J	Start		
Signals Signal Stat. PG/	A Zero PGA Mix.	Oxygen Cal. Blo	od Press. Misc.	Exit Service

2.5.10.2 Signal Stat.

Select the number of samples to use in the measurement of mean, SD and Signal to Noise Ratio. Press Start to make a measurement

2.5.10.3 PGA Zero

PGA Zero is used to adjust the offset calibration of the PGA. It should only be done by qualified personnel.

2.5.10.4 PGA Mix

PGA Mix. is used to adjust the gain calibration of the PGA using a single mixture gas. It should only be done by qualified personnel.

Selected Signal: 20.930	PGA Reg. No.: 0	Dig. Oxygen: 20.99%	
26.00 0	<u>15 20 25 30</u>	35.40.45.50.55	Pump Active
-			Find Signal
21.00			Clear Graph
			Stop Graph
16.00			Print
Offset : Scale : 16.00 10.00	▲ Step Size	0.01 10 Samp. Int.:	Log File
	Oxygen Calibra	ation	Start
What to do Select High or Low Oxyger	n Conc.	Nominel Reference Gas Conc.	Reset PGA
High Conc. will start a 2 pr	oint calibration	▲ ▼	Oxigraf Status Help
Reset Save a	nd Exit Exit	Set High Conc. Set Low Conc.	Exit Service

2.5.10.5 Oxygen Cal.

Press **Set High Conc.** to start a 2-point calibration of the oxygen signal and follow the instructions on the screen. First the Oxigraf (oxygen module) will be calibrated, followed by the analogue signal to the PGA (gas analyser).

2.5.10.6 Blood Pressure

Blood Pressure is used to calibrate the blood pressure module. This should only be done by qualified personnel.

2.5.10.7 Misc.

In **Bolus Fill** a calibration of the bolus filling flow can be performed. This should only be done by qualified personnel.

Selected Signal: 0.049	PGA Reg. No.: 164	Dig. Oxygen: 21.23%	
0.30 0	<u>15 20 25 30</u>	35.40.45.50.55	
0.15			
0.00			
Elapsed time All valves off.	Bolus Fill Air Fill Press	s Sensor Valve Beep	Log Filo
Close to Reb. Bag (Pneu1) Close to open Air (Pneu2) Air String, for Bag fill (AIR) Bolus bag fill (Rebreathing)	Bolus Vol. [ml] = 237 (21)	9 ml STPD)	Ctert Deset.DOA
Airway Zerocal (PAW) Reb. Bag Evacuation (EVAC) Bag Pump	Test Bolus		Christel Status
Spare	Flow Speed: 44.68 ml/se	90	Holp
Signals Signal Stat.	PGA Zero PGA Mix. Ox	ygen Cal. Blood Press. Misc.	Exit Service

In **Air Fill** a calibration of the air filling flow can be performed. This should only be done by qualified personnel.

Selected Signal: 0.049	PGA Reg. No.: 164	Dig. Oxygen: 21.29%	
0.30 0	<u>15 20 25 30</u>	- 	Close Dump_055
			- Find Signal
0.15	an a		- Close Croph
			Stop Scoph
0.00			Print
Elapsed time	Bolus Fill Air Fill Pres	s Sensor Valve Beep	Log Cito
Close to Reb. Bag (Pneu1) Close to open Air (Pneu2)	Air Vol. [ml] = 2163 [10	000 ml, 5000 ml]	Stort
Air String, for Bag fill (AIR) Bolus bag fill (Rebreathing) Airman Zerocal (PAW)	Test Air Vol.		Ronot PCA
Reb. Bag Evacuation (EVAC)			Ovigent Status
Spare	Flow Speed: 47.80 ml/s	ec	Help
Signals Signal Stat. F	PGA Zero PGA Mix. 0	cygen Cal. Blood Press. Misc.	Exit Service

In **Press Sensor** a calibration of the pressure sensor can be performed.

Selected Signal: 0.000	PGA Reg. No.: 0	Dig. Oxygen: 21.25%	
300.00	15 20 25 30	. 35 . 49 . 45 . 50 . 55 	
Elapsed time	Bolus Fill Air Fill Press	Sensor Valve Beep	Lon File
Unscrew and remove the Gass-Bottle slowly from Innocor	Bottle Press. = Gain 120.24 43.8	* Signal + Offset 3.25∨ -21.8	Stort
Afterwards, when signal is stable, select "Gain + Offset" or just "Offset".	Press Unit : bar		Poset PCA
	Gain + Offset		Ovigraf Statua
	Offset		1. to tp
Signals Signal Stat. P	GA Zero PGA Mix. Ox	ygen Cal. Blood Press. Misc.	Exit Service

In **Valve** the user can open the valves individually – one at a time – which can be useful in troubleshooting.

Selected Signal: 0.049	PGA Reg. No.: 164	Dig. Oxygen:	21.27%
0.30 0	.15202530	35 40 45 5	
0.15			
Elapsed time	Bolus Fill Air Fill Press S	Sensor Valve Beer	
All valves off. Close to Reb. Bag (Pneu1) Close to open Air (Pneu2)	Single Valve Control Pneu 1 (D1)	EVAC (D7)	tion U Blocked
Air String, for Bag fill (AIR) Bolus bag fill (Rebreathing)	Pneu 2 (D2)	PAW (D6)	ag Evac.
Airway Zerocal (PAW) Reb. Bag Evacuation (EVAC) Bag Pump	REB (D5)	Bag Pump (D4)	tolus Fill
Spare	AIR (D3)	Be	ag Air Fill
Signals Signal Stat. F	PGA Zero PGA Mix. Oxyo	gen Cal. Blood Press.	Misc. Exit Service

In **Beep** the user can test the beep / sound support in the different modes.

Selected Signal: 0.049	PGA Reg. No.: 164	Dig. Oxygen: 21.24%	
0.30 0 <u>5</u> <u>10</u>	<u>15 20 25 30</u>		Flow Pump OFF
0.15			
0.00			
Elapsed time	Bolus Fill Air Fill Press	Sensor Valve Beep	Log Filo
All valves off. Close to Reb. Bag (Pneu1) Close to open Air (Pneu2)	Sound: Off		Steet
Air String, for Bag fill (AIR) Bolus bag fill (Rebreathing)	Change		Reset PCA
Airway Zerocal (PAW) Reb. Bag Evacuation (EVAC)			Ovigent Status
bag rump Spare			Stolp
Signals Signal Stat. F	PGA Zero PGA Mix. Ox	rgen Cal. Blood Press. Misc.	Exit Service

2.6 NIBP

From the main menu the NIBP can be accessed in which a stand-alone blood pressure measurement can be performed. Mount the cuff as described in the Service Manual and keep the arm relaxed without moving it. Press the **Start button** to start the automatical blood pressure reading. The NIBP inflates the cuff to the initial pressure (default 160 mmHg), and thereafter slowly releases the pressure. If the measurement fails and if it is suspected that the subject has a higher systolic value than the initial pressure, the initial pressure should be increased.


2.7 HELP SYSTEM

The on-line Innocor help is entered via the **Help** button. The entry in the help menu depends on where the **Help** button is pressed. The help system is web/html pages running in a reduced Internet Explorer.

Back	Forward	Home	Refresh	Print	Exit Help				
MEASU	MEASUREMENT								
Evaluating result - Index, go to - Patient data - Preparing a test - Test parameter - Prints									
PREPARI	ING A TEST								
Check that the	e bottle pressure is adequate	e (i.e. > 10 bar), and c	heck that the lower bal	loon in the rebreathin	g valve is inflated.				
Press Test to weight, haem	<mark>o start a new measurement. T loglobin (Hb) etc.).</mark>	The first time the patie	ent data is displayed. E	Enter or verify the pati	ent data (height,				
Normal value	es for Hb:								
Male =	8-11 mmol/l								
Female =	7-10 mmol/l								
When the patient data is entered, the Innocor automatically prepares the rebreathing bag by emptying and filling it with the desired volume of gas. A mixture of air and gas from the cylinder is filled into the bag.									
NIBP option: It is a good idea to start a blood pressure (BP) measurement during the bag filling (the Start NIBP button), because it can be difficult to keep the arm quiet during the rebreathing manoeuvre. When the BP measurement is started, the current cuff pressure is shown in the status bar in the lower right comer of the main test window. The BP measurement can be stopped / aborted (the Stop NIBP button) and restarted again under the test. Only the last measured values are saved in the database. When the BP measurement is finished the resulting Systolic / Diastolic pressures are shown for 20 s in the status bar.									
(1.)h	- 1- 60- J W R		J 4 J - I 4 4		al t				

See section 3.10 for details on the help system.

2.8 DATA MANAGEMENT

Data Management	09-03-2007 12:54:37
	Export Data
	Script found
	Exit Data

The data management contains 2 sub-menus:

- Export Data, where data is converted to text into the export folder.
- Script found, where programmable scripts can be executed in order to e.g. make a backup, update software or copy files.

2.8.1 Export of data

The "export of data" transfers results or data from the Innocor into tab separated ASCII/text files. Select **Data Management** from the main menu, then **Export**.



On the left side select the subject(s) from which the data shall be exported. On the right side select the measurement(s) to export. Two types of data export are supported: results or raw data.

Test	Symbol	Raw data	Results
BBB exercise test	B∙B	Exports all data for each Breath in an exercise test, i.e. Vo_2 , Vco_2 , V_E , etc.	Exports all data for the results of an exercise test, i.e. rest, AT and max values
Rebreathing test	•	Exports the raw data related to a rebreathing test, i.e. O_2 , CO_2 , SF_6 , N_2O_2 and flow/mpp	Exports the results of a rebreathing test, i.e. CO, SV, VL, Vo ₂ etc.

If the flow and gas signals of the exercise test are going to be exported, a special software tool can be used to export data from an *.ino file (Innofileconverter.exe – available on request).

The exported files are by default stored in the EXPORT directory. See section 3.5.10 on how to change the default export directory. The data is not removed from the internal database of the Innocor by an export. For details on the format of the exported files, see section 3.5.2.

The exported data contains all data available. If only a subset of the data is wanted or if the data shall be averaged the export to file can be used from BBB details (2.4.2) or Data Table (2.4.7).

2.8.2 Script

A script is a simple code like a macro or batch file that can be used to pre-programme some sequences that often are used, e.g. to copy some data from A to B. Several scripts are supported and can be placed on the Innocor or on USB media. The script can be defined by the user.

Script file execution	
Script files:	
USB unit: copy 3.02 to hdr.idm	
USB unit: Copy protocols to Innocor.idm	
USB unit: Copy protocols to key.idm	
USB unit: Backup.idm	
USB unit: copy 3.02 from viewer.idm	
USB unit: Export.idm	
The commands to be executed:	
Export Data from Export folder to USB unit All *.TXT files are copied	
Copy c:\innocor\Export*.TXT \Data*.TXT 🗠	Perform
	Close
× K	

The script page lists the available scripts that can be performed. The scripts can be located internally on the hard disk (and will always be present) or located externally on a remote media, e.g. a USB memory key. When a script is selected the script information is displayed on the screen, and if the user wants detailed information the ▼ button can be pressed, and the script commands will be shown. Pressing the **Perform** button will execute the script.

The script file supports simple commands like Copy, Move and Delete. A script file can be used for several operations, e.g.:

- Make a backup of the Innocor data to a remote hard disk.
- Restore a backup of the Innocor data.
- Move exported files to a USB memory key.
- Update help pages from e.g. a USB CD-ROM.
- Update Innocor software.
- Install a new language file.
- Change the software configuration

See section 3.8.2 for a detailed description of the format of a script file.

2.9 INNOCOR CONFIGURATION

Pressing the "i" on the Innovision logo on the main screen will bring up an about screen with some information on hardware / software versions.



Inno	cor									
	Serial N	0.		7081	53			Calibrated	02/03/2007	
	Oxigraf		~	Prot	ocol	~		ВЬВ	~	
	Main pro	ogran	n	5.07	- BbB					
	BP devi	ce		Ergo	oline_E	BIKE		5	.0.0.1	
	HR devi	се		Non	in			5	.0.0.1	
	SPO2 de	evice		Non	in			5	.0.0.1	
-PC S	System			Caa	do/TM) Intog	rotod [u Notional Comi	
	SBC Type		Geo	Viewse A Wiedows VD E 1						
	Plauon	m		MICT	USUN ¥	4 JE OO				
	Disk C			97%	37% IFEE UI .33330 MD					
	Disk D	-		/0%	tree o	1:2137	мв			
		INN	ovisi	ON A/S	Tel		+45	65 95 91 00		
		Lind	vedvej	75	Fax		+45	65 95 78 00		
		5260	Oden	se SV	Ema	ail	info(@innovision	.dk	
		Den	mark		Hor	ne P.	www	innovision.	lk	
S	Software Code								Exit About	

2.9.1 Calibration date

The time of the last Innocor calibration is displayed in the upper right corner. The Innocor S/W checks this time for the last calibration/service performed on the Innocor on every boot-up, and if the date is more than one year old a warning message is displayed during boot-up and on the main menu. Sixty days before the end of the year the user is prompted that it is time to arrange for a service check of the Innocor.

🔥 Warning				
Service interval exceeded by 15 days				
ОК				
Exit				
1 Time for service				

The calibration date is reset after a zero and mix gas calibration. See section 2.5.10.

2.9.2 Software code

The **Software Code** is used to enter a new software code when updating the software or upgrading from basic to exercise version. The software version is shown in the lower right corner on the main page. A basic version displays only the version number, e.g. **5.07**. A Breath-by-Breath version displays the version number followed by BBB, e.g. **5.07 BBB**. A version without Breath-by-Breath, but with protocol support displays the version number followed by protocol, e.g. **5.07 protocol**.



2.10 EXIT / SHUT DOWN OF INNOCOR

Always use **Exit** to shut down the Innocor in order to make a safe shut down of the Innocor S/W as well as the Windows system. A power down of the Innocor using the power switch can – in rare cases – damage the Innocor databases or other system files including windows system files.

The menu when shutting down the Innocor has the purpose of making it clear when it is necessary to release the Innocor internal pressure system.

It is always recommended to turn the gas cylinder $1\frac{1}{2}$ turns counter-clockwise to avoid that the complete content of the gas cylinder is wasted in case of a leak – this corresponds to closing the main valve on a standard gas cylinder.

When the Innocor is powered on again the gas cylinder is turned back again $(1\frac{1}{2} \text{ turns clockwise})$ – which corresponds to opening the main valve on a standard gas cylinder.

A release of the Innocor internal pressure system is only necessary if the gas cylinder has to be removed in order not to have a sudden pressure release in which case the o-ring can get out of position. The internal pressure system of the Innocor has a volume of a few ml, but at high pressure this corresponds to bolus gas for 2 or 3 tests.

Shut down of Innocor	
Close Innocor	
Close Innocor and remove the Gas Cylinder	
Cancel	

2.11 OFFLINE VIEWER

The Innocor software is available as a Viewer, where the offline parts of the Innocor software can be executed on a standard Windows based computer. This means that results and raw data can be displayed and exported using the offline Viewer similar to working on the Innocor directly. The Innocor Viewer is tested under Windows XP, but can also run under Win 98, Win Me and Win 2000 (Not under Windows NT).

The Innocor Viewer requires a USB memory key with a valid code (Viewercode.bin) in order to operate. However the Viewer can also run as a demo if the database only contains 1 or 2 subjects.

An easy way to view the Innocor data offline is to go through the following steps:

- 1) Insert the USB memory in the USB port of Innocor
- 2) Copy the databases and raw data from the Innocor to the USB memory key:
 - a. Enter Data Management
 - b. Enter Script found
 - c. Select Backup Data or Copy data to USB and press Perform
- 3) Insert the USB memory in the USB port of the remote computer
- 4) Run the Start.bat on the USB memory key from the remote computer
- 5) Select the database directory:
 - a. Press Setup
 - b. Press Viewer dir.
 - c. Find the root of the USB memory key
- 6) Enter Measurement or Data Management and look at the Innocor data offline

Select database folder							
Drive:	- f:		_				
FA databases innocor Protocol rawdata							
Folder:	F1						
database	Created	Modified	Accessed	Capcol			
Patients.db	09-09-2004 14:52:14	09-09-2004 09:07:22	09-09-2004	Cancer			
Experiments.db	09-09-2004 14:52:10	09-09-2004 09:01:52	09-09-2004	OK			
User.db	09-09-2004 14:52:14	09-09-2004 08:57:32	09-09-2004				

Note that the offline Viewer is capable of handling several sets of databases using the **Viewer dir.**, where the location of the actual database is defined. (Only one database at a time). The only requirement is that the folders DATABASES and RAWDATA is at the same level. I.e. if two sets of databases should be stored on the USB memory key the following file structure could be used:

E:\

INNOCOR DATA 1 DATABASES RAWDATA RAWDATABBB INNOCOR DATA 2 DATABASES RAWDATA RAWDATABBB

3 DETAILED SOFTWARE DESCRIPTION

3.1 HOW TO EXIT TO WINDOWS

Normally it is not necessary for a user to enter the Windows environment, but the system administrator may need to change some setups in order to e.g. connect the Innocor to a network or install a new printer. From the Innocor main screen exit to Windows by pressing the top right corner followed by the top left corner.



3.2 BASIC INSTALLATION

It is not possible to make a basic installation of the Innocor S/W on a new hard disk. In case of hard disk crash, a new hard disk can be ordered from Innovision. The hard disk will be prepared with software, and if backups of the patient and experiment database exist, this will be installed too.

3.2.1 Native country

During factory manufacturing the destination country for Innocor is assigned and can only be changed by Innovision. The country name is displayed on the main page in the lower right corner. The native country is used to distinguish between the US and non-US markets. If the country is set to United States the Vo₂ calculation during rebreathing is inhibited as well as the BBB option.

3.3 BACKUP OF DATA

Below is an easy procedure on how to make a backup of the Innocor data and database onto a USB key (a standard USB key will do):

- Enter Data Management
- Select Script Found
- Locate the script called Backup Data or Copy data to USB
- Press Perform
- The backup will be placed on the USB key
- If the same USB key is used again for backup, the backup procedure will automatically overwrite the existing backup and save the latest version.

If a stronger backup procedure is wanted, the data on the USB key can be transferred to a standard PC for storing.

3.4 UPGRADING SOFTWARE

Updating the Innocor software is possible by downloading a compressed file (ZIP) from <u>www.innovision.dk</u>. The installation procedure can vary - check the readme.txt - but will be something like:

- Request a licence number from Innovision the serial number must be provided.
- Unzip "Update to xxx.zip" to the root of a USB Flash drive
- Insert the flash drive in the Innocor USB socket
- At Innocor select Data management and Script Found
- Select External device: Update to xxx.idm and press Perform
- Exit Script execution and return to the data management menu.
- Press Script Found again
- Select Export:Innocor.exe and press Perform
- When prompted enter the licence number of the new software Note, that the licence number is unique for each Innocor
- The new software is ready for use check the version number on the main screen of the Innocor.

3.5 FILE STRUCTURE

The file structure of the Innocor software is as illustrated below:

C:\ INNOCOR DATABASES EXPORT HELP GB

DK ... LANGUAGE PRINT GB DK ... PROGRAM PROTOCOL RAWDATA RAWDATABBB SETUP

3.5.1 Databases

The DATABASES directory contains the databases for the patient data as well as the experiment data (results).

File	Description					
experiments.db	Experiment / result database					
experiments.mb						
experiments.px						
patients.db	Patient database					
patients.mb						
patients.px						
bbb.db	Proath by Proath result database					
bbb.px	Diealii-by-biealii iesuli ualabase					
experiments~.db						
experiments~.mb	Backup of experiment / result database					
experiments~.px						
patients~.db						
patients~.mb	Backup of patient database					
patients~.px						
bbb~.db	Backup of Breath by Breath result database					
bbb~.px	Backup of Breath-by-Breath result database					
user.db						
user.px	User defined parameter database					
user.uni						
user~.db	Backup of user defined parameter database					
user~.px	Dackup of user defined parameter database					

The *.db files are the main databases which contain all the data, except long comments fields (above 256 characters), which are stored in the *.mb files. The *.px files are index files and help the software to navigate faster through the databases. If an index file is damaged or lost the Innocor S/W will generate a new index file automatically. The user.uni contains the units of the user defined parameters.

Every time a new patient is entered or a patient is deleted a backup of the patient database is generated. Similar with the experiment and user databases: Every time a new test is performed or a test is deleted a backup of the experiment and user databases is generated. In case of a corrupt database the Innocor S/W will automatically restore the backup copy. The corrupted database will be copied to a *_Err.db or a *_Err.mb file. If the backup copy is also corrupt a new empty database will be generated. If a database is corrupt and the Innocor S/W is not able to detect the error in order to restore the backup copy, a software databases repair tool can be used, see 3.6.1.

The database file *.db can be opened and read by Microsoft Access, but it is not recommended to edit or change the database using Microsoft Access.

3.5.2 Export

The EXPORT directory contains exported files of results or raw data (TAB separated). The export of data can be performed from **Data Management** (see section 2.8.1), **BBB detail** (see section 2.4.2) or **Data Table** (see section 2.4.7). The export from **Data Management** exports all data in a fixed format, whereas the export from **BBB detail** and **Data Table** are user configurable. The directory is also used to temporarily hold a new Innocor.exe file in case of upgrading the Innocor software. The default EXPORT directory is C:\Innocor\Export, but can be redirected, see section 3.5.10.

The file naming of the exported files is:

File	Description
PD_x_y_hh.mm.ss.txt	Text file of exported rebreathing and/or Breath-by-Breath results
	x = patient ID
	y = number of patients in the file
	hh = hour - when export file created
	mm = minutes - when export file created
	ss = seconds - when export file created
BBBx-ddmmyyyy-hhmm.txt	Text file of a raw Breath-by-Breath data file containing Vo ₂ , Vco ₂ ,
	V _E , etc. for each breath.
	x = patient ID
	dd = day – when test performed
	mm = month - when test performed
	yyyy = year - when test performed
	hh = hour - when test performed
	mm = minutes - when test performed
BBBtable_x-dd.mm.yyyy-	Export to file from BBB-detail: Text file of a raw Breath-by-Breath
hh.mm.ss.txt	data file containing user defined parameters for each average
	interval – defined in Setup.
	x = patient ID
	dd = day – when test performed
	mm = month - when test performed
	yyyy = year - when test performed
	hh = hour - when test performed
	mm = minutes - when test performed
	ss = seconds - when test performed
RBx-ddmmyyyy-hhmm.txt	Text file of a raw rebreathing data file containing CO_2 , O_2 , N_2O ,
	SF_6 & flow / mouth piece pressure (raw) at 10 / 30 ms time
	interval.
	x = patient ID
	dd = day – when test performed
	mm = month - when test performed
	yyyy = year - when test performed
	hh = hour - when test performed
	mm = minutes - when test performed
RBtable_x.txt	Export to file from Data Table: Text file of rebreathing results
	containing user defined parameters – defined in Table Setup.
	x = patient ID

Example of exported result file with 1 BBB test and 3 rebreathing tests:

Number of Subjects 1

ID number	091063							
Last name	Pedersen							
First name(s)	Knud							
Sex	Male							
Date of birth	09-10-1963							
Height	186							
Weight	100							
Memo	test							
*****	* BBB Result	s *****	* * * * * * * * * * *	* * * *				
	Date	Time	Comments	Load-MIN	Load-AT	Load-MAX	Load-RC	
				watts	watts	watts	watts	
1	04-01-2007	15:23:52		0.000	260.000	290.000	-1.000	
*****	* RB Results	******	******	* * *				
	Date	Time	Protocol	Comments	*	HR	VL	
					*	bpm	1	
1:1	04-01-2007	15:29:58	exercise		*	63.000	2.597	
1:2	04-01-2007	15:35:10	exercise		*	83.000	2.686	
1:3	04-01-2007	15:40:17	exercise		*	106.000	2.894	

Example of exported raw Breath-by-Breath data file from Data Management:

Innocor, by Innovision Denmark Breath by Breath data

I.D.	091063	
Last Name	Pederser	ı
First Name	e(s)	Knud
Height [cn	1]	186
Weight [kg	1]	100
Date of bi	rth	09-10-1963

test perf	formed:	04-01-2007	15:23:52				
Time	Load	Hr	Resp.Freq.	Ve	VCO2	V02	
Sec.	watts	/min	/min	l/min	l/min	l/min	
29.393	0	57.4	11.4503816793893	14.1410159810536	0.332220785827269	0.413256691694657	
35.852	0	58	9.28792569659443	12.2040981235339	0.323891496414183	0.390267053658837	
41.84	0	58.5	10.016694490818	11.5320086923182	0.271191833219968	0.325622723153324	
48.24	0	59	9.375	11.0535974450219	0.285931911164538	0.3393629068928	
54.298	0	60.66666666666	9.9009900990099	10.8796016369568	0.269731980768335	0.323256581341622	
73.366	0	64.333333333333333	9.34579439252336	9.73480004526223	0.260773371371102	0.319863887509834	
78.794	0	61.3333333333333333	11.0497237569061	13.9269544445527	0.289239734088262	0.364742001514969	
84.702	0	62	10.1522842639594	14.1997740119259	0.270401641911748	0.344239098150569	

Example of exported raw Breath-by-Breath data file from BBB detail - export to file:

091063, Samples Signals	Pedersen, 479 10	Knud								
Time	Ve	VCO2	VO2	R	Vt	Load	Hr	Resp.Freq.	Ve/VCO2	Ve/VO2
0:29 mir	n 14.1	0.332	0.413	0.80	1.23	0.0	57	11.5	36.9	29.6
0:36 mir	1 12.2	0.324	0.390	0.83	1.31	0.0	58	9.3	32.9	27.3
0:42 mir	ı 11.5	0.271	0.326	0.83	1.15	0.0	59	10.0	36.4	30.3
0:48 mir	n 11.1	0.286	0.339	0.84	1.18	0.0	59	9.4	33.2	28.0
0:54 mir	n 10.9	0.270	0.323	0.83	1.10	0.0	61	9.9	34.3	28.6
1:13 mir	ı 9.7	0.261	0.320	0.82	1.04	0.0	64	9.3	31.4	25.6
1:19 mir	n 13.9	0.289	0.365	0.79	1.26	0.0	61	11.0	41.8	33.2
1:25 mir	n 14.2	0.270	0.344	0.79	1.40	0.0	62	10.2	46.3	36.4
1:30 mir	n 15.5	0.443	0.541	0.82	1.37	0.0	61	11.3	30.7	25.2

Example of exported raw rebreathing data file from Data Management:

Innocor, by Innovision Denmark						
Experiment perf	ormed	04.01-2007	15:29			
I.D. Last Name First Name(s)	091063 pedersen knud					
Rel. humidity Temperature Amb. pressure	38.0 22.0 746.0					
Time sec. 0 0.03 0.06 0.09 0.12 0.15 0.18	CO2 % 3.70800781 3.79785156 3.86914063 3.9359375 3.98828125 4.02929688 4.06250000	Oxygen % 16.7500000 16.68750000 16.61718750 16.53125000 16.46093750 16.3281250 16.32031250	Solub. % -0.00168610 -0.00149536 -0.00122833 -0.00136566 -0.00120544 -0.00102997	InSolub. % -0.00015259 -0.00010681 -0.00012970 -0.00012207 -0.00014496 -0.00015259 -0.00012207	Mouth Press. Volt 0.00766754 0.00431061 0.00254059 0.00164795 0.00123596 0.00126648 0.00162506	

Example of exported raw rebreathing data file from Data Table – export to file:

091063, Samples Signals	Pedersen, 11 6	Knud				
	Load	V02	CO	HR	SV	Ve
1:1	0.0	0.269	4.5	69	65	15.0
1:2	43.3	1.001	9.4	78	120	29.4
1:3	129.4	2.084	13.6	100	136	50.2
1:4	213.0	2.756	16.7	121	138	81.2
1:5	305.4	3.735	19.0	150	127	111.3
2:1	0.0	0.191	2.9	63	45	13.5
2:2	100.0	1.308	10.4	83	125	41.6
2:3	200.0	2.287	14.9	106	141	71.4
2:4	230.0	2.612	16.2	118	137	82.8
2:5	260.0	3.118	17.9	130	137	91.3
2:6	290.0	3.621	19.1	145	132	110.9

3.5.2.1 Import of Innocor data into EXCEL

The exported tab separated files can be imported to EXCEL via the following procedure:

- Start EXCEL
- Select open (Files open)
- Change file type to text files
- Locate the file to open
- Select open
- Press finish
- The file is now imported into EXCEL

3.5.3 Help

The HELP directory contains html pages for the on-line help of Innocor – a subdirectory for each supported language. See also 3.10.

File	Description
DataExport.htm	Main page of data export help
Index.htm	Main page of help with reference to the other help pages
Measurement.htm	Main page of measurement help
Patient.htm	Main page of patient help
Setup.htm	Main page of setup
*.gif, *.jpg	Various images

3.5.4 Language

The LANGUAGE directory contains the setup files for the supported languages.

File	Description
*.lan	Translation file
*.bmp	Images of the flag for identification of the language

See section 3.7 for details.

3.5.5 Print

The PRINT directory contains the setup of the printing layout – a subdirectory for each supported language.

File	Description
PrintSetup.ini	Configuration file for the print layout
*.bmp	Images used in the print layout

See section 3.9 for details.

3.5.6 Program

The PROGRAM directory contains the executable Innocor software.

File	Description			
Innocor.exe	Main Innocor software			
Innocor.log	Files for debugging			
Innocor.map				
InnoSys.dll	Innocor system file			
Innoupdate.exe	Program used to upgrade Innocor software			
FlowmeterCalibration.exe	Program to generate a flow table			
FlowmeterCalibration.map				
InnoDatabaseRecover.exe				
InnoDatabaseRecover.map	Program used to repair Innocor databases			
TUTIL32.DLL				
Wct32dr3.dll	Files for displaying curves on-line and offline			
Wrt32dr3.dll				
CosmosMill.dll	File for controlling the Cosmos treadmill			
Dummy_Bike_Mill.dll	File for simulating a control of an ergometer bicycle or a treadmill			
Ergoline_Bike.dll	File for controlling the Ergoline ergometer bicycles			
Lode_BIKE.dll	File for controlling the Lode ergometer bicycles			
Nonin.dll	File for controlling the internal Nonin device (HR & SpO ₂)			
SunTech.dll	File for controlling the internal SunTech device (blood pressure)			

3.5.6.1 Drivers for exercise devices

The Innocor software supports different exercise devices. The drivers for these exercise devices are located in *.dll files in the program folder. The drivers are specially made by Innovision based on the information given by the manufacturer on the software protocol interface. See section 2.3.1 for the list of supported exercise devices.

3.5.7 Protocol

The PROTOCOL directory contains the setup of the exercise protocols.

File	Description
*.pro	Configuration file for an exercise protocol

The format of the file is:

```
[ID]
Original name=Protocol name
Type=0 or 1 (0=bicycle / 1=treadmill)
[Protocol]
Step1=Load Slope Speed Time Bag Bolus Freq RB NIBP
```

Examples:

Example1 is a treadmill protocol running with fixed settings:

[ID]								
Original na	ame=Examp:	le1						
Type=1								
[Protocol]								
Step1=0	0	5	5	2	10	20	On	Off
Step2=0	1	5	5	2	10	22	On	Off
Step3=0	1	б	4	2	10	24	On	Off
Step4=0	2	6	4	2.5	10	26	On	Off
Step5=0	2	7	3	2.5	10	28	On	Off
Step6=0	3	7	3	3	15	30	On	Off
Step7=0	3	8	3	3.5	20	32	On	Off

Example2 is a bicycle protocol running with auto settings:

[ID]								
Original nam	ne=Examp	le2						
Type=0								
[Protocol]								
Step1=0	0	5	5	*2	*10	*20	On	Off
Step2=25	0	5	5	*2	*10	*20	On	Off
Step3=50	0	5	4	*2	*10	*20	On	Off
Step4=75	0	5	4	*2	*10	*20	On	Off
Step5=100	0	5	3	*2	*10	*20	On	Off

The * indicates that the field is set to Auto.

3.5.8 RAWDATA

The RAWDATA contains the raw data files; one file for each measurement. The format is a binary format.

File	Description
RBx-ddmmyyyy- hhmm.rwd	Raw rebreathing data file containing CO_2 , O_2 , N_2O , SF_6 & flow/mouth piece pressure. x = patient ID dd = day – when test performed mm = month - when test performed
	hh = hour - when test performed mm = minutes - when test performed

3.5.9 RAWDATABBB

The RAWDATABBB contains the raw data files; one file for each measurement. The format is a binary format, but can be converted to a text format or Excel using the program InnofileConverter.exe (available on request).

File	Description
BBBx-ddmmyyyy-	Breath-by-Breath data file containing raw signals: CO ₂ , O ₂ , N ₂ O,
hhmm.rwd	SF ₆ & flow and results: Vo ₂ , Vco ₂ , V _E , R etc.
	x = patient ID
dd = day – when test performed	
mm = month - when test performed	
yyyy = year - when test performed	
hh = hour - when test performed	
	mm = minutes - when test performed

3.5.10 SETUP

The SETUP directory contains configuration files for the Innocor software.

File	Description
Ambient.ini	Ambient data (pressure, temperature & humidity)
BBBctlr.ini	Configuration file for Breath-by-Breath
BBBlin1.cal	Flow table
BBBMainSetup.bin	Binary setup file for Breath-by-Breath results
BBBNumShow.bin	Binary setup file for Breath-by-Breath online numerical graphic
BBBTableSetup.bin	Binary setup file for Breath-by-Breath detail table
Dataview.ini	Setup file for all plots
Flowctrl.ini	Configuration file for flowmeter
Formulae.ini	Configuration file for calculated parameters
Gassystem.ini	Calibration coefficient for bolus and air filling flow & gas bottle
	pressure
Graphsetup.ini	Configuration file for rebreathing graphical setup
Hardware.ini	Configuration file for the hardware. Setup of com ports and
	installation of optional sensors
Rb.sys, Rb.~sy	Configuration file for the rebreathing calculation – should only be
	changed by qualified personnel, otherwise erroneous results will be
	calculated by the Innocor software
Search.sys	Configuration file for where the software shall look for Innocor
	script files (*.idm)
Service.ini	Configuration file for the service part of the Innocor software
SymbolSetup.ini	Configuration file for graphical symbols
TableSetup.bin	Binary setup file for rebreathing table setup

Example of GasSystem.Ini:

[GasFilling] Bolus_ml=320 Bolusflow=35.32464 Airflow=51.94 InitialVolpct=10 Bolus_%=20 MaxBolus_%=20 [GasPressure] Gain=43.75 Offset=-21.8 unit =bar [Insoluble] Normconc=1.0 [CO2_Corr] OnOff=0[N20_CO2_Corr] N0=9.8591E-1 N1=8.2864E-3 N2=-5.2389E-3 N3=1.4278E-3N4=-1.9475E-4 N5=1.3417E-5 N6=-3.6776E-7 [SF6_CO2_Corr] N0=9.8363E-1 N1=-3.3148E-3 N2=3.5815E-4 N3=-1.8592E-5 N4=5.3471E-8 N5=0 N6=0 [VO2Corr] GainInv=1144 OffsetInv=-167 NOTE ! values entered times 1000 i.e. 1.144 as 1144

Example of Hardware.Ini:

[Screen] BtnSound=0

[PGA] Installed=1 Port=1

[Oxygen] Installed=1 Port=4

[BEEP] Beep=0

[BPHardware] Driver=SunTech Installed=0 Port=5 Start Press=160

[HRHardware] Driver=Nonin Installed=0 Port=6

[SPO2Hardware] Driver=Nonin Installed=0 Port=6

[BBB] Installed=0 FlowzeroAfterRB=1 FlowzeroInterval=60

[Ergometer] Installed=1 Port=7 Driver=Manual control QuickStop=0

[MPP] sign=-1

[VALVE] Delay=500

[RB] Periode=30

[VO2] Code=1

[Fileprint] Path=

[Export] Path=

[USBDrives] FirstUSBDrive='E:\'

;These values are update when the Innocor program runs [AutoAbout] PgaSoftware=01.01.003 OxigrafSerNo=7711V442 OxigrafSoftware=X2K V1.16A.0

Example of BBBctrl.Ini:

[flowGasDelay] 02=1550 C02=1550 OnlineCalc=1 Co2Calc=0 [BBBFilter] Time=10 [Deadspace] Flowmeter=0.12 Valve=0.045

3.5.10.1 Increase max bolus concentration

The supported range in bolus is by default set to [7.5% to 20%]. In case of rebreathing under hypoxic conditions the max bolus concentration can be increased up to 50%. The MaxBolus_% in GasSystem.ini under [GasFilling] must be changed manually using Notepad:

[GasFilling] MaxBolus_%=50

3.5.10.2 Variable flow zero interval

The flow signal is automatically zero adjusted when using the Innocor. The default is every 1 minute and after each rebreathing test. This can however be controlled differently by the following entries in Hardware.ini under [BBB]:

[BBB] FlowzeroAfterRB = 1 FlowZeroInterval = 60

FlowzeroAfterRB:

1: the zero calibration is done immediately after the rebreathing end.

0: the zero calibration is done FlowZeroInterval seconds after the rebreathing end. FlowZeroInterval:

0: no zero calibration, except at the beginning of a test

>0: the period in seconds between zero calibration during breath by breath

3.5.10.3 Printout to Microsoft EMF files (Enhanced Metafile)

The Innocor software support printouts to Microsoft EMF files (Enhanced Metafiles). These files can be displayed on any Windows system from Windows 95, and the files can be transferred and saved electronically. The EMF format is device-independent. This means that the dimensions of graphics are maintained on the printed copy regardless of the resolution in dots per inch of the printer. The EMF files can at least be opened by:

- Windows Picture and Fax Viewer,
- Microsoft Office Picture Manager and
- Paint

EMF files can also be imported into a Word document using insert picture.

To enable this feature the following entries must be added to the Hardware.ini under [FilePrint]:

```
[FilePrint]
Path = 'path'
Examples:
Path = 'USB:\'
Path = 'C:\INNOCOR\EXPORT\'
```

The EMF files will be saved on the USB memory key (if present, otherwise a normal printout will be activated) The EMF files will be saved in the export folder.

If the path cannot be found the standard printout to a printer will be performed. The support for EMF files is only available when a printer is installed, but not necessarily connected. When the support for EMF files is enabled the printouts will be saved when the **PRINT** or **PRINT TABLE** button is activated.

3.5.10.4 Beep support

The Innocor has a beep support during the rebreathing test, where the beep helps the instructor to guide the subject to inspire and expire at the right speed. See section 2.5.1. The beep is however only supported for Innocor's with serial number higher than xxxx051. The following entry in Hardware.ini controls the beep function:

[BEEP] Beep=*n*

n=0 disables the beep function, applicable for Innocor's with serial number lower than xxxx050

- n=1 beep function enabled, but turned off
- n=2 beep function enabled, short beep
- n=3 beep function enabled, long beep

3.5.10.5 "Quick stop" for a treadmill

A **quick stop** can be available, when running a treadmill protocol. The **Quick stop** will immediately stop both the treadmill and the protocol without any prompts. The following entries must be added to the Hardware.ini to enable this function (it is disabled by default):

[Ergometer] QuickStop=1



3.5.10.6 Controlling the automatic flow-gas delay adjustment

The flow-gas delay is by default automatically adjusted during an exercise test, but it requires a certain exercise level in order to start – typically at 40-50% of the max exercise load. The automatic adjustment can be turned off, if desired. The following entries must be added to the BBBctrl.ini to control the delay calibration:

[flowGasDelay] OnlineCalc=1 CO2Calc=0

The setting above is the default setup, where the "OnlineCalc=1" enables the online delay calibration, and the "CO2Calc=0" fixes the CO₂-delay to the O₂-delay. "CO2Calc=0" means that the automatic adjustment only calculates the O₂ delay and then corrects the CO₂ delay with the same amount.

If "OnlineCalc=0" the automatic adjustment is turned off, and the delay found under calibration is used during the complete exercise test.

If "CO2Calc=1" (and "OnlineCalc=1") both the CO₂ and O₂ delays will be calculated online, which is not recommended, because the O₂ delay calculation is more accurate during exercise

breathing.

If the flow gas delay calibration is not performed with the standard RVU the volume of the dead space between the inlet and ambient air must be changed in the BBBctrl.ini file. The Valve volume is important for the flow gas delay calculation: a wrong volume value will result in incorrect delay values. If the volume is changed during on-line measurement, the new volume should be entered or the on-line delay calibration must be disabled.

[Deadspace] Valve=0.045

Similarly the flowmeter dead space (the volume from the mouth to the inlet) must be changed in the BBBctrl.ini file or via the Breath-by-Breath Setup menu, see section 2.5.2.3 if the standard RVU is not used. The flowmeter dead space has only influence on the calculated subject dead space (V_d) and on the $V_E/Vo_2 \& V_E/Vco_2$.



3.5.10.7 Controlling the Vo₂ calculation during a rebreathing test

The setting for the Vo_2 calculation during a rebreathing test is controlled by the following entries of the Hardware.ini:

[VO2] Code=n

If n=0 the Vo₂ calculation during a rebreathing test is disabled. If n=1 the Vo₂ calculation during a rebreathing test is enabled (default). If n=2 the Vo₂ calculation during a rebreathing test is equal to the last 1 minute value from the BbB calculation.

If the native country is United States the setting will be overruled to Code=0, see section 3.2.1.

3.5.10.8 Setting the sampling rate to 100 Hz during rebreathing

The default sampling rate during rebreathing is 33.3 Hz. It can be increased to 100 Hz by the following entries in the Hardware.ini:

[RB] Periode=10

3.5.10.9 Setting the drive letter for the first USB drive.

When the Innocor software looks for a USB drive, it starts searching from d: or e: depending of the hardware.ini. The setting is controlled by the following entries in the Hardware.ini:

[USBDrives] FirstUSBDrive='E:\'

On older Innocor's the FirstUSBDrive is set to "D:". Newer Innocors contain a second partition for a backup XP version and the FirstUSBDrive is set to "E:".

3.6 DATABASE

The patient database contains data of all the patients with respect to:

- ID
- Last name
- First name
- Birthday
- Weight
- Height
- Hb
- Comments
- Reference into experiment database

The experiment and BBB database contains the primary results of all the measurements (derived parameters are calculated on-line).

The raw data file contains the signals: CO_2 , O_2 , N_2O , SF_6 & mouth piece pressure (raw) at 30 ms time interval (default). Typical size of the file is 10 KB.

In order to make a backup of the data on the Innocor the complete directory of DATABASES, RAWDATA and RAWDATABBB must be copied. If the files in RAWDATA and RAWDATABBB are deleted, it is still possible to see the results within the Innocor software, but it will not be possible to display the curves.

3.6.1 Database recovery

InnodatabaseRecovery.exe is a small application program developed for Innocor database maintenance and repair. The database files are essential for the Innocor operation, and will cause the system to halt if they get corrupted. The InnodatabaseRecovery.exe is located in the folder: C:\innocor\program.

3.6.1.1 The screen layout

The recovery program is built to handle patient, experiment and BBB databases.

The type of database to use is selected by pressing the related name in the "Database" panel:

- Patient (standard location: C:\Innocor\databases\patients.db)
- Experiments (standard location: C:\Innocor\databases\experiments.db)
- User (standard location: C:\Innocor\databases\user.db)
- BBB (standard location: C:\Innocor\databases\BBB.db)
- Other (location defined by the user)

Database					Marifu
c:\innocor\databases\Patients.db			verny		
Patient Exper	riments O	User © BBB	© Other		Rebuild
Table Information					Override
Fields:	9	Code Page:	1252		with backup
Record Size:	117	Block Size:	2		
Table Level:	7				
Status:					
Header:					
Indexes:					
Data:					
Rebuild:					
Message:					
					Exit
Version 1.5					

"Table information" summarizes the characteristic parameters for the database:

Fields:	The number of data fields in one record (e.g. fields related to one patient).
Record Size:	Number of bytes used for each record (e.g. bytes related to one patient)
Table Level:	Version number of the database engine, (e.g. Paradox version 7.0)
Code Page:	Code for language driver used by the database
Block Size:	Database is arranged in areas of this size (Kbytes).

During verification and rebuilding of a database the actual status is shown in the status area, and the final result is listed in the Message area.

The action keys are placed in the right panel and include:

Verify:	Database is verified.
Rebuild:	Database is rebuilt.

Override with backup: Database is exchanged with Innocor backup copies.

3.6.1.2 Verify database

The selected database and related files are verified by pressing **Verify**. The actual status of the verification is shown in the status area as progress bars progressing when either the database headers, database indexes or the database data are verified.

The database is not changed by verification.

The verification result is listed either as a 'Verification Successful" or as a list of found errors.

Database					New Ker
c:\innocor\databas	es\Patien	its.db		Select	Verny
Patient Exper	riments 🤆	0 User I O BBB	 Other 		Rebuild
Table Information					
Fields:	9	Code Page:	1252		with backup
Record Size:	117	Block Size:	2		
Table Level:	7				
Status:					
Header:					
Indovos:					
muexes.					
Data:					
D-1-34					
Reduiid:					
Message: Verificatio	n Succes	sful. Table has	no errors.		
					Exit
Version 1.5					

If errors are found they are listed one by one with the file extension, error code, error level and a short description of the error.

Database	
c:\innocor\databases\Experiments.db	Verity
C Patient C Experiments C User C Other	Rebuild
Table Information	Override
Fields: 27 Code Page: 1252	with backup
Record Size: 303 Block Size: 2	
Table Level: 7	
- Status:	
Extension Error Code Error Level Error Message	
PX 41 1 Empty block 1 reports records	
Date can be repaired	
Press "Rebuild" button to repair data	
	Exit
Version 1.4	

File extensions:

- *.MB File with comment fields longer than 255 characters
- *.DB File with the data
- *.PX File with the links between patient and experiment database.

Error code:

Type of error. Currently not used

Error level:

- 0: Database has no error
- 1: An error is found that can be corrected by the rebuild function
- 2: An error is found that can be corrected with some data loss
- 3: An unrecoverable error is found
- 4: An unrecoverable error is found

Based on the error level and the file type the best solution for resolving the error is suggested.

3.6.1.3 Rebuild

Press **Rebuild** to correct errors in the database. The original database will be copied to both *databasename*Backup.* and to the Recycle bin before rebuilding. The backup copies can be used to undo a rebuild procedure if it results in some kind of data loss. During the rebuild process a running progress bar is shown in the status area. The result of the rebuild is automatically saved.

Database	
c:\innocor\databases\Experiments.db	Verify
C Patient C Experiments C User C Other	Rebuild
Table Information	Override
Fields: 27 Code Page: 1252	with backup
Record Size: 303 Block Size: 2	
Table Level: 7	
Status:	
Header:	
Indexes:	
Data:	
Rebuild:	
Message: Rebuild was successful.	
	Exit

3.6.1.4 Override with backup

The Innocor always generates a backup of a database before a test or patient is added or deleted. In case of a corrupted database a functional backup copy is most likely found. However the backup copy may not contain the last changes.

Pressing **Override with backup** will exchange the current database with the backup copy (the files *databasename*~.* are copied to *databasename*.*). The original database files are found in the recycle bin afterwards.

3.6.2 Database merge

It is possible to merge 2 databases using a special program (syncronize.exe) from Innovision (available on request). It is highly recommended to backup the databases before doing the merging, and to perform the merging on a remote PC.

Innocor Me	rge databases 🛛 🛛 🔀
Master:	C:\Innocor\0644146\databases\Patients.DB
Slave:	C:\Innocor\0506115\databases\Patients.DB
	Merge

Procedure:

- Run the syncronize.exe file
- Click on the Master entry, and locate the databases folder of the first database and select patients.db
- Click on the Slave entry, and locate the databases folder of the second database and select patients.db
- Press Merge
- The merged database will be copied to a sub-folder of the master databases including rawfiles

Example:

Master in C:\Innocor\0644146 containing databases, rawdata and rawdataBBB Slave in C:\Innocor\0506115 containing databases, rawdata and rawdataBBB

The merged database will then be saved in C:\Innocor\0644146\databases\merged containing databases, rawdata and rawdataBBB

The merged database can be copied to the Innocor by copying the databases, rawdata and rawdataBBB from (remote-PC)C:\Innocor\0644146\databases\merged to (Innocor)C:\Innocor.

3.7 LANGUAGE SUPPORT

In the setup of the Innocor S/W different languages can be selected by pressing the corresponding flag. The Innocor S/W looks in the LANGUAGE directory for *.lan and *.bmp files. Each set represents one language. E.g. the English version consists of the files GB.LAN and GB.BMP. When a flag is pressed the language-window will change language immediately.

NOTE! No end-user may change/write the Language-files. Only representatives of Innovision are allowed - together with Innovision – to write or change the language-files.

NOTE! When a new language-file has been written, Innovision must approve it, before it legally can be used with Innocor.

Note: the country name displayed on the main page in the lower right corner is NOT the selected language, see section 3.2.1.

How to make a new LAN file

- 1. Make a copy of an existing LAN file e.g. copy GB.LAN to xxx.LAN, where xxx is the new language.
- 2. Use a simple text editor like Microsoft "Notepad" to edit the file. Word and other advanced programs cannot be used.
- 3. The LAN file is divided into sections, where each section corresponds to a sub menu of the Innocor program. However more commonly used words are placed in the Common section. Each section is identified in [], e.g. [Patient]. The section names must not be changed.
- 4. Each section contains a number of sentences or words that must be translated to the new language. Each line contains a keyname on the left of the '=' sign, and the translated part on the right side. The keyname may not be changed, only the right part of the '=' sign.

Example:

SureToDelete=Are you sure you want to delete

Where "SureToDelete": I "Are you sure you want to delete":

Keyname Text to be translated

Notes:

- The lines with the keynames must be written in one line.
- Text with the prefix "dia" appears in a dialog-box in the Innocor program
- Text with the prefix "btn" appears on the buttons in the Innocor-program
- Text with "dia" or "btn" prefix can be written on 2 lines, by inserting a "|"in the text. (Keyboard: "Alt Gr + |")

Example:

btnSel.UnSel.=Select/|UnSelect

diaNibpNF=The blood pressure unit|was not found!

• Buttons show text strings of maximum 12 characters long text.

Examples:

btnSetupTable=Table|Setup

Table Setup

diaConfDelete=Are you sure you want to delete the field ?

Confirmation
Are you sure you want to delete the field ?
Yes No

How to make a new BMP file

- Find a digital image of the flag. Search e.g. on the Internet or on the Microsoft Office CD
- · Load the image into e.g. Microsoft-Paint
- Set the size to 80 x 54 pixels (cm: 2.22 x 1.5 or lnch : 0.83 x 0.56)
- Save the xxx.BMP as a 256 colour bitmap file
- Copy the file to the directory c:\innocor\language (The size of the xxx.BMP file is 6kB).
- Innovision can make the xxx.BMP flag file on request.

Help pages

The html help pages corresponding to the language must be placed in the directory:

c:\innocor\help**xxx**\

E.g. the English version of the help files is placed in c:\innocor\help\GB\. If the help directory is not found the "HELP" buttons will be dimmed (disabled).

Print setup

The language specific layout of the print setup (PRINTSETUP.INI) must be placed in the directory:

C:\innocor\print\xxx\

E.g. the English version of the PRINTSETUP.INI is placed in c:\innocor\print\GB\.

Keyboard

When the language is changed the keyboard is also changed in order to be able to enter special language characters. The keyboard to use is defined in the **LanguageID** in the LAN file, and defined by Innovision. If the LanguageID is invalid the default keyboard is used.

If the following message appears:

To set this language use windows: Control Panel \ Regional Settings",

the new language must be set manually the first time via the Control Panel. Enter "Regional and Language options", then the tab "Languages", then "Details", and finally select the language in "Default input language". If the language is not present in the list, use the Add button to load it. The new language must be marked as "Set as system default locale". If a prompt for files on the **Windows CD-ROM** appears, the directory **C:\windows\l386** is entered.

The Innocor must be restarted before the changes take effect.

The decimal separator can be freely choose between '.' and ','. The default is '.'

Here is an incomplete list of commonly used codepages:

LanguageID (HEX)		Codepage
Used to set the Keyboard layout		
00000813	Belgian Dutch	850
0000080c	Belgian French	
00000c0c	Canadian French	
00001009	Canadian English	
00000416	Brazilian	
00000406*	Denmark	
00000413	Dutch	
0000040b	Finland	
0000040c	France	
00000407	Germany	7
00000410	Italy	
0000040f	Icelandic	
0000080a	Latin America	
00000414	Norway	
00000816	Portugal	7
0000040a	Spain	
0000041d	Sweden	
0000100c	Switzerland (France)	7
00000807	Switzerland (German)	7
00000809*	UK	437 but 850 works
00000409	USA	also
00000415*	Poland	852
00000405	Czechoslovakia	7
0000040e	Hungary	7
00000424	Slovenian	1
00000419*	Russian	866
	Baltic	775
	(Japan)	932
	(China)	950

* Have been tested with Innocor

NOTE: The list above is NOT complete

Before the LanguageID can be used it must have been preloaded from Windows, by the use of the "Control panel/Keyboard".

Example of language file:

Ver 2.01 13. marts. 2003 [Common] All=All Abort=Abort Average=Average AmbPress=Amb. pressure BP-Unit=Blod pressure unit Cancel=Cancel Change=Change [Comport] NoResp=No response UnkResp=Unknown response InUse=Already in use NotOpend=Could not be opened WrErr=Write error ReErr=Read error [Language] DecimalSep= CodePage=850 LanguageId=00000809 diaKeyBoardIdNot .. = The Keyboard code was not found Default keyboard is used diaInvalidKeyBoardId=The Keyboard code was invalid Default keyboard is used diaLangIdNotFound=The Language ID was not found diaBoot=To set this language use Windows: "Control Panel \ Regional Settings" |Set "System default locale" to English Exit, power-down and restart Innocor [RBBagVolume] low=Predicted rebreathing bag volume was too low and forced to high=Predicted rebreathing bag volume was too big and forced to

```
[GasStatus]
btnBottle=Gas|Cylinder
btnPressRelease=Pressure|Release
```

3.8 SCRIPT SUPPORT

A script is a simple code like a macro or batch file that can be used to pre-programme some sequences that often are used, e.g. to copy some data from A to B. Several scripts are supported and can be placed on the Innocor or on a USB media. The script can be user defined. The scripts can be executed from **Data Management – Script Found**, see section 2.8.2.

3.8.1 Search.sys

The Search.sys file defines where the Innocor software shall look for Innocor script files (*.idm) and new executable versions of the Innocor software (Innocor.exe). The file can contain several paths and shall be located in the Setup directory (C:\Innocor\Setup). The format of the Search.sys is:

path <TAB> alias

Example:

d:	DVD
e:	Hard disk
c:\innocor\backup\	Backup
c:\innocor\export\	Export
USB:	USB unit

This means that the Innocor software looks on the d: drive at the root, and if it finds something the source is indicated as "DVD". Similar with the e: drive where the alias is "hard disk". In the example the backup and export directories are also searched. The last line searches all devices on the USB port.

If the Innocor software finds an Innocor.exe in a search location, and the **Perform** button is pressed, the software automatically updates the running version and saves a backup of the original in "PrevVersion.exe".

Note! The Innocor software searches always the c:\innocor\export\ directory for a new Innocor.exe file in order to be backward compatible.

3.8.2 Script files (*.idm)

A script file contains 3 sections:

- 1) Brief description
- 2) Commands to execute
- 3) Free text to display after all commands are executed (optional)

The brief description is displayed on the screen when a script is selected, and is used to identify the script before executing it.

The following commands are supported:

Command	1. parameter	2. parameter	3. parameter	4. parameter	Description
COPY	source	destination			Copy file(s) from a source to a destination
XCOPY	source	destination			Copy file(s) from a source to a destination including sub-directories
MOVE	source	destination			Move file(s) from a source to a destination
DELETE	source				Delete file(s) from a source
EMPTYBIN					Empty the recycle bin (not supported on NT systems)
SC_INSERT	Filename	Group	ID	Value	Insert or change a parameter in a system file (*.ini file)
SC_REMOVE	Filename	Group	ID (optinal)		Delete a parameter or a group of parameters in a system file (*.ini file)

Wildcards (*) are supported

If a file is deleted or overwritten by a COPY or MOVE command, the original file is placed in the recycle bin. (Note! This is not the case for XCOPY).

After the script commands are executed, the free text is used to inform the user of the progress, e.g. to say that the update of help files are completed, or to ask the user to disconnect the external hard disk. The free text must start with an empty line.

The description text and free text must not contain a TAB, otherwise the software interprets the line as a command line.

The script language can accept the "USB:" instead of a drive letter (e.g. "d:"). This is an advantage because the drive letter of e.g. a memory key is not always the same. If an USB memory device is connected to the Innocor, it will typically get the first free drive letter (e.g. "e:"). If another device (maybe of same type) is connected instead of the first device, the second device will get the next free drive letter (e.g. "f:"), and etc. Using the "USB:" in the script, the Innocor will look for the first active removable drive on the USB.

Example 1:

Backup data to USB unit Both databases and raw data are copied Copy c:\innocor\databases*.* USB:\databases*.*

Copy c:\innocor\rawdata*.* USB:\rawdata*.* Copy c:\innocor\rawdataBBB*.* USB:\rawdataBBB*.*

Backup performed

Example 2:

```
Disable NIBP support
Redirect print-outs to emf files in the export folder
26.10.2006 / Innovision
SC_Insert C:\Innocor\setup\hardware.ini NIBP Installed 0
SC_Insert C:\Innocor\setup\hardware.ini FilePrint Path 'C:\innocor\export\'
Update of hardware.ini completed.
```

The first SC_Insert sets the Installed parameter to 0 in the NIBP group.

The second SC_Insert inserts the parameter Path='C:\innocor\export\' in the FilePrint group.

I.e. the hardware.ini will be changed to:
[NIBP]
Installed=0
...
[FilePrint]
Path='C:\innocor\export\'
....

Example 3:

Redirect print-outs to printer 26.10.2006 / Innovision

SC_Remove C:\Innocor\setup\hardware.ini FilePrint

Update of hardware.ini completed.

The SC Remove will delete the entire FilePrint group in the hardware.ini file.

I.e. the following lines in hardware.ini will be deleted:
[FilePrint]
Path='C:\innocor\emf\'

3.9 PRINTER SETUP

3.9.1 Installation of new printer

If a new printer is connected to the Innocor, the corresponding driver must be installed according to the user manual of the printer. The driver software can be installed from a remote CD-drive, USB CD-drive or from a USB memory key. See section 3.13.4 for information about using a remote CD-drive for installation. If a new printer driver is installed and the Innocor software shall use it, the new printer must be set to the default printer.

- Enter from Innocor software Print. Prev select Printers select new printer, or
- Enter in Windows control panel printers right click the new printer set the "use as default".

3.9.2 Print layout

The layout of the printing is defined in the file PrintSetup.Ini located in the Print directory under the specific language directory. Each section (defined by []) corresponds to one page print-out, and are displayed as separate TAB's in the preview. As default the Results and Graphs pages are defined.

The PrintSetup.Ini can be a combination of graphs, data, fixed text and images. The following types are supported:

Туре	Description

Innocor™ Software User Manual

Subject	Data from patient database
	Format:
	Subject=value,x,y,fontsize,fontname,fontattribute,fontcolor
Data	Data from experiment database
	Format:
	Data=value,x,y,fontsize,fontname,fontattribute,fontcolor
Decimal	Decimal Data from experiment database
	Format:
	Decimal=value,x,y,decimals,fontsize,Fontname,fontattribute,fontcolor
BBBMainData	Data from BBB results
	Format:
	BBBMainData=BBB Data type,x,y,fontsize,fontname,fontattribute,fontcolor
Chart	Graph from display (Chart1,Chart2,Chart3,Chart4 or Trend)
	Format:
	Chart=chart type,left,top,right,bottom
DataView	Graph from dataview display (DataView1-4 or DataView5-8)
	Format:
	DataView=DataView type,left,top,right,bottom
BBBGraphs	Graph from BBB display (3x3 plots)
	Format:
	BBBGraphs=BBBgraphs type,left,top,right,bottom
Meta	Meta file from disk (*.wmf file)
	Format:
	Meta=filename,left,top,right,bottom
Bitmap	Bitmap from disk (*.bmp file)
	Format:
	Bitmap=filename,left,top,right,bottom
Text	Fix text
	Format:
	Text=value,x,y,fontsize,fontname,fontattribute,fontcolor
Line	Draw a line
	Format:
	Line=linewidth,start x,start y,stop x, stop y,color
Frame	Draw a filled frame
	Format:
	Frame=linewidth,left,top,right,bottom,framecolor,fillcolor

Where

X = Y = Fontsize = Fontname = FontAttribute = FontColor, Color, FrameColor,	Horizontal position on the page ([01], 0 is left side, 1 is right side) Vertical position on the page ([01], 0 is top, 1 is bottom) Size of font [10100] Times New Roman, Arial B: Bold, I: Italic, BI: Bold and italic
FillColor =	Colour, see colour coding table below, default black
Chart =	Chart1: current normal screen,
	Chart2: normalised oxygen screen,
	Chart3: semi-logarithmic plot of N ₂ O
	Chart4: SF ₆ screen
DataView =	DataView1: DataView 1 to 4,
	DataView2: DataView 5 to 8
BBBGraphs =	BBBGraphs: current BBB display (up to 3x3 plots)
BBB Data =	BBB Data: current BBB results table
Left =	Left position on the page ([01], 0 is left side, 1 is right side)
Top =	Top position on the screen ([01], 0 is top, 1 is bottom)
Right =	Left position on the page ([01], 0 is left side, 1 is right side)
Bottom =	Bottom position on the screen ([01], 0 is top, 1 is bottom)

- Filename = Filename of image complete path
- Linewidth = Thickness of line [1,2,3...]
- Start x = Start vertical position on the page ([0..1], 0 is top, 1 is bottom)
- Start y = Start horizontal position on the page ([0..1], 0 is left side, 1 is right side)
- Stop x = Stop vertical position on the page ([0..1], 0 is top, 1 is bottom)
- Stop y = Stop horizontal position on the page ([0..1], 0 is left side, 1 is right side)

Colour coding:

Colour	Code
Black	\$000000
Maroon	\$000080
Green	\$008000
Olive	\$008080
Navy	\$800000
Purple	\$800080
Teal	\$808000
Grey	\$808080
Silver	\$C0C0C0
Red	\$0000FF
Lime	\$00FF00
Yellow	\$00FFFF
Blue	\$FF0000
Fuchsia	\$FF00FF
Aqua	\$FFFF00
White	\$FFFFF

The following value's are supported:

Subject:

First name(s) Last name ID number Height Weight

Data & Decimal:	
Dale	
VO2 VO2prKa	
5V	
SI % SpO2	
%SpO2	
%SVU2	
PBF	
Qs/Qt	
SYS	
DIA	
MAP	
SVR	
SVRI	
BSA	
HB	
Vrb	
Comments	s (only supported by Data)

Note the decimal separator must be ".".

An example with 5 print screens is shown below. The first TAB is named **Results**; the second is named **Graph**, the third **BBBView**, and the last 2 **DataView 1-4** and **DataView 5-8**. If the headings are going to be changed the lines with "Text= Heart Clinic...." must be changed. (One for each TAB), see 3.9.3.

[Results] Bitmap=C:\innocor\print\GB Text= H e a r t C l i n i	<pre>\top.bmp,0.05,0.015,0.20,0.10 . c,0.20, 0.04, 50,Times New Roman,Bl</pre>
Text=Name, 0.10	,0.10,16,arial
Subject=First name(s),0.25	,0.10,16,arial,B
Subject=Last name, 0.45	,0.10,16,arial,B
Text=ID, 0.10	,0.125,12,arial
Subject=ID number, 0.25	,0.125,12,arial,B
Subject=Memo, 0.10	,0.14,10,arial
Text=Test Date: , 0.10	,0.185,12,arial
Data=Date, 0.30	,0.185,12,arial,B
Text=Time:, 0.50 Data=Time, 0.60 line= 1,0.10	,0.185,12,arial ,0.185,12,arial,B ,0.200,0.9,0.200
Text=Cardiac Output,	0.10,0.200,14,arial,B,\$0000FF
Decimal=CO,	0.48,0.200,1,14,arial,B,\$0000FF
Text=l/min,	0.55,0.200,13,arial,B,\$0000FF
Text=Cardiac Index,	0.10,0.215,14,arial,B,\$005000
Decimal=CI,	0.48,0.215,1,14,arial,B,\$005000
Text=l/min/m2,	0.55,0.215,13,arial,B,\$005000
Text=Oxygen Uptake /kg,	0.10,0.230,14,arial,B,\$FF0000
Decimal=VO2prkg,	0.48,0.230,1,14,arial,B,\$FF0000
Text=ml/min/kg,	0.55,0.230,13,arial,B,\$FF0000
Text=Stroke Volume,	0.10,0.246,14,arial,B
Decimal=SV,	0.48,0.246,0,14,arial,B
Text=ml,	0.55,0.246,14,arial,B
Text=A-V O2 diff.,	0.10,0.262,14,arial,B

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Decimal=AVO2diff,	0.48,0.262,0,14,arial,B
Text=%,	0.55,0.262,14,arial,B
Text=Detailed,	0.10,0.290,13,arial
line= 1	,0.10,0.306,0.90,0.306
line= 1	,0.48,0.306,0.48,0.505
Text=Stroke Volume,	0.10,0.315,13,arial
Decimal=SV,	0.32,0.315,0,13,arial
Text=ml,	0.38,0.315,13,arial
Text=Stroke Index,	0.50,0.315,13,arial
Decimal=SI,	0.72,0.315,0,13,arial
Text=ml/m2,	0.78,0.315,13,arial
Text=Oxygen Uptake,	0.10,0.330,13,arial
Decimal=VO2,	0.32,0.330,2,13,arial
Text=1/min,	0.38,0.330,13,arial
Text=Oxygen Uptake /kg,	0.50,0.330,13,arial
Decimal=VO2prkg,	0.72,0.330,1,13,arial
Text=ml/min/kg,	0.78,0.330,13,arial
Text=Heart Rate,	0.10,0.345,13,arial
Decimal=HR,	0.32,0.345,0,13,arial
Text=bpm,	0.38,0.345,13,arial
Text=Lung Volume,	0.50,0.345,13,arial
Decimal=FRC,	0.72,0.345,1,13,arial
Text=l,	0.78,0.345,13,arial
Text=SpO2,	0.10,0.360,13,arial
Decimal=%SpO2,	0.32,0.360,0,13,arial
Text=%,	0.38,0.360,13,arial
Text=A-V O2 diff.,	0.50,0.360,13,arial
Decimal=AVO2diff,	0.72,0.360,0,13,arial
Text=%,	0.78,0.360,13,arial
Text=SvO2,	0.10,0.375,13,arial
Decimal=%SvO2,	0.32,0.375,0,13,arial
Text=%,	0.38,0.375,13,arial
Text=Shunt,	0.50,0.375,13,arial
Decimal=Shunt,	0.72,0.375,0,13,arial
Text=%,	0.78,0.375,13,arial
Text=Sys. BP,	0.10,0.400,13,arial
Decimal=SYS,	0.32,0.400,0,13,arial
Text=mmHg,	0.38,0.400,13,arial
Text=Vascular Resistance,	0.50,0.400,13,arial
Decimal=SVR,	0.72,0.400,1,13,arial
Text=mmHg/(l/min),	0.78,0.400,13,arial
Text=Map. BP,	0.10,0.415,13,arial
Decimal=MAP,	0.32,0.415,0,13,arial
Text=mmHg,	0.38,0.415,13,arial
Text=Vascular Res. Index,	0.50,0.415,13,arial
Decimal=SVRI,	0.72,0.415,1,13,arial
Text=Dia. BP,	0.10,0.430,13,arial
Decimal=DIA,	0.32,0.430,0,13,arial
Text=mmHg,	0.38,0.430,13,aria
Text=Height,	0.10,0.455,13,arial
Decimal=Height,	0.32,0.455,0,13,arial
Text=cm,	0.38,0.455,13,arial
Text=Hb,	0.50,0.460,13,arial
Decimal=HB,	0.72,0.460,1,13,arial
Text=g/dl,	0.78,0.460,13,arial
Text=Weight,	0.10,0.470,13,arial
Decimal=weight,	0.32,0.470,0,13,arial
Text=kg,	0.38,0.470,13,arial
Text=Load,	0.10,0.485,13,arial
Decimal=Load,	0.32,0.485,0,13,arial
Text=watt,	0.38,0.485,13,arial
Text=Body Surface Area,	0.50,0.475,13,arial
Decimal=BSA,	0.72,0.475,1,13,arial
Text=m2,	0.78,0.475,13,arial
0.10,0.510,13,arial 1,0.10,0.525,0.90,0.525 Text=Test Comments, line= Data=Comments, 0.10,0.530,10,arial Chart=Chart1,0.06,0.560,0.51,0.760 Chart=Chart4,0.52,0.560,0.98,0.760 Chart=Chart3,0.06,0.762,0.51,0.962 Chart=Chart2,0.52,0.762,0.98,0.962 [Graph] Bitmap-C:\innocor\print\GB\top.bmp,0.05,0.015,0.20,0.10 Text= H e a r t C l i n i c,0.20, 0.04, 50,Times New Roman,BI 0.10,0.10,16,arial Text=Name Subject=First name(s),0.25,0.10,16,arial,B Subject=Last name, 0.45,0.10,16,arial,B Text=ID, 0.10,0.125,12,arial Subject=ID number, 0.25,0.125,12,arial,B Subject=Memo, 0.10,0.14,10,arial Text=Test Date, 0.10,0.185,12,arial Data=Date, 0.30,0.185,12,arial,B Text=Time, 0.50,0.185,12,arial Data=Time, 0.60,0.185,12,arial,B line= 1,0.10,0.200,0.9,0.200 Text=Cardiac Output, 0.10.0.200.14.arial.B.\$0000FF 0.48,0.200,1,14,arial,B,\$0000FF 0.55,0.200,13,arial,B,\$0000FF Decimal=CO, Text=1/min, Text=Cardiac Index, 0.10,0.215,14,arial,B,\$005000 Decimal=CT. 0.48,0.215,1,14,arial,B,\$005000 0.55,0.215,13,arial,B,\$005000 Text=1/min/m2. Text=Oxygen Uptake /kg, 0.10,0.230,14,arial,B,\$FF0000 Decimal=V02prkg, 0.48,0.230,1,14,arial,B,\$FF0000 Text=ml/min/kg. 0.55,0.230,13,arial,B,\$FF0000 Text=Stroke Volume, 0.10,0.246,14,arial,B 0.48,0.246,0,14,arial,B 0.55,0.246,14,arial,B Decimal=SV, Text=ml, Text=A-V O2 diff., 0.10,0.262,14,arial,B 0.48,0.262,0,14,arial,B Decimal=AVO2diff, 0.55,0.262,14,arial,B Text=%, Chart=Chart1,0.06,0.28,0.51,0.61 Chart=Chart4,0.52,0.28,0.98,0.61 Chart=Chart3,0.06,0.62,0.51,0.95 Chart=Chart2,0.52,0.62,0.98,0.95 [BBBView] Bitmap=C:\innocor\print\GB\top.bmp,0.05,0.015,0.20,0.10 Text= H e a r t C l i n i c,0.20, 0.04, 50, Times New Roman, BI 0.10,0.10,16,arial Text=Name :, Subject=First name(s),0.25,0.10,16,arial,B Subject=Last name, 0.45,0.10,16,arial,B Text=TD : 0.10,0.12,12,arial Subject=ID number, 0.25,0.12,12,arial BBBMainData=BBB Data, 0.15,0.44,9,arial BBBGRAPHS=BBBGRAPHS, 0.05,0.45,0.95,0.95 [Dataview 1-4] Bitmap=C:\innocor\print\GB\top.bmp,0.05,0.015,0.20,0.10 Text= H e a r t C l i n i c,0.20, 0.04, 50,Times New Roman,BI 0.10,0.10,16,arial Text=Name :, Subject=First name(s),0.25,0.10,16,arial,B Subject=Last name, 0.45,0.10,16,arial,B Text=ID :, 0.10,0.125,12,arial Text=ID:, 0.10,0.125,12,arial Subject=ID number, 0.25,0.125,12,arial,B DATAVIEW=DATAVIEW1,0.05,0.14,0.95,0.90 [Dataview 5-8] Bitmap=C:\innocor\print\GB\top.bmp,0.05,0.015,0.20,0.10 Text= H e a r t C l i n i c,0.20, 0.04, 50, Times New Roman, BI Text=Name :, 0.10,0.10,16,arial Subject=First name(s),0.25,0.10,16,arial,B Subject=Last name, 0.45,0.10,16,arial,B

Text=ID :, 0.10,0.125,12,arial Subject=ID number, 0.25,0.125,12,arial,B

DATAVIEW=DATAVIEW2,0.05,0.14,0.95,0.90

3.9.3 Print layout header & footer

The header of the prints can relatively easy be changed by modifying a few lines in the PrintSetup.Ini without changing the data and graph layout. Only the following 2 lines for each tab have to be modified (here the English version (GB)):

[tab name]

 $\texttt{Bitmap=C:\innocor\print\GB\top.bmp,0.05,0.015,0.20,0.10}$ Text= H e a r t C l i n i c,0.20, 0.04, 50, Times New Roman, BI

Default header layout:



Alternative configuration of the header:

Anernative configuration of the neader: Bitmap=C:\innocor\print\GB\inno.bmp,0.75,0.016,0.92,0.11 Text= Innovision A/S,0.15, 0.02, 16,Areal,B Text= Lindvedvej 75,0.15, 0.04, 16,Areal,B Text= DK-5260 Odense S,0.15, 0.065, 12,Areal,B Text= Prof. Dr. H. C. Andersen,0.15, 0.082, 12,Areal Text= Tel: (+45)-65 95 91 00,0.15, 0.097, 12,Areal Line= 1,0.05,0.12,0.95,0.12



Configuration of footer:

Text=Innovision A/S testlab. Lindvedvej 75 DK-5260 Odense S, 0.05,0.965,8,arial Text=Tel +45 65 95 91 00,0.7,0.96,6,arial Text=Fax +43 65 95 78 00,0.7,0.967,6,arial Text=WEB www.innovision.dk,0.85,0.96,6,arial Text=E-MAIL info@innovision.dk,0.85,0.967,6,arial

Innovision A/S testlab. Lindvedvej 75 DK-5260 Odense S	Tel +45 65 95 91 00 Fax +43 65 95 78 00
Innocor	

WEB www.innovision.dk E-MAIL info@innovision.dk

3.9.4 Preparing an image for the header & footer

The image & logo used in the header or footer must be in a *.bmp or *.wmf format. The image is located by the "Bitmap=C:\innocor\print\GB\top.bmp". Use e.g. Microsoft Paint to convert an existing image to the bmp format. The size of the image is not important, since the scaling is done when the image is loaded by the Innocor software to fit the defined print area. If the image is available in Microsoft Word, then try to copy & paste the image to Microsoft Paint, where the image can be saved as bmp.

3.10 HELP SYSTEM

The help system consist of html pages stored in the HELP directory under the specific language directory. The help system contains 4 main entries:

DataExport.htm =	Help on how to export data to txt files
Measurement.htm =	Help on how to perform a measurement
Patient.htm =	Help on how to enter patient data
Setup.htm =	Help on how to setup the Innocor

These files are directly addressed via the Innocor S/W. An extra main page (Index.htm) is also present in order to group these 4 help pages together.

The html pages must be compatible with the Internet Explorer 5, and can be generated using different tools, e.g. Microsoft Frontpage or Microsoft Word.

3.11 TIPS & TRICKS

3.11.1 Mouse support

The Innocor software is designed to use the touch screen to navigate through the program. However a mouse can be used in case of a damaged touch screen. The mouse support is turned on by starting the Innocor software with a "/M" on the command line. This can be done in a short cut or directly in the Windows Registry if the support shall be permanent. The registry key is:

HKEY_LOCAL_MACHINE SOFTWARE MICROSOFT WINDOWS NT CURRENT VERSION WINLOGON SHELL C:\innocor\program\innocor.exe /M

Note: Be careful when editing the Registry - one mistake and the Innocor may not start again!

3.11.2 Keyboard support

The Innocor is not delivered with a keyboard. But in some cases in the Windows environment it is necessary to enter/change a value using a keyboard. Connect a USB keyboard or use the built in OSK (On-screen keyboard), which can be used by the touch screen and stays on top of all applications (see 3.12).

= 0	In-9	ācr	een	Key	bo	ard																			×
Eile	<u>K</u> ε	зyb	oard	Se	ettir	ngs	Help)																	
esc			F1	Fź	2	F3	F4		F5	F6	E	,	F8		F9	F10) F1	1 F12	psc		brk				
•	1	L	2	3	I	4	5	6		7	8	9		0	-	=	Ь	ksp	ins	hm	pup	nik	7	*	-
ta	Ь	•	4	w	е	Ι	r	t	у	u	i	Ι	0	р		[1	#	del	end	pdn	7	8	9	
lo			a	s	Ι	d	f	g		h	j	k	Γ		;	•		ent				4	5	6	+
-				z	×	(:	v	Ь	n	m	Γ			1	•						1	2	3	
cti		4	5													-)	•	ent

3.11.3 Setting speed to km/h or mph

The treadmill protocol is by default using the unit km/h for the speed, but can be changed to mph in the **Patient Data** menu:

- Select a patient
- Select Pt. Data
- Toggle to get **Patient data to use in new test** displayed
- Select the Exercise tab
- Set speed to km/h or mph

Patient data to use in a new test.	\
Load Watt Speed mph Slope Km/h mph rpm Norm NIBP Exercise User	7 8 9 ← 4 5 6 Del 1 2 3 - 0 - ← → Cancel OK

3.11.4 How to recalculate rebreathing data

The rebreathing results are calculated directly after a rebreathing test, and saved in the database. Changing calculation parameters will not change the results in the database, but by pressing the ID field a recalculation can be displayed. The recalculation can not be saved.



3.11.5 Running in parallel with an exercise device

When an exercise device is not controlled by the Innocor, the manual control can be selected, in which case the user is prompted to change exercise levels. If the exercise device is controlled by an internal program or by another external unit, the Dummy_Bike_Mill can be selected, and the user will not be prompted when changing exercise levels. Note there is no synchronization between the Innocor and the exercise device, and the load values on the Innocor may therefore be wrong / shifted. If the synchronization is important, the following procedure can help:

- Make the time intervals on the Innocor a little longer than on the external device.
- Every time the exercise level is changed go to View., show protocol,
- Select next test, and
- Press Go to step.

3.11.6 Corrupt gas bottle database

If the Innocor software gives the message "**The Gas Cylinder data was not found - Further measurement not possible**" when trying to make a new test, the gas bottle database is invalid or damaged. This is a serious message that normally only can be resolved by sending the Innocor to Innovision for repair. However the following procedure can maybe rescue the database:

- Exit to Windows (see section 3.1)
- Navigate to C:\innocor\program
- Rename the file Innosys.dll to Innosys.bak
- Restart Innocor

3.11.7 Generating images of graphics

When using a mouse together with the Innocor or Innocor viewer, it is possible to generate an *.emf image of most of the graphics by right clicking on the plot. See section 3.5.10.3 for more information on the EMF format.

3.12 WINDOWS XP EMBEDDED

When using the secret key "Right + Left Upper Screen Corner", see section 3.1, the Innocor program will terminate, and exit to a Windows screen like:

😂 shortcut					_ 8 ×
<u>File E</u> dit <u>V</u> iew F <u>a</u> vorites <u>T</u> ools	Help				
🕞 Back 🔹 🕥 🗸 🏂 🔎 Sea	arch 😥 Folders				
Address 🗀 C:\innocor\shortcut				-	🔁 Go
Folders ×	Name 🔺	Size	Туре	Date Modified	
Desktop My Documents My Computer INNOCOR (C;) Crndcons Documents and Se Innocor backup databases export Help language PGAMON Print program Protocol Rawdata RawdataBBB Setup shortcut Program Files Recycled WINDOWS Shared Documents Ventor Into Shared Documents	Image: control.exe I	1 KB 1 KB 1 KB 2 KB 1 KB 2 KB 1 KB 1 KB 2 KB	Shortcut Shortcut Shortcut Shortcut Shortcut Shortcut Shortcut Shortcut Shortcut Shortcut	29/08/2003 15:24 29/08/2003 15:18 30/05/2006 09:38 01/09/2003 09:15 29/08/2003 15:23 19/09/2003 13:55 02/06/2006 11:40 02/04/2004 15:25 29/08/2003 15:36 02/09/2003 12:53 02/03/2007 10:18	

From this screen the common used shortcuts are available:

Link	Link to:
Control.exe	Control Panel
Elo Touchscreen	Calibration program for the adjustment of the touch screen
FlowmeterCalibration	Calibration of flowmeter table
Innocor Rebreathing Animation	Innocor Rebreathing Animation
Innocor Setup	Setup folder
InnodatabaseRecover	Repair tool for the Innocor databases
Innocor_presentation_May2006	Innocor presentation
OSK	On-Screen Keyboard
PGAMON	Factory tool for multi-calibration of the gas analyser
Restart Innocor	Innocor software
Shutdown	Safe shutdown of the Innocor

More shortcuts can be found under Desktop.

🎑 Desktop					_ 8 ×			
<u>File E</u> dit <u>V</u> iew F <u>a</u> vorites <u>T</u> ools <u>H</u> e	elp							
🚱 Back 🔹 🕥 - 🎓 Search 📂 Folders 🔯 🦅 🗙 🌳 💷 -								
Address 🕜 Desktop				-	🔁 Go			
Folders ×	Name 🔺	Size	Туре	Date Modified				
	My Documents		System Folder					
My Documents	🛛 😼 My Computer		System Folder					
🖃 😡 My Computer	Sector My Network Places		System Folder					
E INNOCOR (C;)	Recycle Bin		System Folder					
🗉 🧰 Documents and Settings	🔁 Internet Explorer		System Folder					
🗆 🔁 innocor	Acrobat Reader 5.0	1 KB	Shortcut	01/09/2003 9:34				
🗄 🧰 BackUp	a InnoCor	1 KB	Shortcut	19/05/2003 8:54				
Copy of databases	📕 Computer Management	1 KB	Shortcut	11/05/2003 6:40				
Copy of Rawdata	control	2 KB	Shortcut	26/06/2003 1:03				
atabases	Event Viewer	1 KB	Shortcut	11/05/2003 6:40				
Databases-org	📲 mspaint	2 KB	Shortcut	26/06/2003 12:13				
R export	🔣 QuickTime Player	1 KB	Shortcut	01/09/2003 8:55				
🕀 🧰 help	Shortcut to Elo Touchscreen	1 KB	Shortcut	29/08/2003 3:18				
	wordpad	1 KB	Shortcut	26/06/2003 1:27				

NOTE! It is recommended to have a USB keyboard and mouse connected to Innocor in order to navigate.

Under Windows XP embedded (XPe) the normal Windows start button and many other normal Windows facilities are disabled!

Using the CTRL ALT DELETE the Windows logon screen will appear. Select the Task Manager, and with "New Task" or "File | New Task" a new task / program can be started, i.e.:

Explorer	will start Explorer
Control	will start Control Panel
Notepad	will start Notepad
Mspaint	will start Paint
Cmd	will start the Command Prompt
Osk	will start an On-Screen Keyboard
WordPad	will start Microsoft WordPad

三 ₩	/indows T	ask M	anager				_ 🗆 🗵
<u>F</u> ile	Options	⊻iew	<u>W</u> indows	<u>H</u> elp			
Ap	plications	Proces	ses Perfo	ormance	Networking		
	Task					Status	
	▲						
			End	Task.	<u>S</u> witch To	New T	ask
Proce	esses: 17	CPI	J Usage: 1	2%	Commit Char	rge: 43148K	/ 18298C //

Create N	lew Task ? 🗶
	Type the name of a program, folder, document, or Internet resource, and Windows will open it for you.
Open:	explorer 🗸
	OK Cancel <u>B</u> rowse

3.12.1 Control Panel

The Control Panel of the XPe on Innocor consists of the following elements:



🕼 Control Panel							
<u>File E</u> dit <u>V</u> iew F <u>a</u> vorites <u>T</u> o	ols <u>H</u> elp						
🕞 Back 🔹 🌍 🔹 🏂 🔎	Search 🦻 Folders 🛛 🏂 🎲 🗙 🍤 💷 -						
Address 🚱 Control Panel 💽 🕤 Go							
Name 🔺	Comments						
Accessibility Options	Adjust your computer settings for vision, hearing, and mobility.						
SAdd Hardware	Installs and troubleshoots hardware						
🔚 Add or Remove Programs	Install or remove programs and Windows components.						
🗃 Administrative Tools	Configure administrative settings for your computer.						
80 CSNW	Client Service for NetWare						
Data Sources (ODBC)	Maintains ODBC data sources and drivers						
😼 Date and Time	Set the date, time, and time zone for your computer.						
Display	Change the appearance of your desktop, such as the background, screen saver, colors, font sizes, and screen resolution.						
Elo Touchscreen	Customizes touch settings and aligns your Elo touchmonitor.						
Folder Options	Customize the display of files and folders, change file associations, and make network files available offline.						
I Fonts	Add, change, and manage fonts on your computer.						
Game Controllers	Add, remove, and configure game controller hardware such as joysticks and gamepads.						
W Internet Options	Configure your Internet display and connection settings.						
/ Experimentary	Customize your keyboard settings, such as the cursor blink rate and the character repeat rate.						
Mouse	Customize your mouse settings, such as the button configuration, double-click speed, mouse pointers, and motion speed.						
Network Connections	Connects to other computers, networks, and the Internet.						
Phone and Modem Options	Configure your telephone dialing rules and modem settings.						
Power Options	Configure energy-saving settings for your computer.						
Printers and Faxes	Shows installed printers and fax printers and helps you add new ones.						
QuickTime	Configures QuickTime software and hardware components.						
Regional and Language Options	Customize settings for the display of languages, numbers, times, and dates.						
Scanners and Cameras	Add, remove, and configure scanners and cameras.						
Scheduled Tasks	Schedule computer tasks to run automatically.						
Sounds and Audio Devices	Change the sound scheme for your computer, or configure the settings for your speakers and recording devices.						
Speech	Change settings for text-to-speech and for speech recognition (if installed).						
System	See information about your computer system, and change settings for hardware, performance, and automatic updates.						
📇 Taskbar and Start Menu	Customize the Start Menu and the taskbar, such as the types of items to be displayed and how they should appear.						
Souther Accounts	Change user account settings and passwords for people who share this computer.						

3.12.2 Backup boot up of windows XP embedded

If the windows XP embedded fails to boot up due to e.g. corrupted files, it is possible to boot up on a secondary drive (d:). This alternative boot up is not starting the Innocor software, only the Windows operating system. With the alternative boot up it is possible to make a check disk of the primary drive or simply copy the corrupted file(s) from the secondary drive to the primary drive. It is also possible to run the Innocor software from the secondary drive, and then later repair the primary drive.

3.12.2.1 How to boot from the alternative drive.

- 1 Connect a keyboard to the USB connection on Innocor
- 2 Press and hold down F8 while switching ON the power.
- 3 Wait for the BIOS to finish. After this a black screen with selection possibilities is shown. Now F8 can be released.
- 4 With the arrow keys select the last row "Return to OS Choices Menu", and press "Enter"
- 5 A new screen is shown with

Innocor (C) XPE Backup (D) Microsoft Windows Recovery Console

Innocor(C) is the normal boot up on the primary drive. XPE Backup (D) is the alternative boot up on the secondary drive. Microsoft Windows Recovery Console is a boot up in a command prompt display with a limited set of DOS like commands.

6 Use the arrow key to select a line and press Enter.

3.12.2.2 How to run Innocor software from the alternative drive.

Press the Start button and select the Innocor program. This will start up the Innocor software located on the primary drive, and the standard database on the primary drive will be used.

3.12.2.3 How to use Microsoft Windows Recovery Console

Recovery Console is for the more advanced user. It is only possible to enter the Windows folder on the C: or D: drive in the Recovery Console mode in order to repair the Windows system. Files can be copied but not edited.

The boot in Recovery Console mode starts with:

- 1 Black screen, then "Please wait ...", which takes 30 60 sec.
- 2 Choose the Windows system to use.
 - 1 : "C:\Windows"
 - 2: "D:\Windows"
- 3 Press "1" to select the primary c:\windows, which properly is the partition with the error to be corrected. Administrator password is : superpass

27 commands are available form Recovery Console. Some of them are listed below:

Help	Show all the commands							
Chkdsk /p	Make at check and repair files on the partition.							
ChDir	Select a new directory							
Сору	Copy files from c:\ or c:\windows to and from a USB memory key (E:).							
Bootcfg	Can be used to change the default boot partition							
	E.g. change the default boot partition from c: to d:							
	type: Bootcfg /default							
	a list with the two windows partitions will be shown as:							
	[1] "Innocor (C)"							
	DI "YPE Backup (D)"							
	\sim solar installation to add \sim \sim type here the 2 to solar the secondary partition							
	Select installation to add . A type here the 2 to select the secondary partition							

3.12.2.4 How to change the default boot partition

The file called **BOOT.INI** located on the C-partition determines the **default boot partition.** The file is a read-only text file.

The normal content of this file is:

```
[boot loader]
timeout=0
default=multi(0)disk(0)rdisk(0)partition(1)\WINDOWS
[operating systems]
multi(0)disk(0)rdisk(0)partition(1)\WINDOWS="Innocor (C)" /fastdetect
multi(0)disk(0)rdisk(0)partition(2)\WINDOWS="XPE Backup (D)" /fastdetect
```

C:\CMDCONS\BOOTSECT.DAT="Microsoft Windows Recovery Console" /cmdcons

To change the boot partition to the secondary drive the number "1" in line 3 (default=...) must be changed to "2":

default=multi(0)disk(0)rdisk(0)partition(2)\WINDOWS

Note: Be very careful when changing the BOOT.INI file – a single mistake and the system will be locked!

Changing BOOT.INI with "Recovery Console" can be done by copying BOOT.INI to a USBmemory key. Edit the file on another PC, and then copy the file back to the Innocor.

3.13 NETWORK CONNECTION

This section contains a short instruction on how to connect a computer to the Innocor in order to transfer files from the Innocor to a remote computer or vice-versa. The instructions are written for a computer super-user.

Basic Setup (IP addresses setup)

The Innocor and the remote computer must use the same IP address range in order to be able to move files between them. The Innocor uses as default the following:

IP:	10.0.0.x,
Mask:	255.255.255.0
Domain/workgroup:	Inno_wrkgrp

where x is in the range 50-99. X is found as the serial number modulus 50 + 50.

I.e.:

sn0303034 = 10.0.0.84 sn0416088 = 10.0.0.88

Either the Innocor can be changed to match the remote computer or the remote computer can be changed to match the Innocor.

Change Innocor to match the remote computer

Change the Innocor settings to match the network it is attached to. You will need a USB keyboard/mouse connected to the Innocor or the On-Screen Keyboard program (osk.exe) to change the settings. Press the right-top corner followed by left-top corner to exit to Windows without shutting down, section 3.1. Enter Control Panel and select the network icon. Find the TCP/IP protocol and change the settings using the properties, see section 3.13.2 for how to change IP address on a Windows XPe system. It is not necessary to change the domain/workgroup of the Innocor to match the external network. If a DHCP server is connected to the network, the Innocor can be configured to get an IP from the DHCP server. Getting an IP address from a DHCP server will however increase the boot-up time in case of using the Innocor not connected to the network.

Change the remote computer to match Innocor

Enter Control Panel and select the network icon. Find the TCP/IP protocol and change the settings using the properties. Set the IP address of the remote computer to e.g. 10.0.0.49.

Hardware connection

Connect the Innocor and the remote computer to the network via a hub/switch, or use a crossed RJ45 cable to make a direct connection. Make the connection before you power on, unless both of them are running Windows XP.

The connection can be checked using the PING command. If the PING command does not work the Innocor and the remote computer cannot communicate.

Enter the command prompt (cmd) and type:

PING 10.0.0.x

Where x is the IP address of the other computer.

📾 Command Prompt 📃 🗖 🗙
C:\>PING 10.0.0.50
Pinging 10.0.0.50 with 32 bytes of data:
Reply from 10.0.0.50: bytes=32 time=1ms TTL=128 Reply from 10.0.0.50: bytes=32 time<1ms TTL=128 Reply from 10.0.0.50: bytes=32 time<1ms TTL=128 Reply from 10.0.0.50: bytes=32 time<1ms TTL=128
Ping statistics for 10.0.0.50: Packets: Sent = 4, Received = 4, Lost = 0 (0% loss), Approximate round trip times in milli-seconds: Minimum = Oms, Maximum = 1ms, Average = Oms
G:\>

Logon from remote computer

(For transferring data files)

The remote computer can logon as **innouser** with password **innopass**, or **innosuper** with password **superpass**. Innouser has restricted access, whereas innosuper has access to the entire Innocor folder.

On the remote computer use the "Network Neighbourhood" to browse to the Innocor computer (named as the serial no. e.g. **0125002**, **sn0326061** or **newinnocor**). See section 3.13.1 on how to find an Innocor on a network.

If the remote computer is running Windows 9x, the following procedure can be used to connect to the Innocor:

- Select Other computer properties
- Select Client program to Microsoft Network properties
- Remove: logon Windows NT-domain
- Restart
- Logon with username = innouser (or innosuper)
- Password = <blank>
- The password innopass or superpass must be entered at the time when the remote computer is logging on to the Innocor.

3.13.1 How to find Innocor on a network using Windows XP

Method 1 (if you do not know the name of the Innocor):

- Press START
- Press My Network Places
- Press Entire Network (View workgroup computers)
- Press Microsoft Windows Network
- Select Inno_wrkgrp
- Select "innocor" by serial number

Note! It can take some minutes before an Innocor can be seen / found on the network.

Method 2 (if you know the name of the Innocor):

- Press START
- Press Search
- Select "Computers or people#
- Select "A computer on the network"
- Enter computer name of the Innocor
- Normally serial number, to which the sn can be added. Example:
 - 0235024
 - sn0315051

3.13.2 How to set IP address on Innocor

- Select Control Panel (Shortcut Control on Desktop in Explorer)
- Select Network Connection
- Right click on Local Area Connection
- Select Properties
- Select Internet Protocol (TCP/IP)
- Select Properties

🔁 Network Connections				<u>_ 8 ×</u>
<u>File E</u> dit <u>V</u> iew F <u>a</u> vorites <u>T</u> ools Adva	nced Help			A.
🚱 Back 👻 🕥 🖌 🏂 🔎 Search 🥡	🏂 Folders 🛛 🔯 🏂 🔰	K 🍤 💷-		
Address 😰 Network Connections				💌 🄁 Go
Name	Туре	Status	Device Name	Phone # or Host Address
LAN or High-Speed Internet				
Local Area Connection	LAN or High-Speed Inter	Enabled	Intel(R) 8255xER PCI Ad	
Wizard				
🔮 Network Setup Wizard 🔟 New Connection Wizard	Wizard Wizard			

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🕹 Local Area Connection Properties 🏼 💽 🗙	Internet Protocol (TCP/IP) Properties
General Authentication Advanced	General
Connect using: By Intel(R) 8255xER PCI Adapter	You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
	○ <u>D</u> btain an IP address automatically ○ Use the following IP address:
Elient for Microsoft Networks QoS Packet Scheduler Elie and Printer Sharing for Microsoft Networks File and Printer CP/IP)	IP address: 10.0.0.61 Subnet mask: 255.255.255.0 Default gateway:
Install Properties Description Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks. Show icon in notification area when connected	Obtain DNS server address automatically Obtain DNS server addresses: Preferred DNS server: Alternate DNS server:
	Adyanced OK Cancel

3.13.3 How to set Computer Name on Innocor

- Right click on My Computer in Explorer (or via Files)
- Select Properties
- Select Tab "Computer Name"
- Press Change...
- Enter computer name as "snyywwnnn
 - where

yy = year ww = week nnn = running number e.g. sn0326061

System Properties		? 🗙 Computer Name Changes	? ×	
System Properties General Computer Name Windows uses on the networi Computer description: Full computer name: Workgroup: To use the Network Ider domain and create a loc ID. To rename this computer	Hardware Advanced Hardware Advance Hardware Adva	? × Computer Name Changes You can change the name and the membership of this computer. Changes may affect access to network resound the membership of this computer name:	? × of this k resources. More	
To rename this compute	r or join a domain, click Change.	je	ncel	
	OK Cancel 🛆	Apply		

3.13.4 How to install software from a CD-ROM on an Innocor

This can be useful for installing e.g. a new printer.

If the Innocor is running Windows XP, an external USB CD-ROM can be used. Otherwise a CD-ROM on a remote computer can be shared.

First of all, establish a network connection between the Innocor and the remote computer. On the remote computer share the CD-ROM disc with permissions that gives Innocor access to the shared CD-ROM disc.

(Locate the CD-ROM disc with the explorer, right click and select sharing).

On the Innocor use the "Network Neighbourhood" to browse to the remote computer. Select the shared CD-ROM and open it. Double-click the installation program (e.g. Setup, Install) and follow the instruction given on the screen.

3.13.5 How to perform a check of the hard disk

Start the Command Prompt by entering **Cmd** when starting a new task, see section 3.9, or start the program c:\windows\system32\cmd.exe using the explorer. Then enter chkdsk.exe /F at the command prompt, and the hard disk will be checked & corrected for errors at the next boot up.

The Innocor is automatically scheduled to run a scandisk (at the next boot-up) if the power is turned off unauthorized.

3.14 USB TO SERIAL CONVERTER

When controlling an exercise device from the Innocor, a USB to serial converter must be used. The Innocor is installed with a USB to serial driver compatible with the USB to serial converters delivered from Innovision. If another type of the USB to serial converter is used the corresponding driver must be installed.

The USB to serial connecter must be listed on the Ports (COM & LPT) in Device manager when connected and installed successfully.

System Properties	? ×
General Computer Name Hardware Advanced	
Add Hardware Wizard The Add Hardware Wizard helps you install hardware.	
Add <u>H</u> ardware Wizard	
Device Manager The Device Manager lists all the hardware devices installed on your computer. Use the Device Manager to change the properties of any device.	
Device Manager	
Hardware Profiles Hardware profiles provide a way for you to set up and store different hardware configurations.	
Hardware Profiles	
OK Cancel Ap	ply

므 Device Manager	_ <u>_ </u> ×
Elle Action View Help	
E G IDE ATA/ATAPI controllers	-
Wice and other pointing devices	
Elo Serial Touchmonitor Interface Microsoft Serial RallPaint	
Image of the solution of	
E- 🚱 Other devices	
Southead Addie Controller	
Ports (COM & LPT) Communications Port (COM1)	
GP Printer Port (LPT1) Wultinort Communications Port (COM3)	
- 2 Multiport Communications Port (COM4)	
→ J Multiport Communications Port (COM5) ↓ Wultiport Communications Port (COM6)	
Prolific USB-to-Serial Comm Port (COM7)	
Sound, video and game controllers System devices	
,	,
olific USB-to-Serial Comm Port (COM7) Properties	
General Port Settings Driver	
Prolific USB-to-Serial Comm Port (COM7)	
Driver Provider: Prolific	
Driver Date: 29/03/2001	
Driver version: 1.3.0.0	
Digital Signel. Not ulgitally signed	
Driver Details	
Update Driver To update the driver for this device.	
<u>Boll Back Driver</u> <u>Boll Back Driver</u> <u>Boll Back to the previously installed driver.</u>	
Uninstall To uninstall the driver (Advanced).	
OK Cancel	
river File Details	
Prolific USB-to-Serial Comm Port (COM7)	
Driver files:	
C:\WINDOWS\System32\DRIVERS\ser2pl.sys	
C:\WINDOWS\system32\drivers\serenum.sys	
Provider: Prolific Technology Inc.	
File version: 2.0.0.18	
Copyright: Copyright(C) 2000 Prolific Technology Inc.	
Digital Signer: Not available	
OK	

3.15 EVENT LOG

Some errors/warnings in the event viewer of the Windows system are normal. These normal events just after a Power Up are displayed below.

Windows NT

<u>L</u> og ⊻iew <u>O</u> pl	tions <u>H</u> elp			
Date	Time	Source	Category	Event
🐵 03/07/2003	09:45:25	i8042prt	None	26
🐵 03/07/2003	09:45:25	i8042prt	None	26
🐵 03/07/2003	09:45:25	i8042prt	None	26
🐵 03/07/2003	09:45:25	i8042prt	None	26
🐵 03/07/2003	09:45:25	i8042prt	None	15
🐵 03/07/2003	09:45:25	i8042prt	None	20
🐵 03/07/2003	09:45:25	i8042prt	None	19
① 03/07/2003	09:45:04	EventLog	None	6005
① 03/07/2003	09:45:04	EventLog	None	6009
103/07/2003	09:45:25	i8042prt	None	17
① 03/07/2003	09:43:33	EventLog	None	6006

The errors "i8042prt" are caused by the fact that there is no keyboard connected to the "Keyboard/PS2 mouse" connector on PCM-3350. This error is of no importance.

Windows XP embedded

📑 Event Viewer								_ 🗆 🗙
Eile <u>A</u> ction <u>V</u> iew E	<u>t</u> elp							
← → 🗈 🖪 😭	1 🗟 🔁							
🔃 Event Viewer (Local)	System 2 ever	nt(s)						
Application	Туре	Date	Time	Source	Category	Event	User	Computer
Security	Information	02/07/2003	14:01:48	SNMP	None	1001	N/A	INNOCORXP
System	Error	02/07/2003	14:01:40	monmo	None	26	N/A	INNOCORXP

The Monmouse error is caused by the touch screen and is of no importance!

Under Computer management / Device manager:

🗄 📲 😨 Computer
🗄 🥌 Disk drives
🚊 😼 Display adapters
🔚 📆 National Semiconductor Corporation Win2K Graphics Driver
🗄 📹 Floppy disk controllers
🗄 🎰 Human Interface Devices
🗄 📹 IDE ATA/ATAPI controllers
🚊 🦥 Keyboards
🧼 🧼 Microsoft USB Internet Keyboard Pro
🖃 🐌 Mice and other pointing devices
📉 🗞 Microsoft Serial BallPoint
🔃 🕮 Network adapters
🖻 🐕 Other devices
📲 Multimedia Audio Controller
🔄 🚰 Other PCI Bridge Device
🖻 🖓 Ports (COM & LPT)
- 🖉 Communications Port (COM1)
- Z Communications Port (COM2)
ECP Printer Port (LPT1)
- 🖉 Multiport Communications Port (COM3)
- 🖉 Multiport Communications Port (COM4)
- 🖉 Multiport Communications Port (COM5)
Multiport Communications Port (COM6)
🛨 🕎 Sound, video and game controllers
🛨 👷 System devices
🖅 🔫 Universal Serial Bus controllers