

Communication Interface Manual

Microstream[®]

**Handheld Capnographs and
Capnographs/Pulse Oximeters**

PN: 009815E

Introduction

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Chapter 1. Introduction

1.1. Microstream[®] Monitors

Handheld monitors based on the Microstream[®] technology are available as capnographs and as dual capnograph/pulse oximeter units. They are referred to in this document as monitors or capnographs, depending on the context. The instructions in this manual apply to both types of monitors, with some utilities only available for one type of monitor.

The monitors collect EtCO₂, FiCO₂, Respiratory Rate, SpO₂, and Pulse Rate real time and trend value data. Data collected by the monitor can be transferred to any of the devices listed below (subject to limitations described in the body of this manual). During communication with all types of devices, the monitor continues to function normally.

Microstream[®] handheld monitors can connect to any of the following devices: A detailed description of the connection process with each of these devices appears in this document.

- Seiko DPU-414 printer
- Personal Computer
- Analog devices such as sleep recorders
- Bernoulli[®] /Oxinet[®] III hospital data collection systems
- Nurse Call systems
- Philips Patient Monitors
- Spacelabs Patient Monitors

1.2. **Warnings**

WARNING: When connecting the monitor to another instrument, verify the instrument's proper operation before clinical use. Refer to the instrument's manual for full instructions. For further questions, contact your local distributor.

WARNING: Do not connect the monitor to a printer or PC unless using the Communication Adapter Kit provided by the manufacturer. The kit is an optional accessory.

WARNING: When using the printer/PC with main line power, it is recommended to use a medical grade power supply complying with the following standards: EN60601-1, UL 60601-1, CSA C22.2, and No. 601.1-M90. If the power supply is not medical grade, the printer must be placed at least 1.5 meters from the patient environment in order to comply with standard EN60601-1-2.

Note: When attaching the handheld capnograph or the handheld capnograph/pulse oximeter to network systems, ensure that the directions in this document are followed in order to avoid connectivity issues. The effects of connecting other third-party devices to the same network or making other changes to the network to which the handheld capnograph or the handheld capnograph/pulse oximeter is attached should be considered in advance prior to final implementation. A change management process will help identify potential risk.

1.3. **Monitor Software**

Only monitors with software version 1.21 or higher have memory capability to download data. To check your software version, look in the upper right hand corner of the initialization screen during the power-on self-test.



Figure 1. Initialization Screen

The handheld capnograph has a 14 hour memory capability and the handheld capnograph/pulse oximeter has an 8 hour memory capability.

Chapter 2. Communication Adapter Kit

The Communication Adapter Kit enables a printer or PC to interface with the monitor. It is not required for the other communication interfaces described in this manual.

2.1. Communication Adapter Kit Parts

The Communication Adapter Kit consists of the following parts, as shown in Figure 2. Communication Adapter Kit Parts, below:

- Communication Adapter (A)
- Monitor Cable - with identical end-connectors to attach the monitor to the Communication Adapter (B)
- Interface Cable - with different size end-connectors to attach the Communication Adapter to either the Printer connector or PC connector (C)
- Printer connector - D type 9-male (D)
- PC connector - D type 9-female (E)

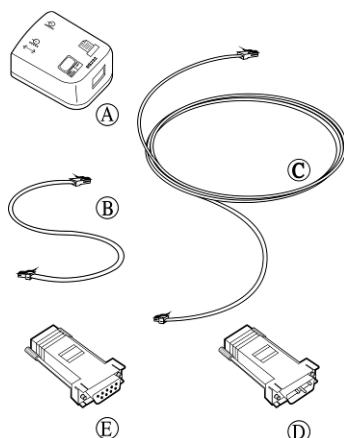


Figure 2. Communication Adapter Kit Parts

2.2. Making the Connections

The following connections must be made for the data to be transferred properly:

- Communication Adapter to the Monitor
- Communication Adapter to the Printer or PC

Note: When using AC power to operate the monitor, the AC adapter connects to the monitor via the Communication Adapter Kit.

2.2.1. Communication Adapter to Monitor

➤ TO ATTACH THE COMMUNICATION ADAPTER TO THE MONITOR

1. Insert the monitor cable (B) into the monitor port, as seen in Figure 3. Communication Adapter to Monitor Connection, below.
2. Insert the other end of the cable (A) into the Communication Adapter output port (J1), as seen in Figure 3. Communication Adapter to Monitor Connection, below.

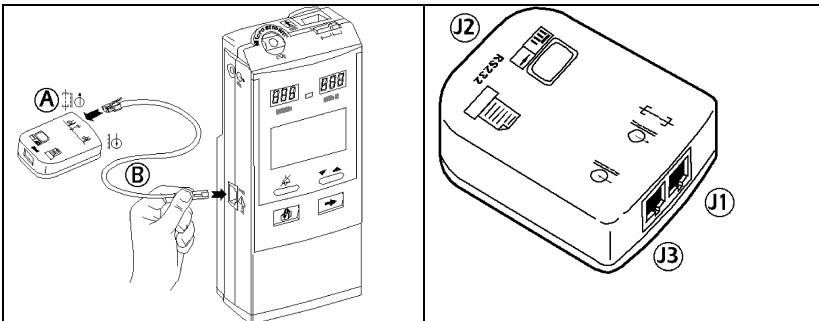


Figure 3. Communication Adapter to Monitor Connection

2.2.2. Communication Adapter to Printer or PC

WARNING: Before connecting the monitor to the printer or PC, ensure that they are turned off.

1. Insert the smaller end-connector of the interface cable (C) into the Communication Adapter output port (J2), as seen in Figure 4. Communication Adapter to Output Device Connection, below.
2. Insert the wider end-connector of the interface cable (C) into either the Printer connector (D) or PC connector (E), as seen in Figure 4. Communication Adapter to Output Device Connection, below.

Note: The same interface cable is used to connect the Communication Adapter to the Printer or PC.

3. Insert the connector into the Printer or PC COM Port.

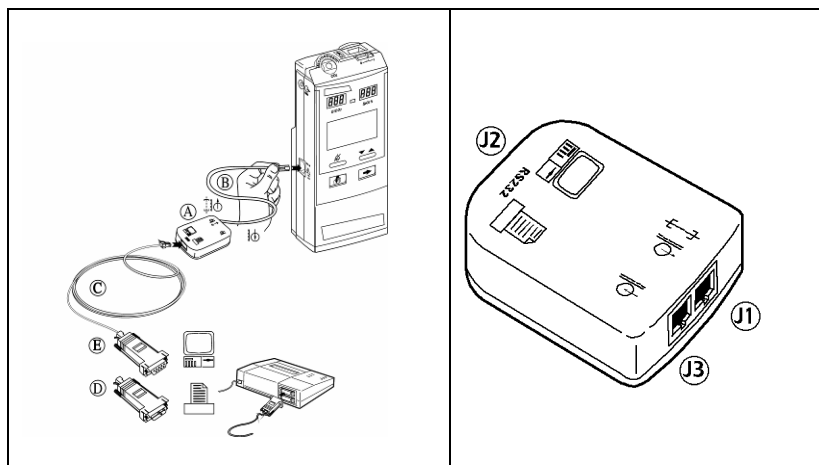


Figure 4. Communication Adapter to Output Device Connection

Connecting the Monitor to the Printer or PC with Medical Grade AC Adapter

1. When operating the monitor from AC power, connect the monitor as follows:
2. Connect the medical grade AC Adapter to the Communication Adapter input port (J3), as seen in Figure 5, below.
3. Plug the medical grade AC Adapter cable into the wall socket.
4. Turn the Printer or PC on and verify proper operation.

Note: For further information, refer to the Printer or PC operator's manual.

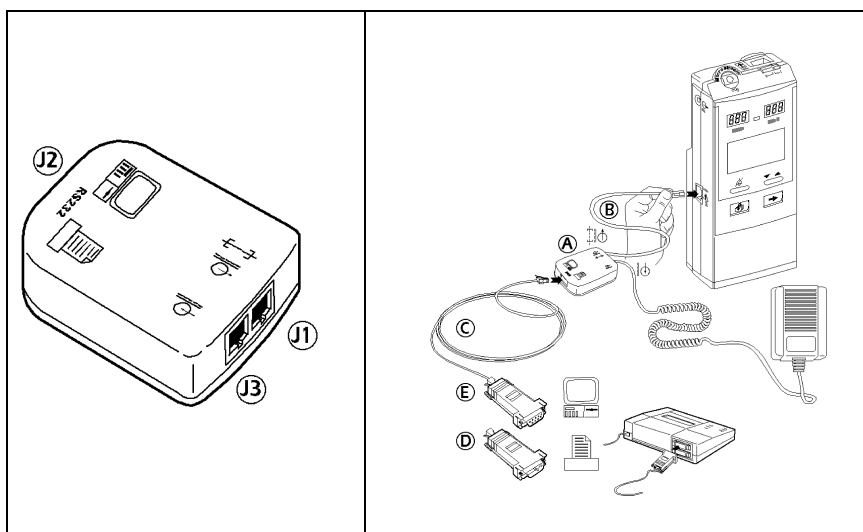


Figure 5. Connecting the Monitor with an Output Device using the AC Adapter

Further Information

For more detailed installation instructions, refer to the Communication Adapter Kit's Instructions for Use.

2.3. Data Types

Table 1. Data Types, below, lists and describes the types of data that can be transferred from the monitor to either a printer and/or PC.

Table 1. Data Types

Option	Description	Device
Screen	The measuring mode displayed on the screen is printed as a graphic freeze screen	Printer only

Graphic Trend	The real time trend data is printed in graphic form.	Printer only
Trend History	The stored trend data is printed in graphic and tabular form.	Printer and PC
Tab. Trend (5s)	The real time trend data is printed in tabular form every 5 seconds.	Printer and PC
Tab. Trend (1m)	The real time trend data is printed in tabular form every minute.	Printer and PC
Tab. Trend (14H) (8H for capnograph/pulse oximeter)	The stored trend data for the last 14 hours (8 hours) is printed in tabular form.	Printer* and PC


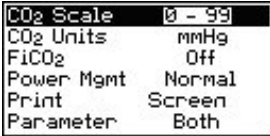
* Transferring 14 (8) hour trend history to a printer is not recommended due to the large volume of data and the amount of paper that would be required.


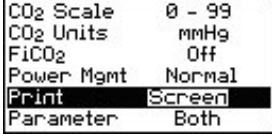

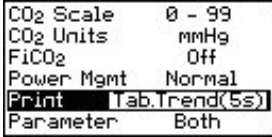


2.4. Monitor Setup for Printer and PC Communication

2.4.1. Selecting the Data Type

To select the data type to be sent to the Printer or PC, refer to the following table:

Table 2. Monitor Setup for Printer or PC

Objective	Action	Result
Access the Instrument Settings menu Note: from the Alarm Limits menu, access any measuring display first.	 long press (twice)	

<p>Select Print from the Instrument Settings menu.</p>	 short press (4x)	
<p>Change the selected value to the data type you want to print or download.</p> <p>Note: See Table 1. Data Types on page 14 for a description of data types</p>	 short press	
<p>Return to any Measuring Mode or allow normal time out of 15 seconds.</p>	 long press	

Chapter 3. Printer Interface

3.1. Introduction

Monitor-printer communication is available both for capnography-only devices and for capnographs/pulse oximeters.

The printer is connected to the monitor via the Communication Adapter Kit using the interface cables provided. For further information, see Chapter 2 Communication Adapter Kit on page 10.

WARNING: For printing monitor data, only use the Seiko DPU-414 printer. For further information regarding use of the Seiko DPU-414 printer, refer to its Operation Manual.

WARNING: When using the printer/PC with main line power, it is recommended to use a medical grade power supply complying with the following standards: EN60601-1, UL 60601-1, CSA C22.2, and No. 601.1-M90. If the power supply is not medical grade, the printer must be placed at least 1.5 meters from the patient environment in order to comply with standard EN60601-1-2.

3.2. Configuring the Seiko DPU-414 Printer

The monitor and the Seiko DPU-414 printer must be configured properly before printing will be successful.

Set or check the printer settings (DIP SW) when:

- Using the printer for the first time
- Unsure of the settings
- The configuration has been changed

3.3. Setting the Dip Switches

There are three DIP Switches on the Seiko DPU-414 printer and eight parameters must be set on each of these three switches.

➤ TO SET THE PRINTER SETTINGS

1. On the printer, slide the power switch to OFF ("O").
2. While pressing the ON LINE button, slide the printer's power switch to ON ("I"). Release the ON LINE button after a list of the current settings starts printing out and the following prompt is printed:

Table 3. DIP Switch Prompts

Screen Prompt	Required action
Continue?	Push 'On-line SW'
Write?	Push 'Paper feed SW'
Do you want to change the DIP SW settings?	If Yes, then press the ON LINE button. If No, then press the FEED button to save and exit. The message, "DIP SW setting complete!!" will appear.

3. Change the DIP SW settings, using Table 4. Dip Switch Settings, below as a guide for the required parameter settings for DIP SW-1, DIP SW-2, and DIP SW-3.
4. To set the setting to ON, press the ON LINE button once. To set the setting to OFF, press the FEED button once.

Note: If you make an error for one of the settings, turn the printer OFF when you reach the prompt:
Continue? ... (as described in Table 3. DIP Switch Prompts, above.)

5. Then turn the printer ON and restart the process.
6. When the settings are set as required, push the ON LINE button on the printer.

7. The prompt "DIP SW setting complete!!" will be printed.
The printer is now ready to receive information from the monitor.
8. The printer retains DIP SW settings when turned off.

Table 4. Dip Switch Settings

DIP SW	Parameter	Setting	Printed
1	1	(OFF)	Input = Serial
	2	(ON)	Printing Speed = High
	3	(ON)	Auto Loading = ON
	4	(OFF)	Auto LF = OFF
	5	(ON)	Setting Command = Enable
	6	(OFF)	Printing
	7	(ON)	Density
	8	(ON)	= 100 %
Continue? : Push 'On-line SW' Write? : Push 'Paper feed SW' To continue to DIP SW-2, push ON LINE.			
DIP SW	Parameter	Setting	Printed
2	1	(ON)	Printing Columns = 40
	2	(ON)	User Font Back-up = ON
	3	(ON)	Character Select = Normal
	4	(ON)	Zero – Normal
	5	(ON)	International
	6	(ON)	Character
	7	(ON)	Set



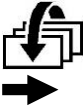



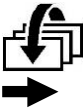



DIP SW	Parameter	Setting	Printed
	8	(OFF)	= U.S.A.= 100 %
Continue? : Push 'On-line SW' Write? : Push 'Paper feed SW' To continue to DIP SW-3, push ON LINE.			
DIP SW	Parameter	Setting	Printed
3	1	(ON)	Data Length = 8 bits
	2	(ON)	Parity Setting = No
	3	(ON)	Parity Condition = Odd
	4	(OFF)	Busy Control = XON/XOFF
	5	(OFF)	Baud
	6	(ON)	Rate
	7	(ON)	Select
	8	(ON)	= 9600 bps
Continue? : Push 'On-line SW' Write? : Push 'Paper feed SW' Push ON LINE DIP SW setting complete!!			

3.4. Transferring Data to Printer

To download the selected data type to the printer in order to print the chosen report, do the following:

1. Check that all cables are properly connected. If you have not already configured the printer for printing with the capnograph (see 3.2 Configuring the Seiko DPU-414 Printer on page 17), do so now.
2. Turn the printer ON and ensure the printer's ON LINE green light is lit before printing.
3. Start and Stop printing using the monitor interface, as described below.

Table 5. Start/Stop Printing Options



Data Type	Start Print	Stop Print
Screen	Simultaneously long press  and 	Automatically stops after printing is finished.
Real time graphic printout	Simultaneously long press  and 	After simultaneously long pressing  and 
Tab. Trend (5s) Tab. Trend (1m) Graphic Trend Trend History Tab. Trend (8 hr)	Simultaneously long press  and 	Automatically stops after printing is finished or After simultaneously long pressing  and 

Note: If the printer is OFF or not connected to the monitor, the "Printer Off Line" message is displayed for 15 seconds. Connect the printer to the monitor and/or turn the printer ON.

3.5. Printout Descriptions

The following section describes the printout for each type of data displayed and stored in the monitor.

3.5.1. Screen

The Screen option prints the current data display, as it appears the moment the combo-print ( and ) buttons are pressed, from any of the following screens:

- Wave form
- CO₂ Trend-30 minutes
- CO₂ Trend - 8 hour
- Plethysmograph
- SpO₂ Trend-30 min
- SpO₂ Trend-8 hour
- Meter Mode

Figure 6: Screen Printout (Wave Form), below, is an example of a printout of the Wave Form screen.

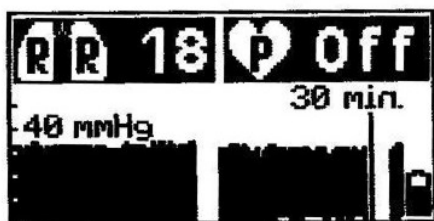


Figure 6: Screen Printout (Wave Form)

3.5.2. Graphic Trend

Graphic Trend data prints Pulse Rate, SpO₂ EtCO₂, FiCO₂, and Respiration Rate values in graphic form.

The printout includes the following characteristics, as shown in Figure 7. Graphic Trend Printout.

- The patient data header is printed at the beginning of the printout and then every 5 hours.
- Alarms: Only warning messages (No breath, EtCO₂ high, EtCO₂ low, FiCO₂ high, SpO₂ high, SpO₂ low, pulse rate high, pulse rate low) print after each graph (after 5 hours). If two or more alarms occur simultaneously, only the alarm with the highest priority

will appear on the printout.

- Time grid is drawn every 10 minutes.
- Time label prints every 30 minutes.
- FiCO_2 values appear as white marks at the bottom of the CO_2 graph.
- Events are marked with a horizontal line beside the time.

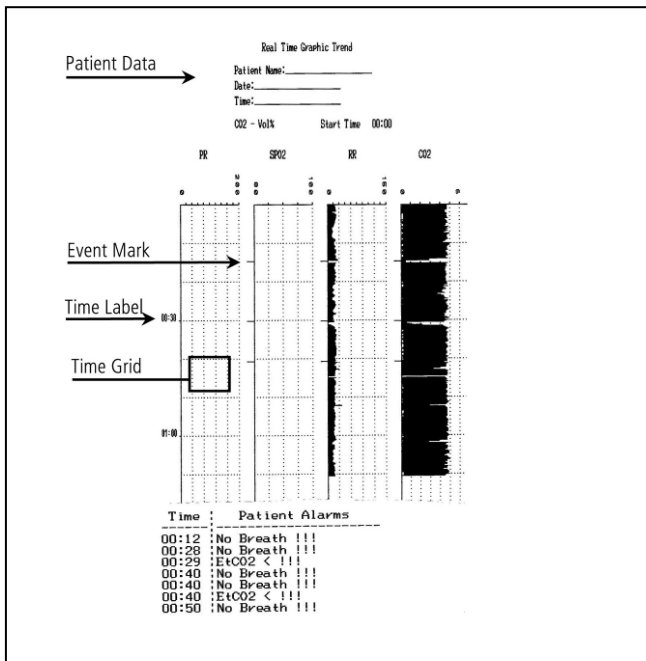


Figure 7. Graphic Trend Printout

3.5.3. Trend History

The Trend History option prints the current trend history of EtCO_2 , FiCO_2 , Respiratory Rate, SpO_2 and Pulse Rate values in tabular

form. The data is printed in 30-minute and 8-hour scales. The CO₂ units printed are those selected in the Instrument Settings menu.

Trend information is stored for 8 hours with a 4-minute resolution and 30 minutes with a 15-second resolution.

The printout includes the following information in the order listed in Figure 8. Trend History Printout on page 25.

- Patient data
- 30-minute graphic trend
- 8-hour graphic trend
- 30-minute tabular trend
- 8-hour tabular trend

The printout includes the following characteristics:

- Patient data includes both 30-minute and 8-hour intervals in both graphic and tabular form.
- "New Patient" prints when the unit exits in Standby Mode, or the unit is turned ON/OFF.
- Alarms are not printed.
- FiCO₂ values appear as white marks at the bottom of the CO₂ graph.
- Events are marked with an asterisk "*" beside the time in the tabular trend and with a horizontal line beside the time in the graph.

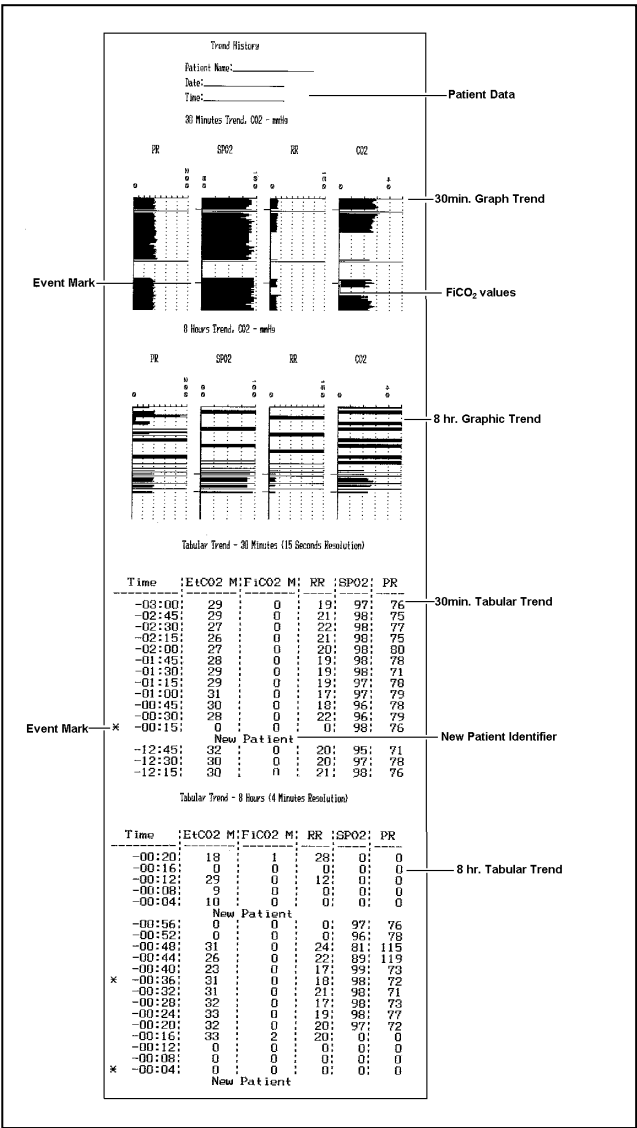


Figure 8. Trend History Printout

3.5.4. *Tabular Trend (5s)/(1m)*

Tabular Trend transfers EtCO₂, FiCO₂, Respiration Rate, SpO₂, and Pulse Rate in either 1 minute or 5 second resolutions, depending on the print option selected.

The printout header is printed at the beginning of the printout and then every five hours, or when the CO₂ units are changed.

The CO₂ units printed are those selected in the Instrument Settings menu. CO₂ units are indicated in the header of the table as:
M = mmHg, K = kPa, or V = Vol%.

If a patient alarm occurs, the types of alarm and the time will be printed. Even if the same patient alarm continues, the message will be repeated only after five minutes. An event marked during measuring mode appears with an asterisk beside the time.

Figure 9. Tabular Trend Printout, below, is an example of the Tabular Trend printout.

Real Time Tabular Trend

Patient Name: _____

Date: _____

Time: _____

CO2 - Vol% Start Time 00:00

Patient Data

Time	EtCO2 V	FiCO2 V	RR	SpO2	PR
00:00:00	4.6	0.0	17	0	0
00:00:05	4.6	0.1	17	0	0
00:00:10	4.6	0.2	17	0	0
00:00:15	4.7	0.2	17	0	0
00:00:20	4.7	0.2	18	0	0
00:00:25	4.7	0.0	19	0	0
00:00:30	4.7	0.0	19	0	0
00:00:35	4.7	0.0	18	0	0
00:00:40	4.6	0.0	18	0	0
00:00:45	4.6	0.0	18	0	0
00:00:50	4.7	0.0	17	0	0
00:00:55	4.7	0.0	18	0	0
00:01:00	4.7	0.0	21	0	0
00:01:05	4.7	0.0	21	0	0
00:01:10	4.7	0.0	20	0	0
00:01:15	4.7	0.0	20	0	0
00:01:20	4.4	0.0	20	0	0
00:01:25	4.0	0.0	20	0	0
00:01:25	No Breath !!!				
00:01:30	0.4	0.0	0	0	0
00:01:31	EtCO2 < !!!				
00:01:35	0.4	0.0	0	0	0
00:01:40	3.1	0.0	17	0	0
00:01:45	3.8	0.0	18	0	0
00:01:50	3.8	0.0	19	0	0
00:01:55	3.9	0.0	18	0	0
00:02:00	4.4	0.0	18	0	0
00:02:05	4.6	0.0	18	0	0
00:02:10	4.6	0.0	18	0	0
00:02:15	4.7	0.0	18	0	0
00:02:20	4.7	0.0	19	0	0
00:02:25	4.6	0.0	18	0	0
00:02:30	4.6	0.0	18	0	0
00:02:35	4.6	0.0	18	0	0
00:02:40	4.6	0.0	19	0	0
00:02:45	4.6	0.1	18	0	0
00:02:50	4.6	0.2	18	0	0

Table Header

Alarm Message

Event Mark

Figure 9. Tabular Trend Printout

3.5.5. Tabular Trend (14 H) (8H)

During the 14-hour (8-hour) tabular trend period, the data of up to the last 100 patients are stored. A new patient is defined each time the monitor is turned ON/OFF or enters Standby.

The Tabular Trend (8H) option prints the following at a 5-second resolution:

- The contents of the stored trend data for the last 8 hours
- The EtCO₂, FiCO₂, Respiratory Rate, SpO₂ and Pulse Rate values

Note: The stored trend data for the last 14 hours (8 hours) can be transferred to a PC and a printer. However, downloading 14 hours (8 hours) trend history to a printer is not recommended

due to the large volume of data and the amount of paper that would be required. To shorten transfer time, disconnect the monitor from the patient, start the download process, and put the monitor in Standby mode.

The printout includes the following characteristics:

- The last 14 hours (8 hours) of data is displayed, in tabular form, with a 5-second resolution of trend history.
- Alarms are not shown.
- Events are indicated with an asterisk "*" marked next to the relevant point in time.
- CO₂ units printed are those selected in the Instrument Settings menu and are indicated in the header of the table:
M = mmHg, K = kPa, V = Vol%.
- "New Patient" appears when the unit exits Standby Mode, or the unit is turned ON/OFF.

3.6. Additional Information

3.6.1. Technical Support for the Monitor

For technical support for the monitor and monitor accessories (including the Communication Adapter Kit), please call your local distributor or send an e-mail to technicalsupport@oridion.com.

3.6.2. Ordering the Seiko DPU-414 Printer

To order the Seiko DPU-414 Printer, contact your local distributor.

3.6.3. Technical Support for the Seiko Printer

For technical support for the Seiko DPU-414 printer, refer to the Seiko printer's Operation Manual.

Chapter 4. PC Communication Interface Using HyperTerminal

Monitor-PC communication with HyperTerminal is available both for capnography-only devices and for capnographs/pulse oximeters.

This section will describe the procedure for downloading data from the capnograph/pulse oximeter using the Windows HyperTerminal software. Using this procedure, tabular trend information stored in the monitor's 14-hour (8-hour) or 30-minute memory can be uploaded to a PC and converted into a Microsoft Excel spreadsheet.

4.1. General Description

The monitor is connected to the PC via the Communication Adapter Kit using the interface cables provided. For further information, see Chapter 2 Communication Adapter Kit on page 10.

Please note the following points before beginning the download process:

- Trend information is stored for 14 hours (8 hours) with one point per four-minute resolution, and for 30 minutes with one point per 15-second resolution.
- The data is nonvolatile, except when collected in excess of eight hours or 30 minutes (depending on resolution). In that situation, new data will replace the oldest stored data.
- The PC, using this software, can only process data from either the Trend History or Tabular Trend settings. It cannot process data from the Screen or Graphic Trend formats.
- When a file which contains both tabular and graphic data is downloaded, the tabular data will download correctly, while the graphic data will be transferred as gibberish characters. These gibberish characters will not affect the correctly downloaded tabular and data and can simply be deleted from the Excel sheet produced.

4.2. *Setting up Data Transfer with HyperTerminal*

4.2.1. *Selecting the Data Type*

To select the type of data to be sent to the PC, see 2.4.1 Selecting the Data Type on page 15.

4.2.2. *Preparing for Data Transfer*

Before you attempt to transfer data to the PC, ensure the following:

- The HyperTerminal software is installed on the PC on which you want to download the data
- The monitor is connected to a COM port that is functioning and available. Some devices, such as palm computers, have programs that automatically occupy the COM port. You must close the program that is occupying the COM port before continuing.
- All cables are properly connected.

The process of transferring data from the monitor to a PC using Windows HyperTerminal is done in three parts:

- Setting the communication parameters.
- Uploading the data to a file on the PC.
- Importing the file into Microsoft Excel.

4.2.3. *Setting Communication Parameters*

Note: This procedure is only performed once. For future uploads you can skip this section and proceed with Uploading the Data to a File on the PC on page 33.

➤ TO SET THE HYPERTERMINAL SOFTWARE FOR COMMUNICATION WITH THE MONITOR

1. Click on the *Start* button. From the Programs menu, click *Accessories>Communications>HyperTerminal*.

- HyperTerminal opens with the Connection Description dialog box displayed in Figure 10. Naming the Connection, below. In the *Name* field, enter the name under which you want to save this connection. For example, you may call this connection Microcap.



Figure 10. Naming the Connection

- Click OK. The Connect To screen (seen in Figure 11. Connect To, below) will appear.
- In the *Connect Using* field, select the communication port to which the Communication Adapter is connected from the drop down menu.



Figure 11. Connect To

- Click **OK**. The COM Properties dialog box (Figure 12. COM Properties, below) is displayed.

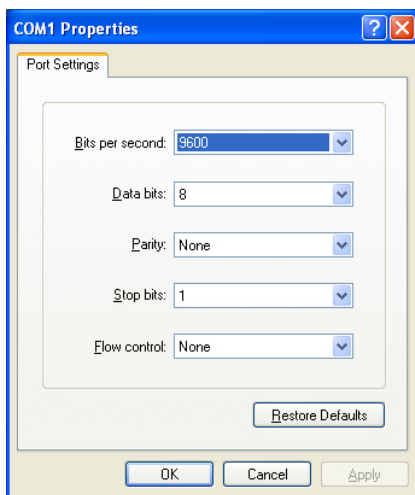


Figure 12. COM Properties

- From the drop down menus on the screen select the following settings in the COM Properties dialog box:

Table 6. COM Settings

Field Name	Setting
Bits per second	9600
Data bits	8
Parity	None
Stop Bits	1
Flow Control	None

- This flow control setting applies to printer emulation only. When communicating according to the Oridion Serial Communication Protocol, set *Flow Control* to *None*.

Note: Contact Oridion for more information regarding the Oridion Serial Communication Protocol, described in Oridion document P.N. DD13015.

8. After entering the settings, click *OK*. The HyperTerminal window will appear.

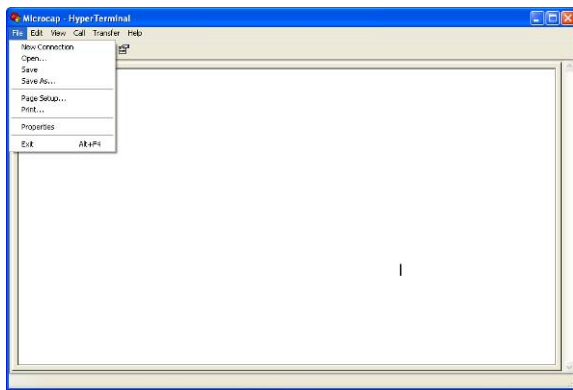


Figure 13. HyperTerminal Main Screen

9. From the *File* menu select *Properties*. The Properties dialog box (seen in Figure 14. Properties, below) is displayed.

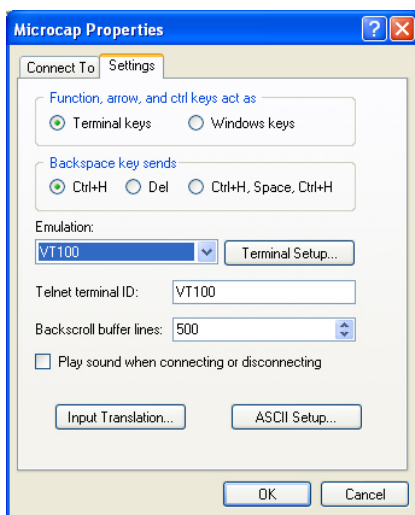


Figure 14. Properties

10. Select the *Settings* tab and copy the information as it appears in Figure 14. Properties, above.
11. Select the *ASCII Setup* button. The ASCII Setup dialog box, seen below, will appear.

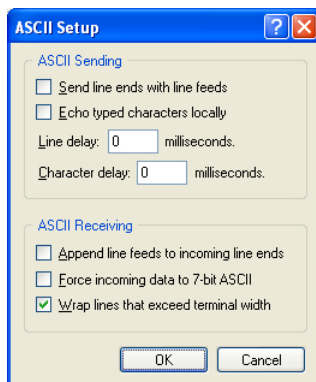


Figure 15. ASCII Setup

12. Enter the information as it appears in the ASCII Setup dialog box above. Click OK to return to the Properties dialog box (seen in Figure 14. Properties on page 34).
13. From the Properties dialog box select the *Input Translation* button. The Host System Encoding Method dialog box, seen below, will appear.

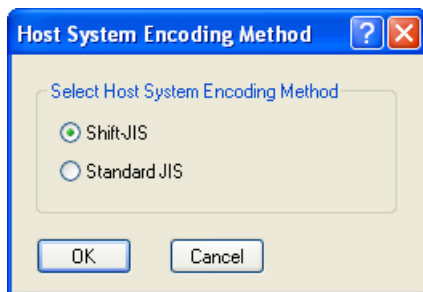


Figure 16. Host System Encoding Method

14. Select the *Shift JIS* radio button and click *OK* to return to the Properties dialog box (seen in Figure 14. Properties on page 34).
15. Copy the information as it appears in the Terminal Settings dialog box above and click OK to return to the Properties dialog box (seen in Figure 14. Properties on page 34).
16. Click OK in the Properties dialog box to return to the Hyperteminal Screen, seen in Figure 13. HyperTerminal Main Screen on page 34.
17. From the *File* menu, choose *Save*. Your settings are now saved in a file called <File Name>.HT. For example, if you named the file Microcap, the settings would be saved in Microcap.HT.

4.2.4. *Uploading the Data to a File on the PC*

➤ **TO UPLOAD DATA TO A FILE ON PC**

1. If the HyperTerminal file which has been created in the previous step (i.e., Microcap.HT) is currently open, skip to Step 5, below.
2. If the HyperTerminal file is not currently open, click the *Start* menu. From the *Programs* menu, select *Accessories>Communications>HyperTerminal*.
3. Click the *File* menu and select *Open...*
4. Select the name of the file with the monitor settings (i.e. Microcap.HT).
5. From the *Transfer* menu, choose *Capture Text*. The Capture Text dialog box is displayed in Figure 17. Naming the .txt File, below.
6. In the *File* field, give a name to the .txt file. This file will be related to a particular patient or time period, so name the file accordingly. For example, a file containing data from monitoring of a patient named John Smith on January 1, 2006 might be named JohnSmith-1-1-2006.

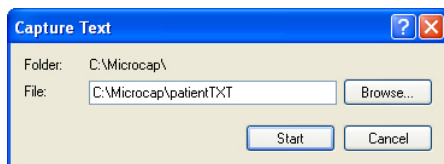




Figure 17. Naming the .txt File

Note: If you want to create a file in a directory on your PC other than the default directory, type in the path or use the Browse button to specify the location. For example, you may want to change the location from c:\npb75\patient1.txt to c:\My Documents\MicrocapData\patient1.txt.

Note: The last path and file name you used will appear by default in the File field. For example, if the previous path and file

name was c:\npb75\patient.txt, this will be the default path and file name in the File field.

- Press  and  simultaneously on the monitor to begin uploading the data. The monitor data will scroll on the HyperTerminal screen on your PC.

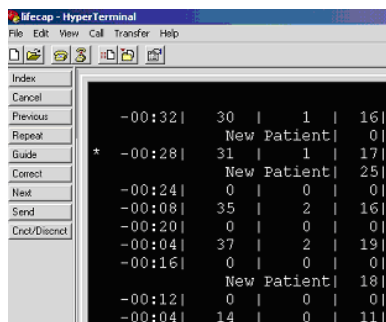


Figure 18. Data Transferring to PC

- After uploading is complete, from the *Transfer* menu, select *Capture Text* and then select *Stop* from the submenu.
- From the *Call* menu, select *Disconnect*.

Note: Because the PC uploading option does not support graphics, while uploading Trend History, various irrelevant characters will scroll on the screen after the 30-minute and eight-hour graphic trend headers. Ignore these characters; they will not affect the final finished product.

4.2.5. Importing the File into Microsoft Excel

➤ TO IMPORT FILE TO MICROSOFT EXCEL

- Open Microsoft Excel.
- From the *File* menu, choose *Open*.

3. With *All Files* selected in the *Files of Type* box, select the text file which contains the Microstream data, for example, patient1.txt. The Text Import Wizard is displayed in Figure 19. Specifying the Data Type, below.
4. In the *Original Data Type* section, select *Delimited*.

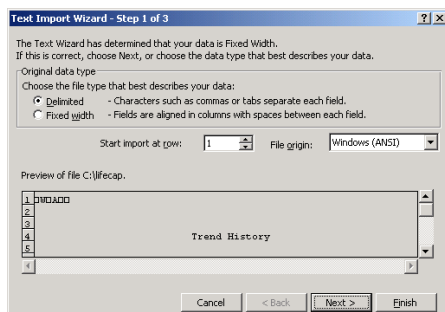


Figure 19. Specifying the Data Type

5. Click *Next>* to display Step 2 of the Import Wizard seen in Figure 20. Specifying the Delimiter, below.
6. In the *Delimiters* section, select *Other* and type in the character “|”.

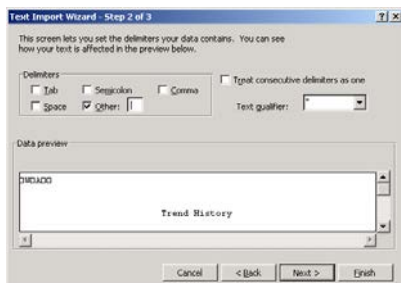


Figure 20. Specifying the Delimiter

7. Select *Next>* to display Step 3 of the Import Wizard seen in Figure 21. Specifying the Column Data Format, below.
8. In the *Column Data Format* section, select *General*.

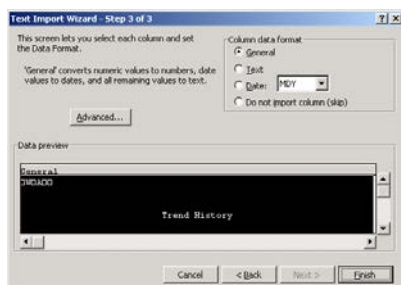


Figure 21. Specifying the Column Data Format

9. Click *Finish* to translate the data into Excel format.
10. Delete the rows in the Excel file that correspond to the eight-hour graphic trend and 30-minute graphic trend. These will contain superfluous characters. If deletion is not done before the sheet is printed, there will be several sheets of superfluous characters which may confuse the user. These characters do not corrupt the tabular data.

Note: See Microsoft Excel help topics on "Converting Text in Worksheets to Columns" for more information on converting the imported data to columns for charting graphs and trends.

Chapter 5. PC Communication Interface Using Profox

Monitor-PC communication with Profox is available both for capnography-only devices and for capnographs/pulse oximeters.

Profox software can be used instead of Windows HyperTerminal software to transfer information to the PC. Profox software must be purchased separately and can be ordered from your local distributor.

5.1. General Description

Profox, software version Respiratory Oximetry – Microstream, is a program that enables IBM PC series computers operating under Windows 95, 98, 2000, NT, XP or ME to collect capnography and oximetry data from devices using Microstream software.

The program collects and reports SpO₂, pulse, end-tidal CO₂, inspiratory CO₂ and respiratory rate. The program can sample in real-time format, in which the computer collects the data while the device continues the measurement process. The program can also collect stored memory data from the devices. During real-time collection, data of up to 24 hours may be collected. For memory transfer, the maximum time collected is dependent upon the maximum storage capability of each device (14 hours or 8 hours).

Up to 5000 patient tests can be stored in one computer folder. These patient tests can be viewed, edited to remove undesired segments of time or artifact, copied, deleted, and reported. Comments can be added to each patient test to indicate oxygen flow or respiratory support. These comments are displayed on the computer screen and generated with the printed reports.

The real-time, graphic display and patient test features, inter alia, provides useful options for data download not available when using the HyperTerminal software.

5.1.1. Overview of Program Functioning

Profox uses patient test data files for storing tests. Each patient test file contains patient information, respiratory test data, and

procedure events. A new test file is created when a new patient is entered, but the test file does not yet contain any respiratory data or procedure events. When real-time data or memory data is collected, the respiratory data is added to the patient test file. If the patient test file already contains respiratory data, the program will create a new patient test file using the patient information.

5.2. *Setting up Data Transfer to a PC using Profox*

The following equipment is required in order to set up data transfer between the monitor and Profox:

- A licensed copy of the Profox Software containing a CD and a dongle
- An IBM PC series computer containing a CD drive and a USB port
- A handheld monitor (either capnograph or a capnograph/pulse oximeter)
- A communication adapter kit


Connect the monitor and the PC (on which Profox is installed, as described below) using the communication adapter kit, with the procedure described in 2.2 Making the Connections on page 11.

5.2.1. *Installing Profox Software*

Caution:	Be sure to disable all anti-virus software on your computer before installing the Profox Software.
-----------------	--

➤ TO INSTALL THE PROFOX SOFTWARE


1. Insert the Profox CD in the appropriate drive and follow the screen instructions.
2. When prompted, insert the dongle in the appropriate drive.

3. A screen prompt will notify you upon completion of installation and  will appear on your desktop. The Profox software is now installed.

5.2.2. Preparing the Monitor for Use With Profox

➤ TO PREPARE THE MONITOR FOR USE WITH PROFOX:

1. Turn on the monitor to access the Measurement Screen.

Press two long presses on  to access the Instrument Settings menu (seen in Figure 22. Monitor Instrument Settings Menu, below).

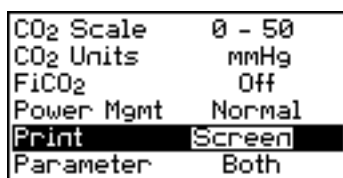





Figure 22. Monitor Instrument Settings Menu

2. Scroll down the menu using short presses  to the Print option.
3. Using  set the Print default parameter to Tab. Trend (5s). (See Table 5. Start/Stop Printing Options on page 21 for more information.)
4. To return to the Measurement Screen, press one long press on .

5.2.3. Recording a New Patient with Profox

➤ TO RECORD A NEW PATIENT

1. To access the Profox Software click  on your desktop.

2. The Profox Main Menu screen (seen in Figure 23. Profox Main Menu Screen, on page 43) will appear.

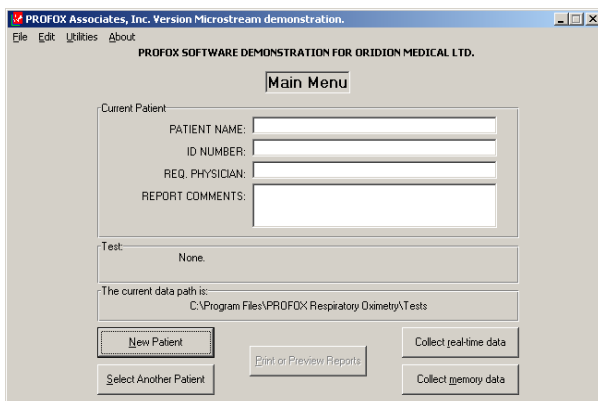


Figure 23. Profox Main Menu Screen

3. Click *New Patient* to access the New Patient screen.



Figure 24. Profox New Patient Screen

4. Fill in the *Patient Name*, *ID Number*, *Req. Physician* and *Report Comments*.
5. Click *Save*. The Profox Main Menu screen (seen in Figure 23. Profox Main Menu Screen, above) will appear.
6. On the Main Menu screen click *Collect real-time data*.

7. The Profox Confirmation dialog box (seen Figure 25. Profox Confirmation, below) will appear.

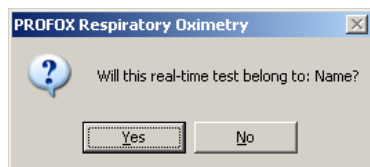


Figure 25. Profox Confirmation

8. Click *No* if the name that appears in the dialog box is not the correct name of the patient. The Main Menu screen will appear. Either click *New Patient* to record a new patient or click *Select Another Patient* to access the Select Another Patient screen and select a patient recorded in the list.
9. Click *Yes* if the correct name appears in the dialog box. This opens the Profox Real-time data Collection screen.

5.2.4. Collecting Real-time Data with Profox Software

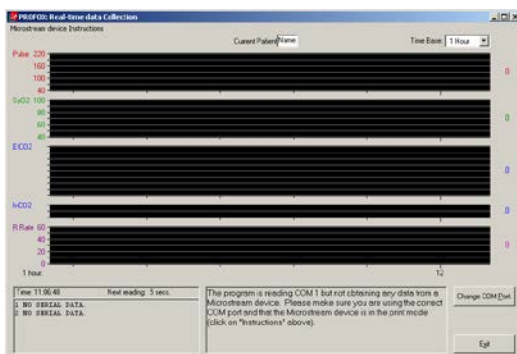




Figure 26. Profox Real-time Data Collection Screen

The Profox Real-time Data Collection screen records the data received from the monitor to the PC. Figure 26. Profox Real-time Data Collection Screen, above, shows the screen without data transfer.

➤ TO COLLECT REAL-TIME DATA

1. On the monitor, simultaneously press  and  to begin transferring data from the monitor to the PC.
2. Figure 27. Profox Real-time Data Collection Screen During Data Transfer, below, shows the screen during successful data transfer.

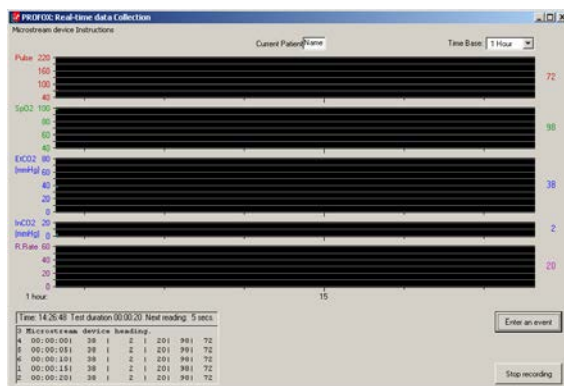


Figure 27. Profox Real-time Data Collection Screen During Data Transfer

5.2.5. Recording an Event

An event is an unusual clinical occurrence that takes place during data transfer. If an event occurs during patient monitoring, Profox allows the user to document the event.

➤ TO ENTER AN EVENT:

1. During the monitoring process, click *Enter an event* in the Real-time Data Collection screen. The Profox Event Box (seen in Figure 28. Profox Event Box, below) will appear inside the Real-time data Collection screen.

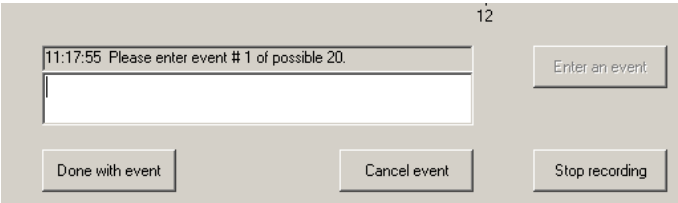


Figure 28. Profox Event Box

- 2. Record the event in the white window and click *Done with event* to save the record of the event. Data collection will not be affected by the event recording process.

Note: Up to 20 events may be recorded per patient.

5.2.6. **Printing Reports**

➤ **TO PRINT REPORTS**

- 1. When data finishes collecting, select *Stop recording*. The Main Menu screen will appear. From the Main Menu screen, select *Print* or *Preview Reports*. The Start Report screen (seen in Figure 29. Profox Start Report Screen, below) will appear.

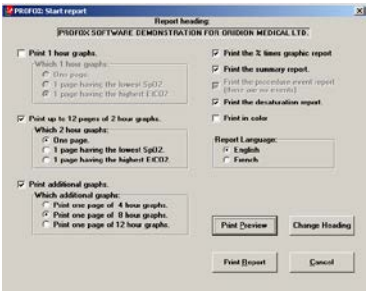


Figure 29. Profox Start Report Screen

- 2. In the Start Report screen, select the desired print option from the choices on the left side of the screen and click *Print Report*. When the report is printed, the Main Menu screen will appear automatically.

5.2.7. Collecting Memory Data with Profox Software

The Profox Collect Memory Data option allows the user to access information stored in the monitor. The handheld capnograph has a 14 hour memory capability and the handheld capnograph/pulse oximeter has an 8 hour memory capability.

➤ **TO BEGIN COLLECTING MEMORY DATA:**

1. Press *Collect Memory Data* from the Profox Main Menu.
2. From the Memory Data Screen, select *Transfer new memory data from Microstream* and click *OK* to begin transferring information from the monitor to the PC.



Figure 30. Profox Memory Data Screen

3. From the Memory Data screen, click *OK* to begin collecting data from the monitor.

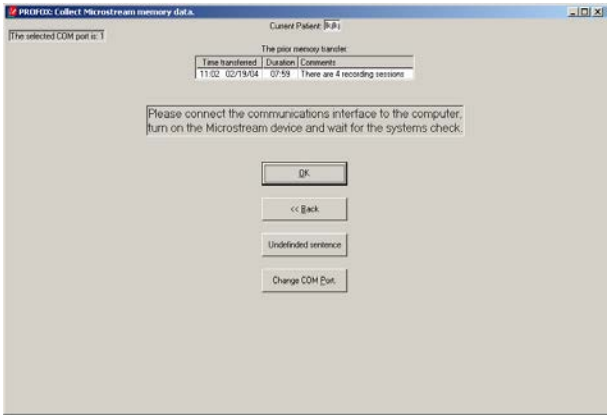


Figure 31. Profox Memory Data Screen

4. The Collecting Trend screen (seen in Figure 32. Profox Collecting Trend, below) appears during data collection. If you wish to stop collection at any time, click *Stop*.

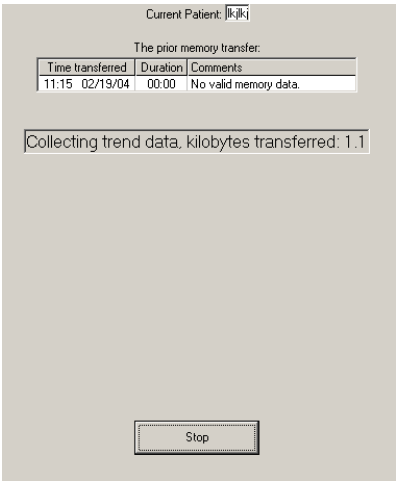


Figure 32. Profox Collecting Trend

5. Once transfer of the trend is complete, the Selecting a Recording Session screen appears. On this screen,

select the desired recording session from the on-screen list and press **OK**.

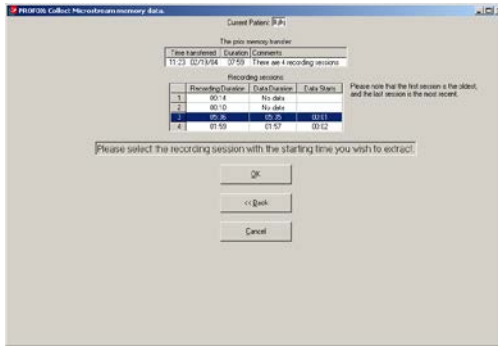


Figure 33. Profox: Selecting a Recording Session

- The Trends screen (seen in Figure 34. Profox Trends, below) will appear. To save the study, select *Save this test*.

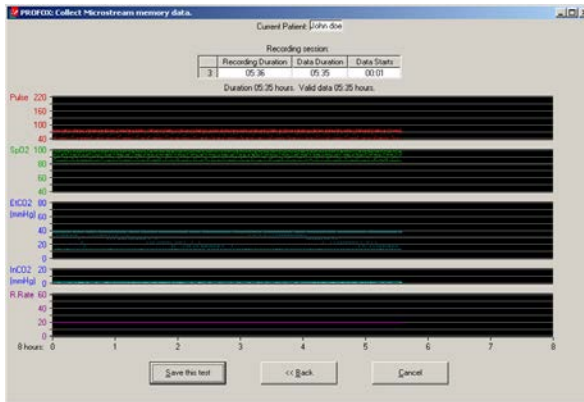


Figure 34. Profox Trends

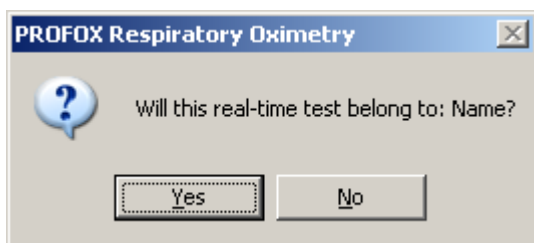


Figure 35. Profox: Confirm Name

7. Select Yes in the Confirm Name dialog box (seen above) if the name that appears in the box is correct.
8. If the name that appears in the Confirm Name dialog box is not correct, enter the correct patient details in the Select Patient Information box (seen in Figure 36, below).

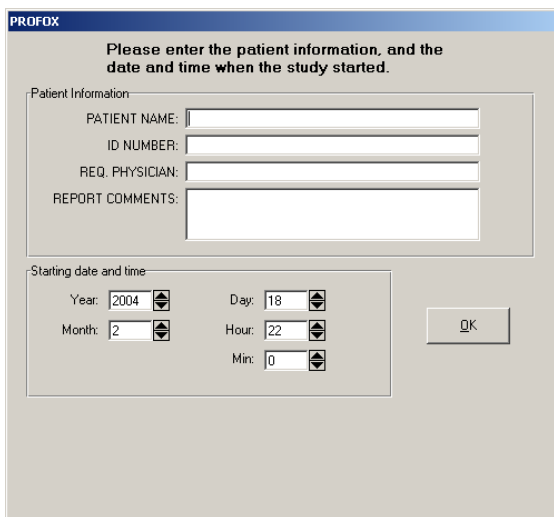


Figure 36. Profox: Select Patient Information

5.2.8. Profox ASCII (text) conversion

Use the Profox ASCII (text) conversion function to convert graphic trends to text files.

➤ TO CREATE ASCII (TEXT) FILES FOR GRAPHIC TRENDS

1. To access the ASCII (text) conversion function, select *Utilities* from the toolbar. From the drop down menu, select *ASCII (text) conversion*. The screen seen in Figure 37. Profox: Naming the ASCII Text File, below will appear:

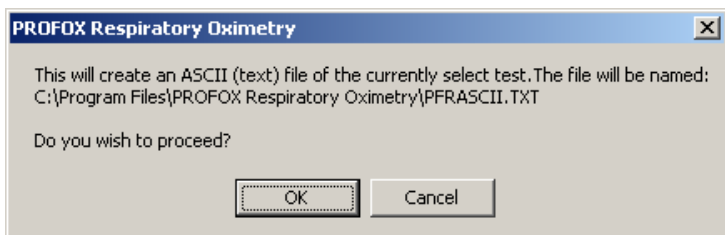


Figure 37. Profox: Naming the ASCII Text File

2. Click *OK* to proceed. The message seen in Figure 38. Profox: Finished Writing ASCII File, below, will be displayed when the process is complete.

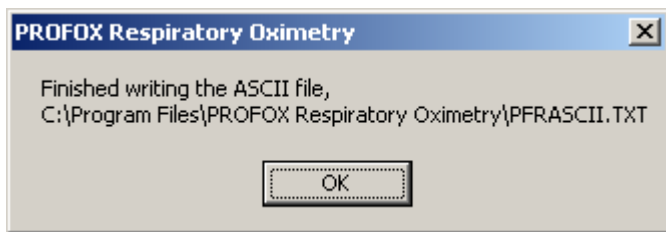


Figure 38. Profox: Finished Writing ASCII File

Note: To prevent overwriting previously recorded files, rename the above file for each new ASCII file at C:\Program Files\PROFOX Respiratory Oximetry\XXXASCII.TXT.

3. Select *OK*.

5.3. *Uninstalling Profox Software*

To uninstall Profox, select *Utilities* from the toolbar to access the Utilities drop down menu. From the drop down menu, select *Remove the software license* and follow the screen prompts.

5.4. *Contacting Profox*

To learn more about Profox Respiratory Oximetry contact Profox in any of the following ways:

Web site: <http://www.profox.net/>

E-mail: info@profox.net

Phone: (760) 432-9921, Monday thru Friday, 8:30 am-4:00 pm
Pacific Standard Time

Chapter 6. D/A Converter

6.1. Introduction

The Digital to Analog (D/A) Converter enables conversion of the monitor data to an analog format for use with analog recording devices. Monitor-D/A communication supports only the transfer of CO₂ data from the monitor to the D/A Converter. Thus, although the D/A Converter can be used with a portable capnograph or with a portable capnograph/pulse oximeter (as long as the device uses software version 1.21 or higher), only the CO₂ data will be transferred when it is used with an capnograph/pulse oximeter.

The D/A Converter converts digital data to seven analog channels and records data to an analog recording device that supports 0-1 V DC, including a polysomnograph.

Note: D/A functions only when monitor is set to mmhg.

Note: Calibrate the host as described in 6.4 Calibrating the Analog Device for Microstream Monitors on page 58.

Caution: Do not short wires not in use.

6.2. Required Equipment

A list of the items required in order to set up data transfer between a Microstream handheld monitor and an analog system appears below.

Item	Details/Oridion PN
Handheld Microstream monitor (Microcap or Microcap Plus)	Any handheld Microstream capnograph or capnograph/pulse oximeter, as long as the device uses software version 1.21 or higher
Power Supply	Supplied with handheld

	monitor
Digital/Analog Converter (includes communication cable)	CS07143 (to be ordered separately from monitor)
Digital/Analog Converter Cable	Supplied with D/A Converter
Calibration FilterLine	Supplied with D/A Converter
Analog system (sleep lab or other analog system)	N/A
Standard communication cables with 3.5 mm (1/8 in) mono audio plug for transfer of data from the Digital/Analog Converter Cable to the analog system (number of cables required will depend on the number of channels on which data will be transferred).	These cables should be purchased separately and can be obtained from any electronic supply store.

6.3. *Setting up Data Transfer with a D/A Converter*

In order to set up data transfer between the monitor and a D/A Converter, the following connections must be set up:

- Connecting the D/A Converter to the Monitor
- Connecting the D/A Converter to the Analog Recording Device
- Connecting the D/A Converter to the Power Supply

All are described below. Once these connections are made, data will flow from the monitor to the analog device as long as the two devices are connected.

6.3.1. Connecting the D/A Converter to the Monitor


➤ TO CONNECT THE D/A CONVERTER TO THE MONITOR

1. Ensure that the monitor is set to work using mmHg as CO₂ units. This process will not work if the monitor is set to indicate CO₂ values in kPa or Vol %.
2. Insert the monitor cable (A) into the monitor's RS232 port (1 in Figure 40). This port, on the left side of the monitor, is marked with the symbols seen in Figure 39. Symbols on Handheld Monitor RS-232 Port, below.



Figure 39. Symbols on Handheld Monitor RS-232 Port

3. Insert the other end of the monitor cable into the D/A Converter's communication power port (2 in Figure 40). This is the right-hand port when the D/A Converter is

seen from the top; it is marked with the  symbol)..

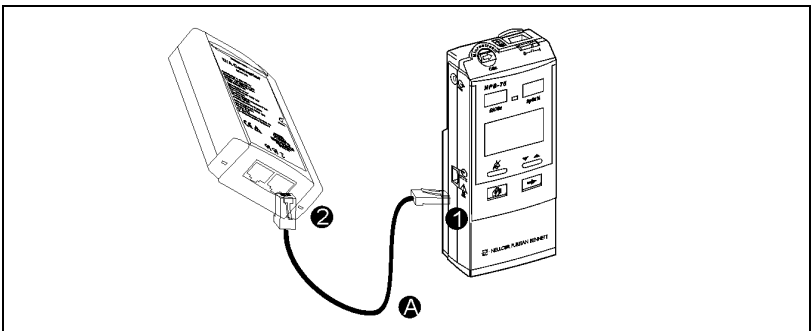


Figure 40. Connecting the Monitor to the D/A Converter

6.3.2. Connecting the D/A Converter to the Analog Recording Device

➤ **TO CONNECT THE D/A CONVERTER TO THE ANALOG RECORDING DEVICE**

1. Insert the 15 pin end of the D/A cable (B) into the D/A Converter's analog output port (3 in Figure 41).
2. On the other end of the D/A Converter cable, select each of the desired output channels (color coded wires, 4 in Figure 41), and, using a standard communication cable with 3.5 mm (1/8 in) mono audio plug, attach each connector to the relevant output channel on the analog device. (One end of the cable should have a 3.5 mm (1/8 in) mono audio plug for attaching to the D/A Converter cable; the other end should have the appropriate connector for your analog device.) See Table 7. D/A Converter Output Channels on page 56 for output channels.
3. Repeat this procedure for each connection that you want to make.

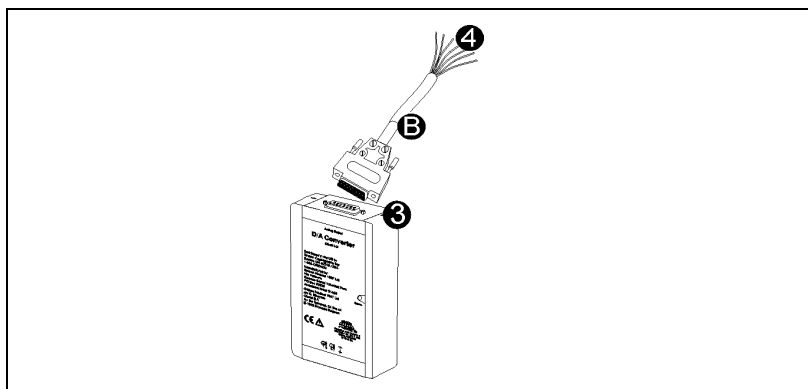


Figure 41. Connecting the D/A Converter to the Analog Recording Device

Table 7. D/A Converter Output Channels

Output Channel Parameter	D-Type 15 Pin (Pin out)	Wire Color
EtCO ₂ + breath indication *	Pin 8	Blue
EtCO ₂	Pin 15	Orange
FiCO ₂	Pin 6	Green
RR	Pin 13	Brown
CO ₂ wave	Pin 4	White
CO ₂ measurement validity **	Pin 11	Yellow
Square wave 0-IV # 1 Hz	Pin 2	Red
Pins 1, 3, 5, 7, 9, 10, 12, 14 = GND (black wire)		

* Both EtCO₂ waves and breath indications are displayed. At the end of each breath, the EtCO₂ value will be displayed; a value of zero will be displayed when no breath is signaled. The duration of the EtCO₂ value is breath rate dependent.

** Indicates invalidity by raising the output voltage to full scale.

6.3.3. Connecting the D/A Converter to the Power Supply

➤ TO CONNECT THE D/A CONVERTER TO THE POWER SUPPLY

1. Insert the power supply cable into the D/A Converter (C)

power port (marked with the  symbol), 5 in Figure 42).

2. Insert the end of the power cord (D) into the power supply electricity connector (6 in Figure 42).
3. Insert the other end of the power cord (D) into an electrical wall socket (7 in Figure 42).

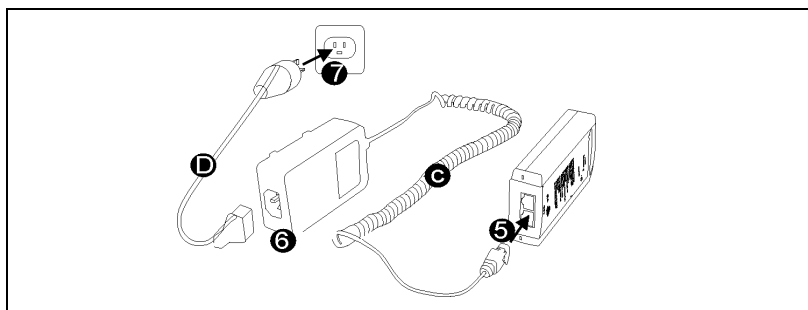


Figure 42. Connecting the D/A Converter to the Power Supply

6.4. Calibrating the Analog Device for Microstream Monitors

The analog device must be calibrated with the D/A Converter to work with the Microstream monitor, using the procedure described below. Since the signal sent from the monitor to the analog device is in volts, the analog device must be calibrated so that it can interpret the voltage figure which it receives as the correct patient value.

The calibration procedure includes two parts: Gain Calibration and Zero Calibration. Both parts of the procedure are required in order to complete calibration. Carry out both of these procedures in order as described below.

- Gain Calibration is used to indicate the maximum value for a parameter, which corresponds to the maximum voltage (1.0 V) on the analog device.
- Zero Calibration is used to indicate the minimum patient value (zero) for a parameter, which corresponds to the zero voltage (0.0 V) on the analog device.

Calibration is required only once, when the devices are set up.

6.4.1. The Calibration Procedures

➤ TO GAIN CALIBRATE AN ANALOG DEVICE (SUCH AS A POLYSOMNOGRAPH)

1. Check that the Microstream monitor and the analog device are connected as described in 6.3 Setting up Data Transfer with a D/A Converter on page 54. Both devices should be turned on.
2. Do not connect a FilterLine to the monitor.
3. Once connected, the monitor will generate an invalid signal of nominally 1V corresponding, in scale, to 111mmHg for the CO₂ outputs and 167 breath/min for the respiration rate output.
4. On your analog device indicate 111 mmHg for CO₂ readings for the 1.0 V signal which is generated, and indicate 167 breath/min for respiration rate output for the 1.0 V signal which is generated.

➤ TO ZERO CALIBRATE AN ANALOG DEVICE (SUCH AS A POLYSOMNOGRAPH)

1. Check that the Microstream monitor and the analog device are connected as described in 6.3 Setting up Data Transfer with a D/A Converter on page 54. Both devices should be turned on.
2. Connect a calibration FilterLine for zero calibration. A calibration FilterLine is included with the D/A Converter (PN of the D/A Converter is CS07143).
3. Ensure that the monitor is not in the process of performing an autozero. If you perform zero calibration during autozero, an invalid signal of 1V will be generated.
4. Expose the FilterLine to room air, and **do not breathe into it**.
5. Once connected, the monitor will generate a nominal voltage of 0V, corresponding to 0mmHg for the CO₂ outputs and 0 breath/min for the respiration rate output.

6. On your analog device, indicate 0 mmHg for CO₂ readings for the 0.0 V signal which is generated, and indicate 0 breath/min for respiration rate output for the 0.0 V signal which is generated.

Note: The device should not be in the process of performing an Autozero procedure while zero calibration is taking place. If Zero calibration is done during autozero, the device will not be properly calibrated.

6.4.2. Following Calibration

Once these two processes are completed, the analog device will be able to interpret the signal it receives from the monitor and record patient values correctly. For example, since it now knows that 0 V = 0 mmHg (for exhaled CO₂) and 1.0 V = 111 mmHg (for exhaled CO₂), a signal received from the monitor of 0.37 V will be interpreted on the analog device as 41 mmHg.

6.4.3. Working with the Digital/Analog System

Once the devices are connected and calibrated as described above, you can begin working with the system. Calibration is required only once, when the devices are set up.

Please take note of the following information.

The status indicator LED indicates communication between the D/A Converter and the monitor. The status LED has three modes:

- On - no communication with the monitor.
- Off - no power to the D/A converter.
- Blinking - communication with monitor functioning properly.

Ensure that the status indicator LED is blinking to indicate that communication between the monitor and the analog device is functioning properly.

The monitor functions normally during communication.

6.4.4. Troubleshooting

Some of the problems you might encounter in setting up the digital/analog conversion system are described below, along with suggestions to solve these problems.

Table 8. Troubleshooting

Issue	Relevant Component	Problem	Solution
CO ₂ data is not transferred.	Monitor	Monitor is set to record CO ₂ in kPa or Vol %.	Set monitor to record CO ₂ in mmHg.
CO ₂ data is not transferred.	Analog device	Calibration was not done or done incorrectly.	Calibrate the analog device as described in this document.
D/A Converter status light is either on or off and CO ₂ data is not transferred.	D/A Converter	Power and communication cables were mixed up, or one of the two cables was not connected correctly.	Connect power and communication cables to D/A Converter as described in this document.
CO ₂ data is not transferred.	D/A Cable	Unused connector in D/A cable has been shorted.	Do not short wires/connectors not in use.
SpO ₂ data is not	Monitor	The D/A utility can be used	N/A

transferred from the monitor		only to transfer CO ₂ data.	
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Chapter 7. *Hospital Patient Data Systems*

7.1. *Introduction*

Microstream monitors provide connectivity with hospital patient data systems (Bernoulli® and Oxinet® III) produced and/or marketed by Cardiopulmonary Corporation (CPC). This option permits regular, real-time transfer of data from the monitor to hospital patient data systems. Eight-bed or 12-bed configurations are available.

Monitor-hospital data system communication is available both for capnography-only devices and for capnographs/pulse oximeters. Please note that this utility is available only for use with Microcap, Microcap Plus, NPB70, and N85 devices containing software version 3.10 or higher.

7.2. *Connecting the System*

Before beginning the connection process, ensure that the following equipment is available:

- Bernoulli® or Oxinet® III system installed in the hospital
- Bernoulli-MSM or Oxinet Client Bridge terminated with a 25 pin D connector cable
- Microstream monitor (capnograph or capnograph/pulse oximeter) with software version 3.10 or higher
- MSM Interface Kit, which includes:
 - Communication Adapter (see Chapter 2 Communication Adapter Kit on page 10)
 - AC Adapter
 - Bridge Mounting Bracket
 - Pole Mounting Clamp

➤ TO CONNECT THE MONITOR TO THE BERNOULLI SYSTEM

1. Please note the parts of the MSM Interface Kit, which arrives preassembled, as seen in Figure 43. The MSM Interface Kit on page 64.
 - Communication Adapter (1)
 - AC Adapter (2)
 - Bridge Mounting Bracket (3)
 - Pole Mounting Clamp (4)

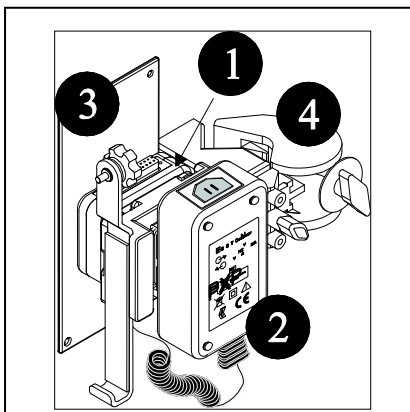


Figure 43. The MSM Interface Kit

2. Using the sketch seen in Figure 44. Assembling the MSM Interface Kit on page 66 as a guide, mount the Monitor (A) onto the designated groove (B) on the Mounting Clamp and screw the monitor securely into the Pole Mounting Clamp (C).
3. Insert the unattached end of the blue connector (D) originating from the Communication Adapter into the Monitor jack (E).
4. Affix the Client Bridge (F) to the Bridge Mounting Bracket (G) by inserting the pins (H) into the holes on the back of the Client Bridge. Remove 2 of the 4 corner screws in the Client Bridge (on whichever diagonal is convenient) and

screw the Client Bridge to the Mounting Bracket (G) using the additional screws provided.

5. Connect the 25 pin D connector (I) originating from the Client Bridge to the designated port on the Communication Adapter (J). The other end of the Client Bridge should be attached to the Bernoulli[®] or Oxinet[®] III system in the hospital.
6. Connect the AC Power Cord (K) to the AC Adapter (L) and plug the unattached end of the line cord into the electrical wall socket.
7. To attach the Pole Mounting Clamp to a support, turn the Pole Mounting Clamp screw (M) counter-clockwise until the pads are tightly secured around the support (such as to a bed, post, or shelf).
8. Position the Pole Mount Clamp jaws (N) around the support and turn the clamp screw until the pads tightly grip the support.



Figure 44. Assembling the MSM Interface Kit

7.3. *Data Transfer with Hospital Data Systems*

Once the connection between the devices is made as described above, data in binary format will be transferred automatically from the capnograph/pulse oximeter to the Bernoulli®/Oxinet® III system. No additional setting of the capnograph/pulse oximeter is required.

The following measurement data is transferred:

- Instantaneous CO₂
- EtCO₂
- FiCO₂
- Resp rate
- SpO₂
- Pulse

In addition, information regarding patient type, alarm data, and device settings (alarm limits, etc.) are transferred.

For more information regarding the Bernoulli system, or for troubleshooting the setup procedure, contact your local distributor.

Chapter 8. Nurse Call Systems

Microstream monitors can transmit data to hospital nurse call systems via an RS-232 device which receives information from the capnograph/pulse oximeter regarding alarm conditions and redirects that information to the hospital nurse call system.

The nurse call alarm output becomes active simultaneously with the occurrence of an alarm on the monitor, and remains active while the alarm condition is present. When the alarm condition is no longer present (that is, when the alarm on the monitor ceases) the Nurse Call alarm output also becomes inactive.

Monitor-Nurse Call system communication is available both for capnography-only devices and for capnographs/pulse oximeters. Please note that this utility is available only for use with Microcap, Microcap Plus, NPB70, and N85 devices containing software version 3.10 or higher.

8.1. Nurse Call Interface Setup

The Nurse Call Interface kit includes the following components:

- Mounting clamp for monitor
- Interface Adapter
- Cable connecting communication adapter to monitor
- AC Adapter with AC power cord

Additional components required for setup which are not supplied as part of the Nurse Call Interface kit include:

- Handheld capnograph or capnograph/pulse oximeter, software version 3.10 and higher
- Nurse Call system installed in the hospital
- Nurse Call cable (3.5 m), which can be purchased from Oridion (part number 011149). One end of the Nurse Call Cable attaches to the handheld Microstream[®] monitor. The cable is supplied un-terminated so it can be built to fit your nurse call system.

or (instead of purchasing a cable)

- Underminated Connecting Cable assembled in your institution – a 1/8 in. (3.5 mm) stereo phono jack connection to connect the Nurse Call Interface Adapter to the hospital's Nurse Call system

8.1.1. Types of Nurse Call Systems

From an alarm activation / deactivation perspective, Nurse Call Systems can usually be configured in two ways, latching and non-latching.

- Latching systems: the nurse call light/alarm will remain active until the connected device ceases to alarm and until the nurse cancels the alarm by pressing the nurse call system's CANCEL ALARM button.
- Non-latching systems: the nurse call light/alarm remains active until the connected device ceases to alarm. User intervention is NOT required if the alarm condition clears. This means that if the alarm condition corrects itself, the nurse call light and tone will automatically cease.

When interfacing between a Microstream® handheld monitor and a Nurse Call system, a non-latching configuration should be used.

Please note that both types of Nurse Call Systems will not permit a Nurse Call alarm to be silenced while there is an active alarm from a connected device such as a Microstream® handheld monitor.

8.1.2. Wiring Guide

➤ TO CONNECT THE CABLE TO THE NURSE CALL INTERFACE ADAPTER

1. The cable should have been previously prepared and wired for the "Normally Open" or "Normally Closed" connection, in accordance with the hospital's standard.
2. The signals on the three connector contacts (seen in Figure 45. The Nurse Call Stereo Jack, below) are:

- Normally closed (1)
- Normally open (2)
- Common (3)

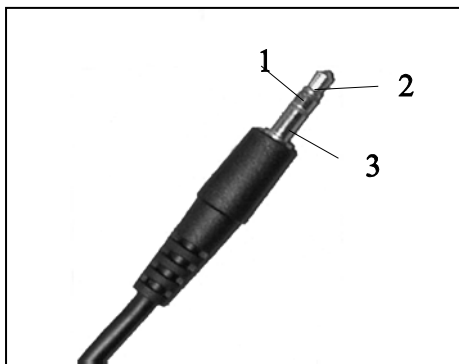


Figure 45. The Nurse Call Stereo Jack

3. Plug the 1/8 inch (3.5 mm) stereo phono jack cable into the top of the Nurse Call Interface Adapter. Connect the other end of the cable to the hospital system.

8.1.3. *Installation Instructions*

The Nurse Call Interface Kit arrives preassembled and consists of the following components:

- Interface Adapter (1 in Figure 46, below)
- AC Adapter (2 in Figure 46, below)
- Mounting Clamp for Monitor (3 in Figure 46, below)

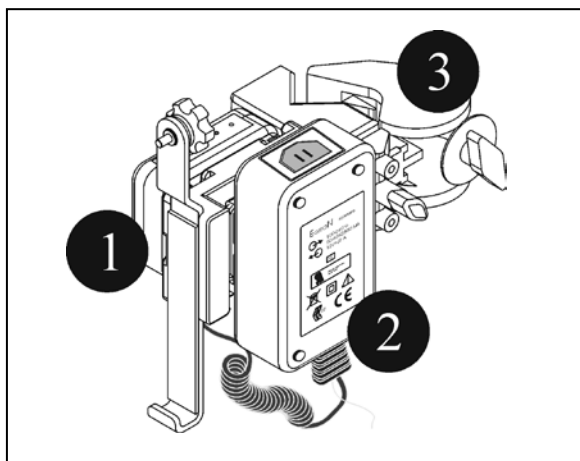


Figure 46. The Nurse Call Interface Kit

➤ **TO INSTALL THE NURSE CALL INTERFACE KIT**

1. Using the sketch seen in Figure 47. Nurse Call System Setup on page 73 as a guide, mount the monitor on the designated groove (1) on the Mounting Clamp and securely screw the monitor to the Mounting Clamp (2).
2. Insert the unattached end of the blue connector (3) originating from the Interface Adapter into the monitor jack (4).
3. Connect the AC power cord (5) to the AC Adapter (6) and plug the unattached end of the line cord into the electrical wall socket.
4. Insert the stereo phono jack cable into the Interface Adapter (7) and turn on the monitor (8).
5. After the monitor is turned on, the indicator LED on the Interface Adapter displays the status of Nurse Call. The LED displays either a green or a red light (see the LED indicator table below). When switching on the unit, verify that the status LED blinks, indicating successful communication.

6. To attach the Mounting Clamp to a support, turn the Mounting Clamp screw (9) counter-clockwise until the pads are completely secured around the support (such as a bed, post, or shelf). Position the Mounting Clamp jaws (10) around the support and turn the clamp screw until the pads tightly grip the support.

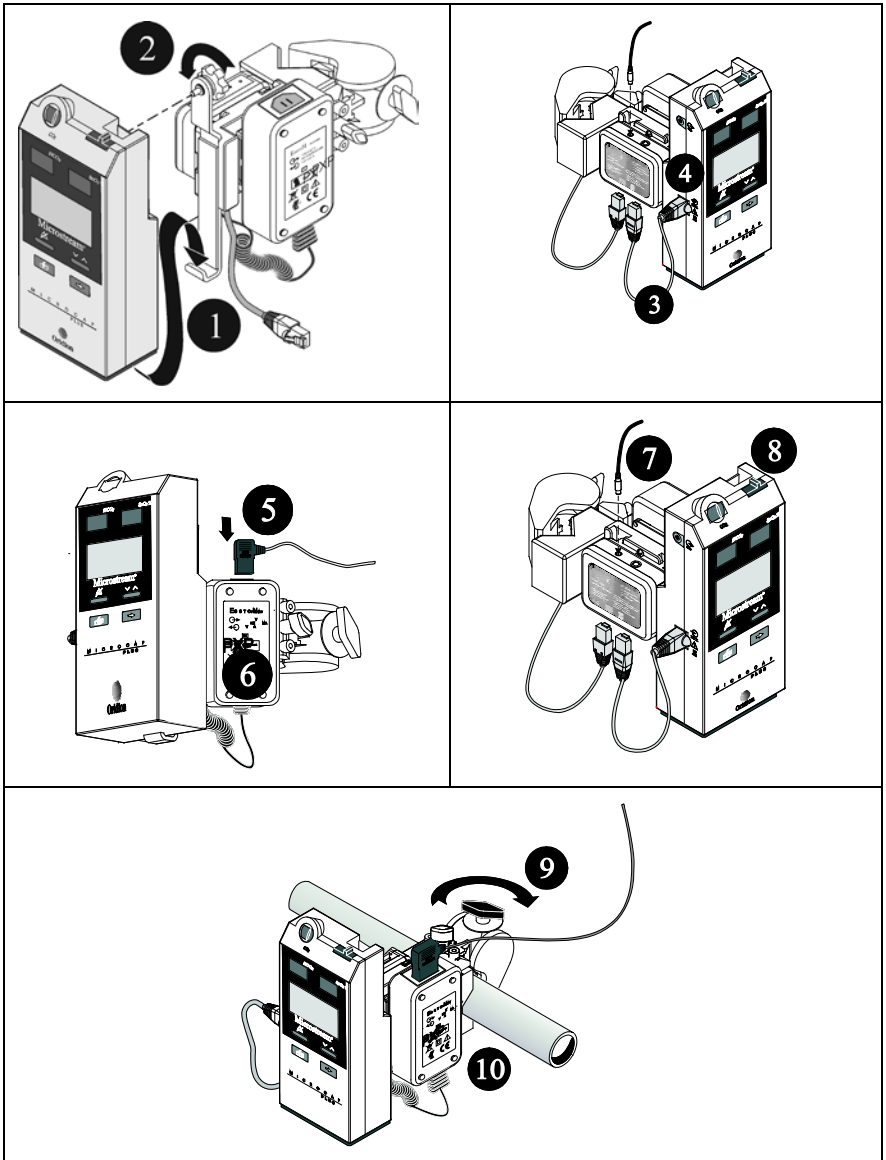


Figure 47. Nurse Call System Setup

8.2. Working with Nurse Call Systems

The nurse call interface is designed to download information regarding the alarms listed in Table 10. Alarms Indicated by Nurse Call on page 75, once the capnograph/pulse oximeter is connected to the Nurse Call system as described in the previous section. No further setting of the capnograph/pulse oximeter is required before information is transmitted.

8.2.1. LED Indicators

The information is transmitted to the system in the form of LED indicators. The indicator LED on the Interface Adapter displays the status of Nurse Call with either a green or a red light; these lights indicate the state of the monitor as described in Table 9. LED Indicators Transmitted to Nurse Call System, below.

When an alarm occurs, the Nurse Call system will display a blinking red LED at the nurse's station; this LED is serves as an indicator of an alarm situation. The alarms listed in Table 10. Alarms Indicated by Nurse Call on page 75 (warnings and cautions) activate the nurse call light.

The Nurse Call system provides real-time information on alarm situations only; no detailed data or historical data is recorded.

Table 9. LED Indicators Transmitted to Nurse Call System

LED	Description
Blinking Red	Alarm has been triggered
Blinking Green	Communicating with the monitor
Constant Green	The following scenarios cause a constant green LED to be displayed: No communication with the monitor Nurse Call failed self test Handheld with unsupported software version
Not lit	No power

8.2.2. Alarms

The patient alarms on the monitor that can trigger a blinking red LED on the hospital nurse call system are listed in Table 10. Alarms Indicated by Nurse Call, below.

Table 10. Alarms Indicated by Nurse Call

Message	Description
No Breath xxx!!!!	No valid breath has been detected for xxx seconds
EtCO ₂ ↑↑ !!!!	The EtCO ₂ value is above the upper alarm limit during the last 15 seconds (updated every 5 seconds)
EtCO ₂ ↓↓!!!!	The EtCO ₂ value is below the upper alarm limit during the last 15 seconds (updated every 5 seconds)
RR↑↑	The RR value is above the upper limit (when RR value is stable)
RR↓↓	The RR value is below the lower limit (when RR value is stable)
SpO ₂ ↑↑	The SpO ₂ value exceeded the current upper alarm limit
SpO ₂ ↓↓	The SpO ₂ value is below the current lower alarm limit
Pulse↑↑	The Pulse Rate value exceeded the current upper alarm limit
Pulse ↓↓	The Pulse Rate value is below the current lower alarm limit
Check Unit!!	This message is displayed when a failure occurs, during self test or measuring mode (full screen message)
Check CO ₂ !!	There is a problem with the CO ₂ module
Blockage!!	Appears after 30 seconds of unsuccessful clearing

8.3. *Installation Verification Procedure*

Once the system is set up, verify that the complete system is functioning by creating a test alarm and checking that the correct result has been received.

➤ **TO VERIFY CORRECT INSTALLATION OF NURSE CALL CONNECTION**

1. Checking the LEDs on the Interface Adapter (using Table 9. LED Indicators Transmitted to Nurse Call System on page 74 for reference) as you proceed, carry out the following procedure:
2. Connect and turn on all the Nurse Call Components.
3. Confirm that there is communication between the Nurse Call Interface Adapter and the monitor.
4. Force an alarm occurrence. For example, start breathing into the monitor for a few seconds and then stop breathing into the monitor. The red LED should blink, indicating the presence of a No Breath alarm.
5. Confirm that you receive the result you expect in the system according to the hospital standard for that alarm.
6. After the test has been successfully concluded, the Nurse Call system is ready for use.

Chapter 9. *Philips Patient Monitor*

9.1. *Introduction*

The Microcap capnograph interfaces to several Philips monitor systems via the Vuelink module. The information is then automatically integrated into the Philips monitors' trends, calculations, reports, and recordings.

This utility is designed for capnography-only devices, not for capnographs/pulse oximeters. Philips' Vuelink module and the Philips patient monitor will work with Microcap capnographs with software version 3.15 and higher and with all VitalCap devices. The capnograph is compatible with all CMS, V24/26 and most IntelliVue models. For more detailed information regarding Philips products, refer to the specific Philips patient monitor User's Reference Manual.

9.2. *Setting up Data Transfer with Philips Patient Monitors*

In order to set up the system, you will require:

- Vuelink Interface Module
- Interface Kit for Vuelink, comprising:
 - Mechanical Mounting Assembly, which includes the Interface Adapter and cable to attach the Interface Adapter to the capnograph, power supply and cable, pole clamp, and Vuelink cable for connecting the Interface Adapter to the Vuelink module.
 - Manuals and Directions for Use for interfacing the monitor with the Philips monitor
- The Microcap capnograph
- Philips patient monitor (purchased separately)

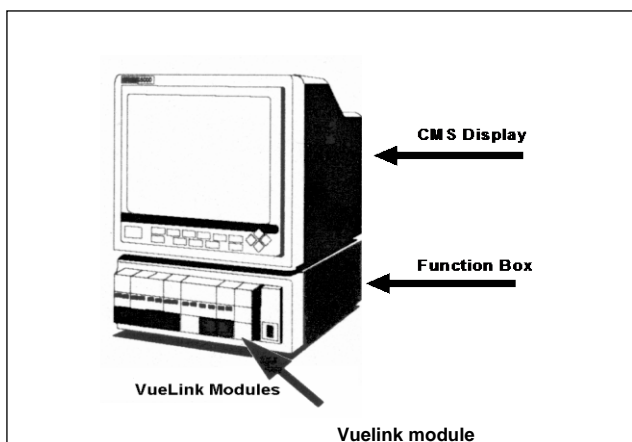


Figure 48. Vuelink Module and Philips Monitor

➤ TO CONFIGURE THE VUELINK MODULE

The Vuelink module must be configured to accept information from the monitor. For configuration instructions, refer to the Philips Vuelink Module Handbook. Be sure to follow the instructions for configuring Open Devices.

Caution:	Use only cables specified by the manufacturer when connecting the capnograph to the Vuelink module. Use of unauthorized or incorrect cables may result in damage to supported devices and may cause incorrect data to be displayed on the Philips monitor.
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➤ TO CONNECT THE CAPNOGRAPH TO THE PHILIPS MONITOR

1. Snap the Vuelink module firmly into place in the function box (see 1 in the sketch below).
2. Connect the capnograph to the Interface Adapter:
 - a. Insert the capnograph cable into the capnograph input/output port (see 2a in the sketch below).
 - b. Insert the other end of the cable into the Interface Adapter's output port (see 2b in the sketch below).

3. Connect the Interface Adapter to the Vuelink module:
1. Connect the Vuelink cable's D-sub 25-pin connector to the Interface Adapter and carefully tighten the screws (see 3a in the sketch below).
2. Connect the other end of the Vuelink cable into the Vuelink module, aligning the notch on the cable head with the matching indented space in the Vuelink module connector (see 3b in the sketch below).
4. Connect the capnograph to external power by:
 - a. Connecting the modular jack of the power supply cord – supplied with the capnograph – to the capnograph Power Supply Unit's input port (see 4a in the sketch below).
 - b. Connecting the other end of the power supply cord to the wall outlet (see 4b in the sketch below).
5. Check that all connections are secure.

Note: The capnograph can be connected to the Philips monitor when either device's power is on or off. It is not necessary to turn off either device while connecting the capnograph to the Vuelink module/Philips monitor.

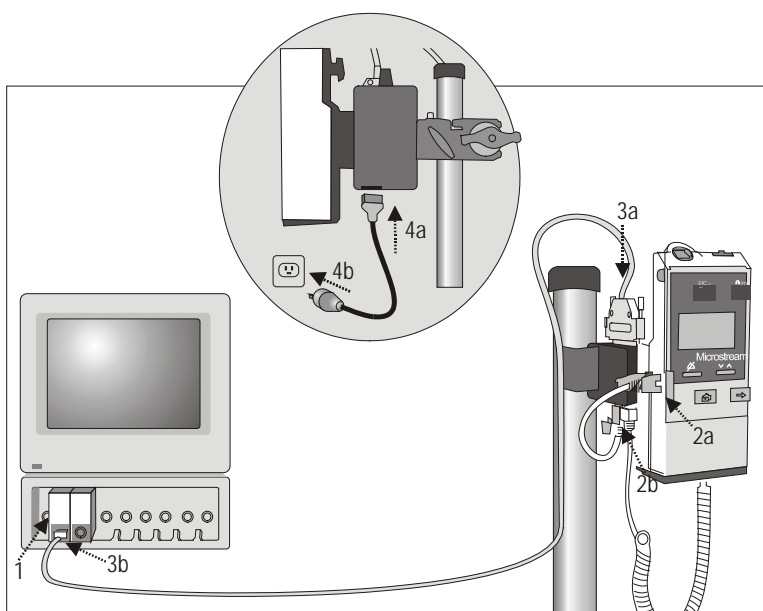


Figure 49. Connecting Microcap to the Philips Monitor

9.3. Working with the Capnograph and the Philips Monitor

9.3.1. Communication Check

After connecting the capnograph to the Vuelink module, the operator must perform a communication check by attaching the capnograph to a patient and ensuring that patient information is transferred to the Philips monitor. A description of the expected appearance of capnography data on the Philips monitor appears below. This is to ensure that the required CO₂ waveform and numerics are displayed on the Philips monitor. Refer to the Philips Vuelink Module Handbook.

9.3.2. Data Flow

When connected to the Philips monitor, the following data is transmitted and viewed on the Philips monitor display:

- CO₂ waveform
- Respiration Rate (AWRR)
- EtCO₂
- FiCO₂ (IMCO₂)
- Microcap setup - Patient mode

Start-up of data flow from the capnograph occurs automatically when the capnograph is connected to the Vuelink/Philips monitor, and both devices are turned on.

Initially, it takes approximately 20 seconds for the capnograph patient data to be displayed on the Standard Display (the default Philips display). If there is a communication failure (that is, a power failure or disconnected cable) or data time-out, the Philips monitor emits a continuous beep and the Vuelink reverts to the start-up phase.

A data time-out occurs when:

- The capnograph goes from Standby mode to measuring mode
- The language option is changed on the capnograph
- The CO₂ scale is changed on the capnograph
- The CO₂ units are changed on the capnograph

9.3.3. Data Display

There are two options of data display types on the Philips monitor:

- Standard Display
- Task Window

Note: The CO₂ waveform appears in real-time, while numeric data and messages are shown after a time lag of 5-7 seconds.

Note: Not all display options available on the capnograph are shown on the Philips data displays. In addition, some of the numeric labels used on the Philips monitor are different from those used on the capnograph. Refer to the Microcap Interface Manual for Vuelink, available from Oridion, for details.

Standard Display

The Standard Display is the default display of the Philips monitor after start-up. This display shows patient data (waveforms and numerics) for all modules selected to be monitored on the Philips monitor. For each Vuelink module connection, the screen displays a waveform section with a numeric value aligned next to the wave. Other parameter numerics are shown on the right side of the display.

Note: The Philips monitor must be configured to display the waveform and assigned numeric value. Refer to the Philips Patient Monitor User's Reference Manual.

For the capnograph, the Standard Display shows the CO₂ waveform and EtCO₂ value aligned next to the waveform. Other parameter numerics (depending on the Vuelink module used - see Table 1 and the Philips monitor configuration settings), are aligned next to the waveform on the right side of the display. See Figure 50. Standard Display for Philips Monitor, below.

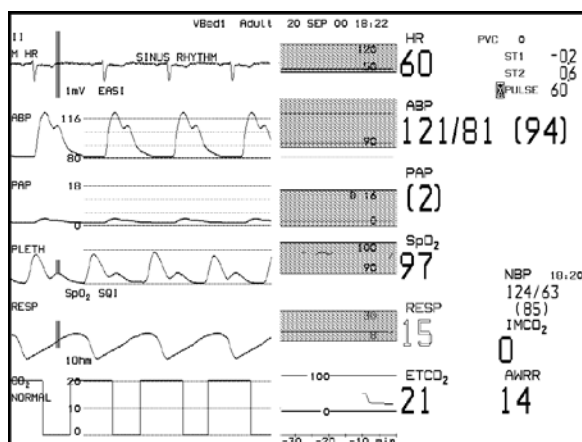


Figure 50. Standard Display for Philips Monitor

The following information appears on the display:

- CO₂ waveform
- EtCO₂
- AWRR (RR)

The AWRR (RR) numeric can be replaced by the IMCO₂ (FiCO₂), depending on the configuration setting on the Philips monitor. For instructions regarding changing the parameter setting, refer to the Philips Patient Monitor User's Reference Manual.

Task Window

The Task Window shows data pertinent for the selected patient module. The following information appears on the Philips monitor task window display (Refer to Figure 51. Philips Monitor—Task Window, below):

- CO₂ waveform (range: 20, 40, 80 mmHg—depending on the scale setting)
- Monitor status mode (WARMUP, NORMAL)
- AWRR (RPM)

- ETCO₂ (mmHg)
- IMCO₂ (mmHg)
- PAT (patient mode: ADULT, NEO.)

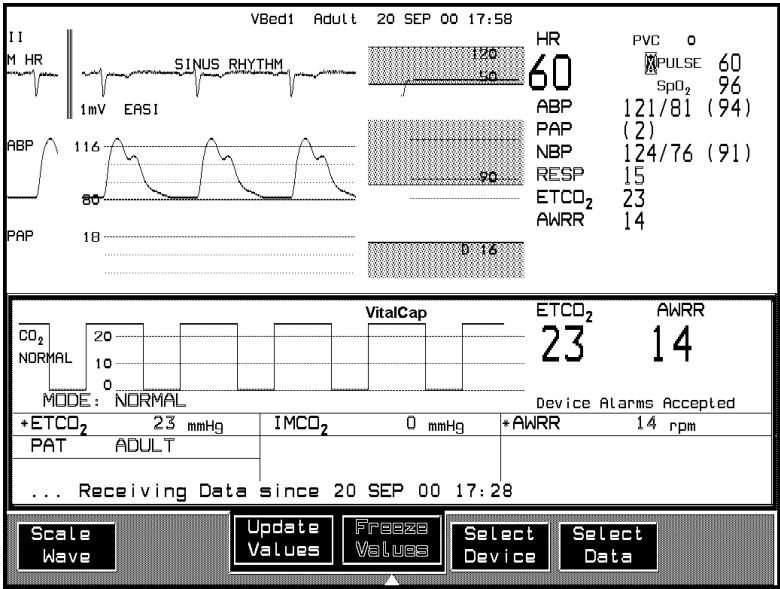


Figure 51. Philips Monitor—Task Window

To move from the Standard Display to the Task Window (and vice versa) use either of the following methods:

- Use a key sequence on the Philips monitor (refer to the Philips Patient Monitor User's Reference Manual)
- Press the setup key on the Vuelink module

9.4. Monitor Settings

The capnograph parameter settings can be changed from different menus on the capnograph. The Philips monitor does not recognize and display all capnograph parameter options. See the Philips Vuelink Interface Manual for details.

9.5. Alarms and Messages

The Philips monitor displays the same alarms and messages as the capnograph but in a different format. The capnograph has four levels of messages that are distinguished by a symbol following the message, and/or audio and visual indicators.

The Philips monitor displays the same alarms as the capnograph, although grouped into three priority levels. The alarm levels are distinguished by color (red, green and yellow), a symbol preceding the message (*), and a visual indicator.

The alarm and message labels appear at the top of the Philips monitor display. The red alert is located at the top right, the yellow alert message is in the center, and the green message is located at the top left.

Different alarm levels may appear simultaneously on the Philips monitor display (i.e. a green alert and a yellow alert). If more than one alert in the same category is active, only the alert with the highest priority is displayed on the Philips monitor.

See the Vuelink Interface Manual for more information regarding alarms.

Chapter 10. Spacelabs Patient Monitor

10.1. General

The Microstream monitor can be connected to a Spacelabs monitor via the Flexport module. The interface with the Spacelabs monitor enables the user to view patient data from the capnograph on the Spacelabs monitor screen as well as on the capnograph, either at the patient's bedside or at a monitoring station. The Flexport module integrates the capnograph patient data into the Spacelabs Monitor. The information is automatically integrated into the Spacelabs monitor's trends, calculations, reports, and recordings.

This utility is designed for capnography-only devices, not for capnographs/pulse oximeters. The Spacelabs Flexport module will work with any Spacelabs monitor manufactured after 1985, with Microcap capnographs using Software Version 3.15 or higher, and with any VitalCap device.

The Spacelabs Monitoring Systems include several classes of monitors. All of these monitor classes are modular patient monitoring systems that display patient data on the Spacelabs Monitor screen. Data consists of waveforms and numeric measuring values. Data may be displayed from different products (e.g., ventilators, anesthesia devices, and gas analyzers). For more information, refer to the Spacelabs Monitor User's Reference Manual.

10.2. Setting up an Interface with Spacelabs Monitors

The following components are required in order to set up an interface between a capnograph and the Spacelabs monitor.

- Flexport Module, SDLC cable, and terminating connector
- Interface Kit, comprising:
 - Mechanical Mounting Assembly, which includes the Interface Adapter and cable to attach the Interface Adapter to the capnograph, power

supply and cable, pole clamp, and cable for connecting the Interface Adapter to the Flexport module

- Manuals and Directions for Use for interfacing the capnograph with the Spacelabs Monitor.
- Microcap capnograph
- Spacelabs monitor (purchased separately)

Note: The Microcap device is compatible with all Spacelabs Monitor models manufactured after 1985.

WARNING: Only use cables specified by the manufacturer when connecting the capnograph to the Flexport module. Use of unauthorized or incorrect cables may result in damage to supported devices and may cause incorrect data to be displayed on the Spacelabs monitor.

➤ **TO CONNECT THE CAPNOGRAPH WITH THE SPACELABS MONITOR**

Before beginning the connection procedure, connect the capnograph to the Interface Adapter as described in the Directions for Use for the Interface Adapter.

1. Connect the L-shaped SDLC cable from the Flexport module to the Spacelabs monitor by connecting the long branch of the SDLC cable to the SDLC connector on the back of the Spacelabs monitor (see 1 in the sketch below).
2. Connect the Interface Adapter to the Flexport module as follows:
 - a. Connect the Flexport–Interface Adapter cable’s D-sub 25-pin connector to the Interface Adapter, and carefully tighten the screws (see 2a in the sketch below).
 - b. Connect the other end of the Flexport cable into the modular jack of the Flexport module (see 2b in the sketch below).
3. Connect the capnograph to external power by:

- a. Connecting the modular jack of the power supply cord – supplied with the capnograph – to the capnograph's Power Supply Unit's input port (see 3a in the sketch below).
 - b. Connecting the other end of the power supply cord to the wall outlet (see 3b in the sketch below).
4. The switch marked SW2 at the back of the Spacelabs monitor should be set to the On position (the upper position).
 5. Check that all connections are secure.

Note: It is recommended to connect the capnograph to the Spacelabs Monitor when the monitor's power is off.

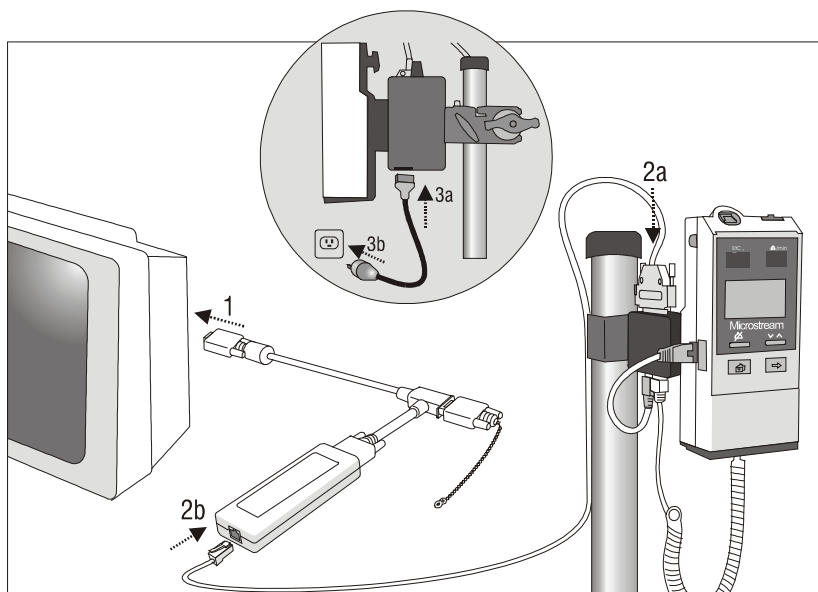


Figure 52. Connecting the Capnograph to the Spacelabs Monitor

10.3. *Communication Check*

After connecting the capnograph to the Spacelabs monitor, you must perform a communication check by attaching the capnograph to a patient and ensuring that patient information is transferred to the Spacelabs monitor. A description of the expected appearance of capnography data on the Spacelabs monitor appears below. This is to ensure that the required CO₂ waveform and numerics (digital numeric data) are displayed on the Spacelabs Monitor. Refer to the Spacelabs Monitor User's Reference Manual.

10.4. *Data Flow*

Start-up of data flow from the capnograph occurs automatically when the capnograph is connected to the Spacelabs Monitor via the Flexport Module, and the capnograph and the Spacelabs Monitor are turned on.

It takes approximately 5 seconds for the capnography patient data to be initially displayed. If there is a communication failure (i.e., a power failure or disconnected cable), or a data time-out, the Spacelabs Monitor will emit a continuous beeping sound, and the Flexport module will revert to the start-up phase.

When connected to the Spacelabs Monitor, the following data is transmitted and viewed on the monitor display:

- CO₂ waveform
- Respiration Rate (RR)
- EtCO₂
- Microcap setup—Patient mode
- FiCO₂

A data time-out occurs when:

- The capnograph goes from Standby mode to Measuring mode
- The language option is changed on the capnograph
- The CO₂ scale is changed on the capnograph

- The CO₂ units are changed on the capnograph

10.5. Data Displays

There are several options for data display modes on the Spacelabs Monitor:

- Small text/ Large text
- Waveform on /Waveform off

Either size text display can be viewed with or without the waveform, making four viewing options in all.

Note: Numeric (digital) data and messages appear in real-time, while the CO₂ waveform is shown after a time delay of approximately 5 seconds.

Note: Not all display options available on the capnograph are shown on the Spacelabs Monitor data displays. Additionally, some of the digital output labels used on the Spacelabs Monitor are different from those used on the capnograph. Refer to Microcap Interface Manual for Flexport, available from Oridion, for additional details.

10.5.1. Default Display

The default display after start-up of the Spacelabs Monitor is the large text view mode. This display shows all the relevant patient data (waveforms and numerics). See Figure 53. Default Display for Spacelabs Monitor, below.

For the capnograph, the display shows the CO₂ waveform with the EtCO₂ and RR values aligned next to the waveform.

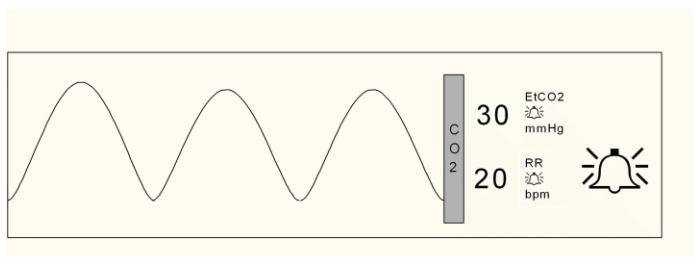


Figure 53. Default Display for Spacelabs Monitor

10.6. Monitor Settings

The capnograph parameter settings can be changed from the various menus on the capnograph. The Spacelabs monitor does not recognize and display all capnograph parameter options. The parameters set on the capnograph can be displayed on the screen but cannot be controlled by the Spacelabs monitor. The Spacelabs monitor has its own option for displaying trends. Refer to the Spacelabs Monitor User's Reference Manual for the monitor in use.

10.7. Alarms and Messages

The Spacelabs monitor displays the same alarms and messages as the capnograph but in a different format.

The capnograph has four levels of messages. These are distinguished by symbols following the message, as well as by audio, visual, and textual indicators.

The Spacelabs monitor displays the same alarms as the capnograph, although they are grouped into two different priority levels. The alarm levels are distinguished by color (red and yellow). Refer to Microcap Interface Manual for Flexport, available from Oridion, for additional details. The alarm message text is displayed in blue, above the waveform (which is also shown in blue.)

The alarm and message labels appear in two areas of the Spacelabs monitor:

- Together with the numerics, in the center of the screen

- At the bottom of the display.

The CO₂ button¹ in the center of the Spacelabs monitor screen flashes the color of the alarm (red or yellow), and the relevant button on the monitor also changes color.

The priority level of alarms on the capnograph is slightly different. See the Flexport Interface Manual for more information regarding alarms.

1 Spacelabs calls the touch-sensitive buttons on its monitor screens: "keys."