BIOMEDICAL DEVICE CONNECTION

Diane

VERSION HISTORY			
Version	Date of writing	Name of editor	Nature of modification
01	19/03/2020	Kevin Lacroix	Documentation creation

| Name, role, initials of editor	Name, role, initials of editor	Name, role, initials of editor
Kevin Lacroix Deployment Manager	Kevin Lacroix Deployment Manager	Kevin Lacroix Deployment Manager
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Summary

1. Different types of connection

DIANE has various connection modes that can be used depending on the export capacities of the biomedical devices:

- Direct RS232 cable communication (DB9 connector or other)
- RS232 communication via the network using a port server (or concentrator)
- HL7 communication via a biomedical unit
- Direct network/LAN cable communication (RJ45).
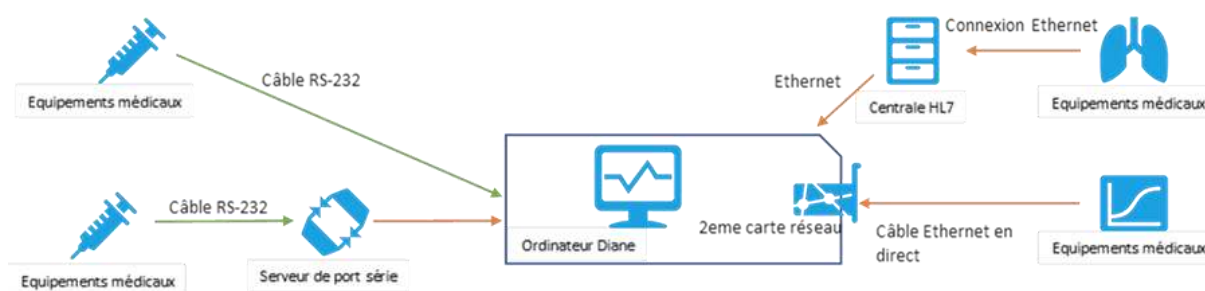
Of course, each type of connection has its advantages and disadvantages, as well as a specific configuration to be implemented for DIANE.

If your computer does not have an RS232 port or a secondary network card for direct communication, USB-RS232 or USB-RJ45 adapters can be used to circumvent the problem.

Noting whether each biomedical device has its own export protocol and configuration is recommended. BOW Medical is fully independent in developing its drivers which are installed on the computer at the same time as the executables.

2. RS232 cable operation

2.1 How it works

A specific RS232 cable connects the biomedical device and the computer.

Advantages	Disadvantages
Low-cost solution	Cable connecting workstation and equipment
Simple configuration	Limited cable length (6m max. recommended)
Reliable in case of network failure	Limitation if workstation far from equipment
No need for network port	Needs right cables for equipment
No need for electrical socket	No Citrix
Possibility of using smart cables that automatically recognise the equipment connected.	PC panels (required in this case) can be difficult to install next to the bed due to the number of machines
Most machines do not have a network exit point	
Minimal disturbance from cable if computer next to equipment	

2.2 Configuration in DIANE

RS232 driver configuration is accessed via the module **Visual.exe**, **Configuration** tab**, Drivers COM/Rs232** sub-tab (the first):
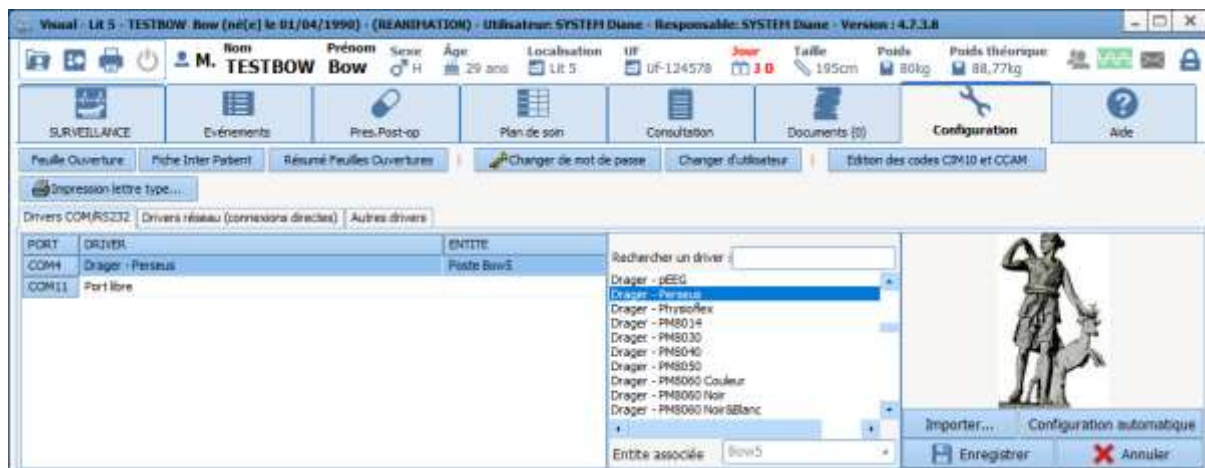
Figure 1 - Driver configuration in Visual

The COM ports available on your machine are found to the left of the window:

Figure 2 - COM/RS232 drivers

On the right, you can see the list of drivers and the buttons for saving the assigned configuration for the computer:
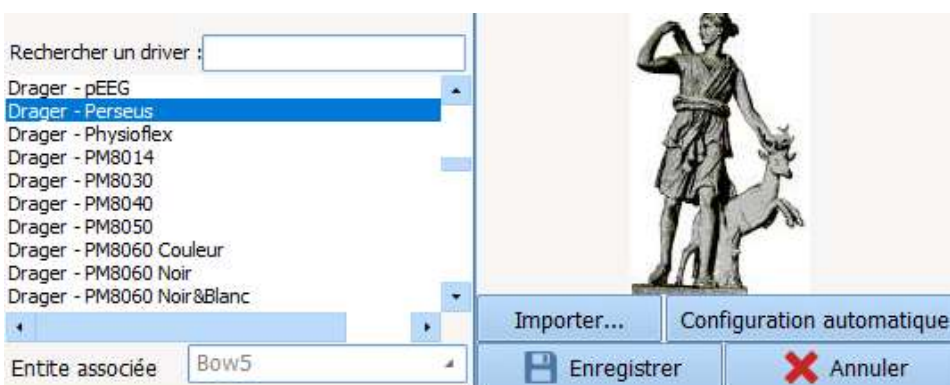
Figure 3 - List of drivers

The manipulation to configure communication is very simple. Search for the driver associated with your biomedical device and drag/drop it to the COM port to be used by the cable. Once this has been done, click "Save" to store this configuration.
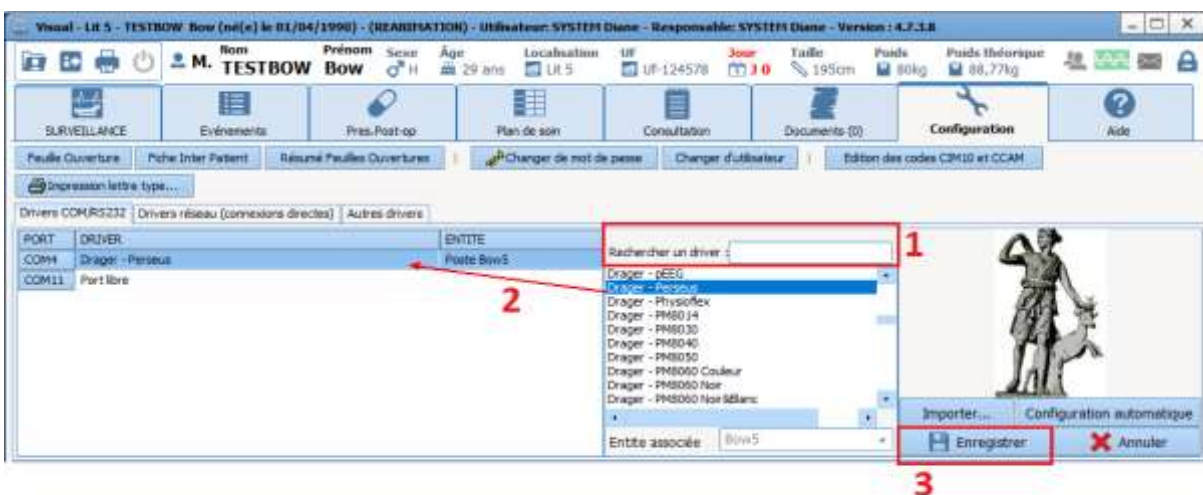
Figure 4 - Integrating a driver

This configuration is also available via the configuration tool in the driver tab:
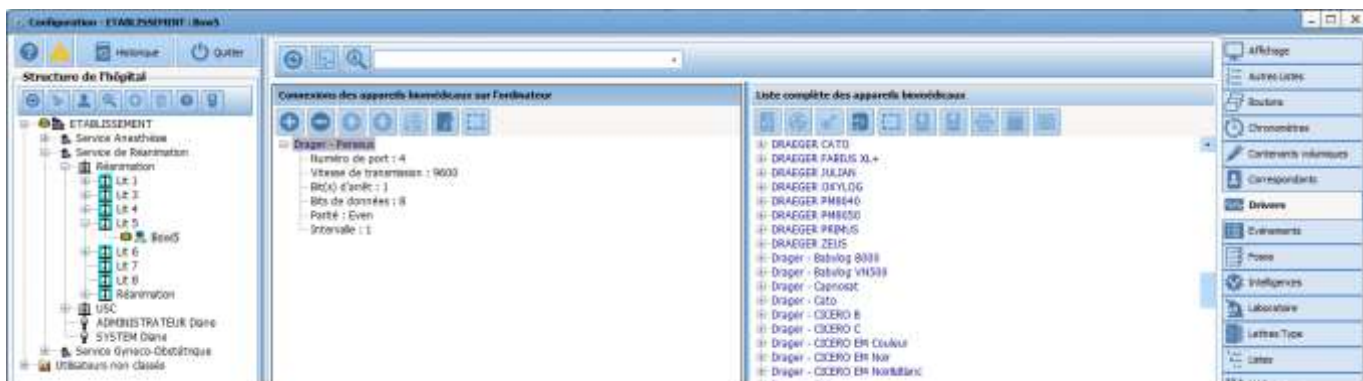
Figure 5 - Driver configuration

Please note that if your computer is used for several beds (recovery computer, for example), you must pay particular attention to the entity selected (see red box):
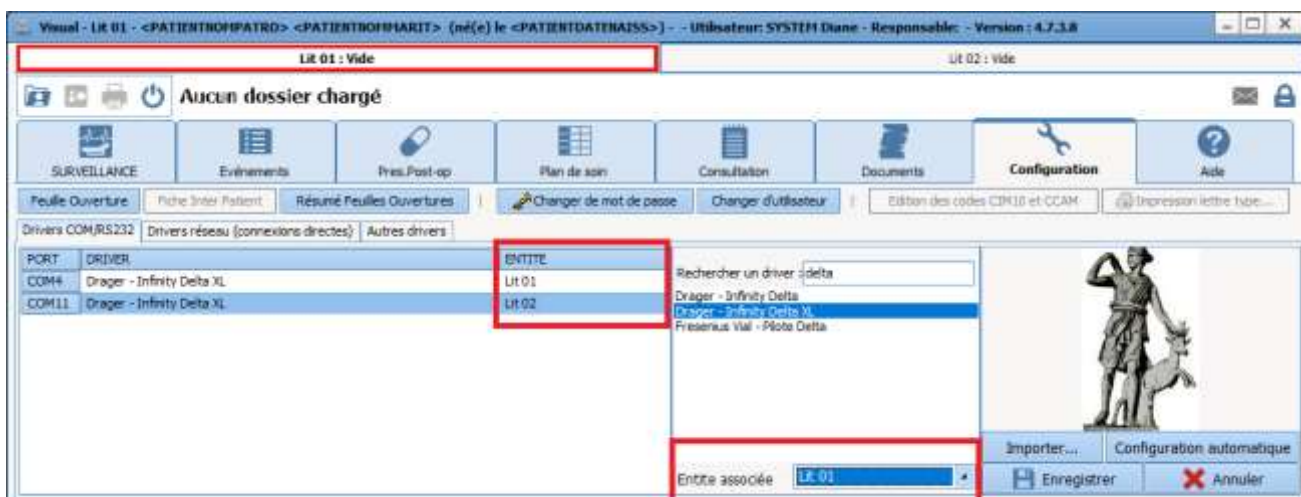
Figure 6 - Driver configuration for several beds with Visual

In this case, you can also use the configuration tool in the driver tab, but you must apply the driver to the bed, not to the computer:
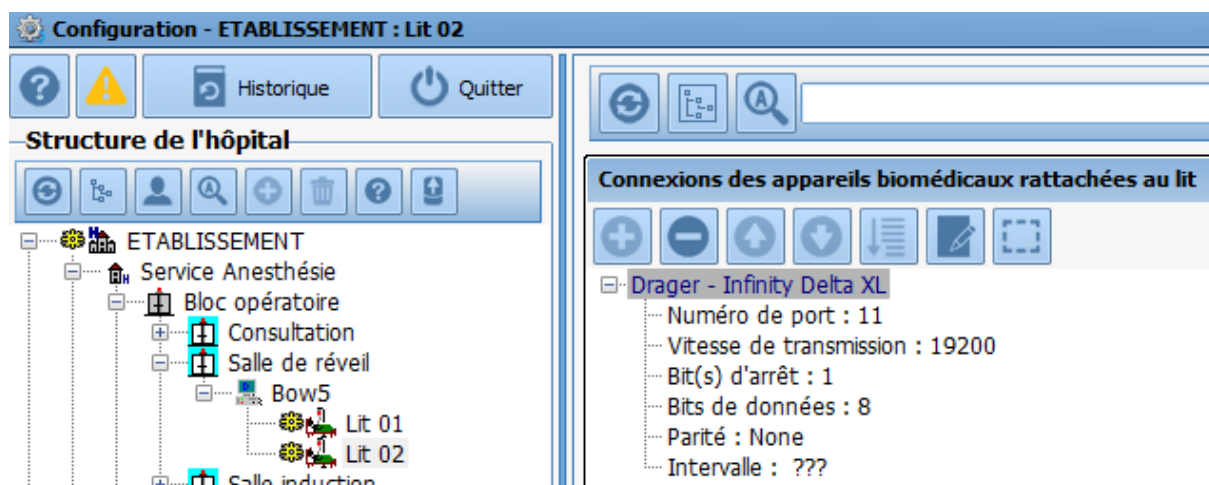
Figure 7 - Driver configuration for several beds

2.3 Frequent errors

- Cable unplugged.
- Driver not dropped on (correct) COM port during configuration.
- Biomedical device configured incorrectly.

3. Operation via port server

3.1 How it works

This type of data retrieval is similar to the RS232 cable connection but uses a box (port server) external to the computer to "displace" the physical COM ports. The RS232 cable is therefore connected to the box and the biomedical device (and not the computer and the device). This external box is then connected to the facility network and sends (when configured) information from the machines to the relevant computer.

| Advantages	Disadvantages
Can be adapted to many situations	Expensive solution
No limit to distance between equipment and PC	Complex configuration (each device must be configured independently)
Minimal disturbance from concentrator box	No data retrieval in case of network failure (on switch in question)
Citrix possible if no other equipment to be connected directly	Requires a port server of the correct size for the number of virtual ports to be managed to use Citrix
	Requires an additional electrical socket
	Requires an additional network port (although some boxes include a 'mini network hub' to replace the network port used)
	Box size (number of ports) must take into account future changes
	Needs right cables for equipment
	Equipment cannot be portable without reconfiguration of ports
	Large number of cables around equipment

3.2 Configuration in DIANE

The first step of this configuration is to connect your computer and your port server. In our case, we mainly use Moxa boxes. This is the manipulation to carry out:

Install the Nport Administrator driver (provided with delivery)

Go to the COM Mapping section of the software and click **Add** in the top menu.
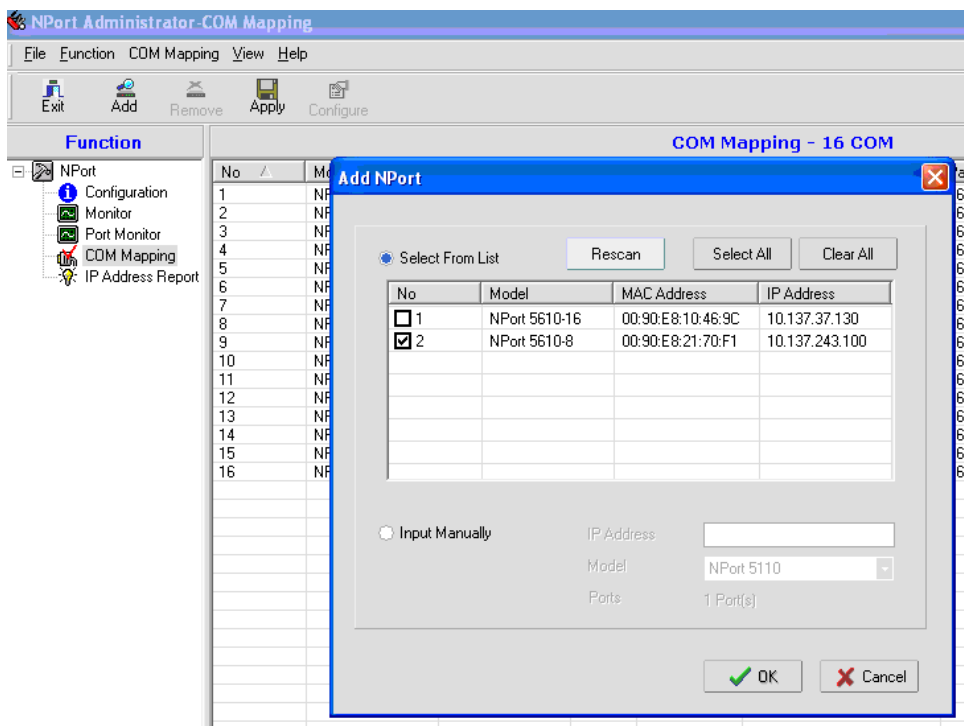
Figure 8 - Adding a port server to the computer

Select the box to be connected to your computer.

If the box is not shown, click **Rescan**.

All COM ports will be added to the list. Click Apply in the top menu.
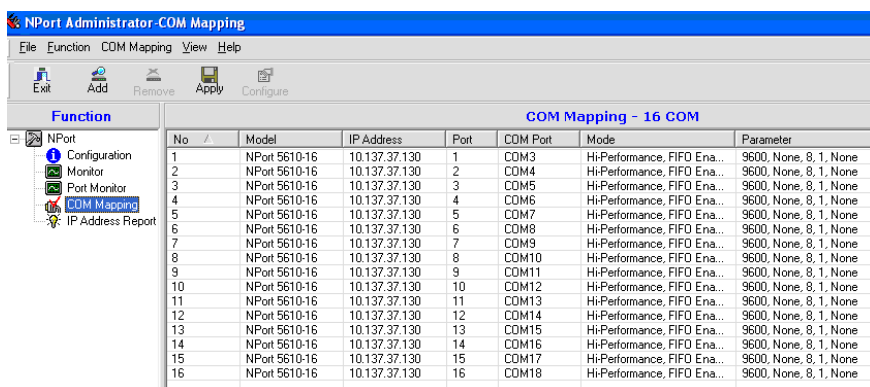
Figure 9 - Presentation of COM ports

The COM ports on your Moxa port server are now present on your computer.

Configuration is now identical to that for RS232 cable connection as given in section 2.2 of this document.

3.3   Frequent errors

- RS232 cable unplugged.
- Driver not dropped on (correct) COM port during configuration.
- Biomedical device configured incorrectly.
- Port server or computer not on network (or has incorrect IP address).

4. Operation via Gateway HL7

4.1 How it works

This type of data retrieval is used when the biomedical equipment is generally very homogeneous. The objective is to have a large number of monitors connected to a central HL7 unit that processes the biomedical data. This unit then transfers the information to the DIANE HL7 interface server which will save the data in a shared folder so that the client computers can retrieve information for the relevant rooms/beds.

Advantages	Disadvantages
Cost-effective solution if equipment is homogeneous and gateway already in place	No data retrieval in case of network failure
Standard network cable, potentially long if shielded (parasite)	Equipment cannot be portable without network reconfiguration (depending on equipment)
No need for electrical socket	High price of gateway if not already present or equipment from different manufacturers
Citrix possible if no other equipment to be connected directly	Complex configuration and maintenance requiring input from developer and manufacturer at same time (longer resolution time)
	Retrieval not possible for all equipment types depending on manufacturer No retrieval of alarms
	Requires network port close to equipment

4.2 Configuration in DIANE

4.2.1 Server:

First, you must copy the executable files on the server. There are then two possibilities for its installation, as there are two different versions of the interface:

- **DiaHL7NetToFile.exe: Version with graphic interface:** this can be used to initially configure the key parameters (in particular correspondence between entities) but also to test the interface is working properly more easily thanks to real-time display of the data sent and received.
- **DiaHL7NetToFileS.exe: Service version: designed for production** (once configuration has been established and tested), this enables you to ensure that the interface is constantly working at an optimal level.

The key parameters to be systematically configured in the file are the export file, port and address. Other modifications may be required (see Annexes).

Information is exchanged between the monitor and the DIANE HL7 interface via the TCP/IP protocol. The HL7 interface can work as a client or a TCP server to adapt to how the monitor operates. **The firewall on your computer must authorise incoming and outgoing communication on this port (e.g. port 8000 for eGateway).**

Finally, the **DIANE HL7 interface must be installed using an administrator account** so that the necessary permissions are assigned for the interface installation folder and the scheduled automatic restart task.

An "Export" folder must be shared on the network to give access to client computers for the retrieval of files generated in this folder.

The "InterfacesHL7" folder on the server must be available and contain the configuration and interface files (DiaInterf.exe package during server installation). In this folder, the DiaHL7NetToFileS.ini (service configuration file) is present and contains the configuration to allow data retrieval within your hospital, the main aspects of which are as follows:

4.2.1.1   Connection port

In this case, the DIANE HL7 interface acts as a server (eGateway) or as a client (always TCP protocol). In "client mode", an IP address corresponding to the HL7 gateway must be defined, as must a port number which will be used as a listening port (for eGateway) in server mode or as a target connection port in client mode. The port number to be used can be modified as long as the following are ensured:

- The new port is authorised by the firewall
- The new port is not used by a different service
- The HL7 gateway and the DIANE HL7 interface use the same port.

=> The DiaHL7NetToFileS.ini configuration file must contain this new port.

4.2.1.2   Export Folder (Directory)

Files exported by the DIANE HL7 interface are placed in the folder named in this line.
Client computers must have unrestricted access to this folder.

4.2.1.3   Name of destination DIANE entity

Mapping is carried out within the DiaHL7NetToFileS file and looks like this:

[HL7BedsAssignation] → Name of monitors retrieved by HL7 interface
AssignmentsCount=2
HL7Bed0="SSPI 1"
HL7Bed1="BLOC 11"

[DianeEntitiesAssignation] → Mapping of monitor names to DIANE entity.
SSPI 1="<Name of DIANE room or bed>"
BLOC11="Salle 11"

Files exported by the HL7 interface are sent to a specific DIANE computer. As a computer can have several beds, each able to retrieve HL7 data, the computer name cannot be used as the name for the export file. The following rule must be respected:

- If your DIANE computer has beds, give the name of the destination bed
- Otherwise, replace it by the room name (e.g. THEATRE1="Room1" for the computer DESKTOP-SRK456L).
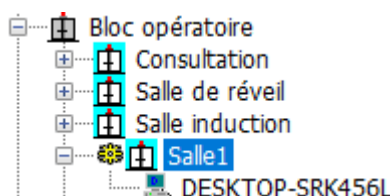

Figure 10 - Example DIANE entity configuration

4.2.1.4 Other settings

There are other configuration keys relating to how the DIANE HL7 interface operates, which depend on the HL7 gateway used. Please see the specific documents for the HL7 gateways in question for values and meanings.

4.2.1.5 Saving the configuration file

To deal with occasional resetting of the configuration file (during service crashes), save the contents of your DiaHL7NetToFileS.ini file in a DiaHL7NetToFileS_backup.ini file in the same directory.

4.2.1.6 Service installation

Finally, follow these steps to install the service:

- Open a command prompt as administrator
- Drag and drop the DiaHL7NetToFileS.exe executable
- Add a space then the setting **/install** to the command line
- Execute the command. A "Service installed successfully" message should tell you whether or not the command was successful.

Note: At this stage, the service has not been started. If you open the Services administration tool, you will see that the DIANE HL7NetToFile1 service has appeared and can be started.

4.2.2 DIANE HL7 file driver configuration

Files exported by the HL7 interface are sent to one or more DIANE computers/beds. For these files to be processed by the relevant DIANE computers, **the "HL7 file driver" must be activated and configured correctly** on the computers. This configuration is available from the Drivers tab of the list configuration tool (Configuration.exe).
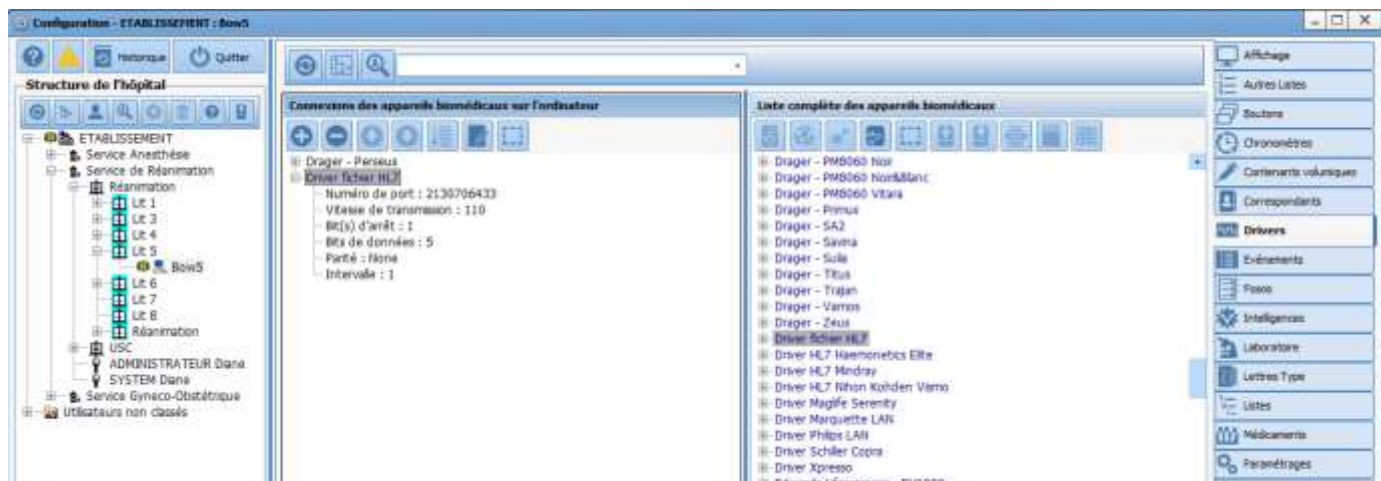
Figure 11 - HL7 file driver configuration

Via Configuration.exe, create a configuration for the DIANE computer or the room in which it is located (or the beds) and apply the HL7 file driver settings as shown on the screengrab below (for HL7 eGateway, but keys can have other values depending on the HL7 gateway used).

Once this step has been validated, modify the configuration of this driver in the central column to direct it to your export folder accessible on the network.

Ensure that the DeleteExportFileOnStart key is set to 1.
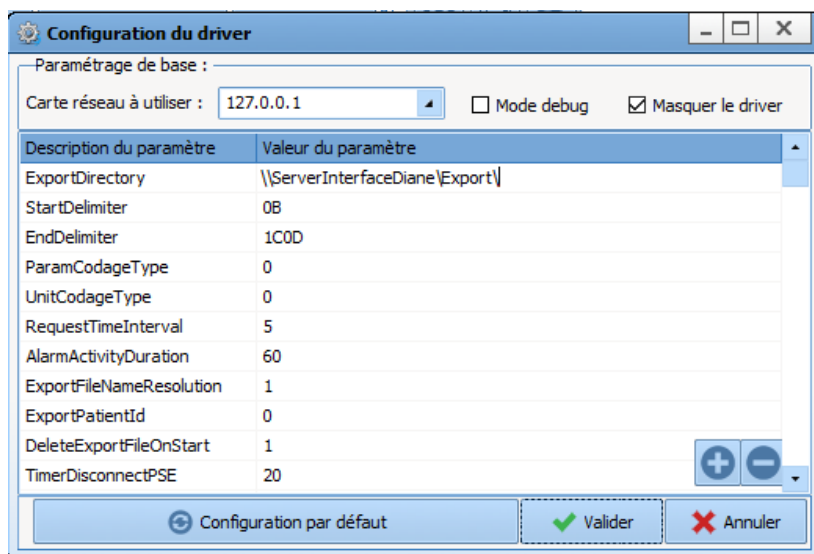
Figure 12 - HL7 file driver configuration in detail

Note: DIANE must be fully restarted on the computer for this change to be taken into account.

4.3   Frequent errors

- Monitor or computer network cable unplugged.
- The folder retrieving information (on the DIANE interface server) is not accessible from the client computer.
- HL7 file driver configuration is not active or is incorrect on the client computer.
- The monitoring unit is not exporting data to the DIANE server.
- The DIANE HL7 interface service has stopped.
- The biomedical monitor has been renamed without modifying the DIANE server configuration file.

5. Operation via direct network connection

5.1 How it works

This type of operation is very similar to the RS232 cable mode. It is generally used when the monitor does not have an RS232 port for exporting its values. A network cable then connects the monitor and a dedicated second network card on the computer.

Advantages	Disadvantages
Low-cost solution	Requires two network cards on the PC
Simple configuration (each monitor configured with the same IP address)	Equipment must allow the configuration (rare)
Reliable in case of network failure (direct connection)	No Citrix/TSE
No need for additional network port	
No need for electrical socket	
Portable equipment possible	
Distance between equipment and PC can be several metres	
Standard network cable	

5.2 Configuration in DIANE

The network driver is also configured via an INI file (LANDrivers.ini), which can be edited from the DIANE list configuration tool (**Configuration.exe**), on the Settings tab.

5.2.1 Declaring driver network cards:

By default, a network card is not dedicated to network drivers. This must be configured in the DIANE application. Modify the "Network driver configuration" section in the LANDrivers.ini file in order to do this.

NICx keys can be created manually as explained above, or via a graphic interface accessible via advanced configuration. A new window will appear, listing the network cards currently dedicated to drivers and offering the opportunity to add or delete cards and change the card IP address:
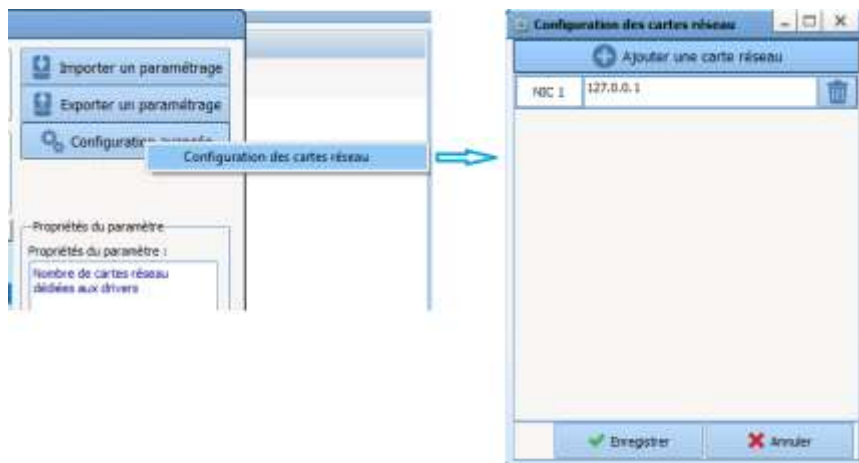
Figure 13 - Adding a network card

Note: ensure you enter the correct IP addresses (4 numbers from 0 to 255 separated by decimal points), otherwise the network card will keep the last valid IP address it was assigned (127.0.0.1 on its creation).

This gives the following result:

Description du paramètre	Valeur du paramètre
Configuration générale	
Configuration des drivers réseau	⊟
Nombre de cartes réseau dédiées aux drivers	1
NIC1	127.0.0.1
Driver réseau HL7	

Figure 14 - Network card in configuration

5.2.2   Configuration of network driver:

Once the network cards have been declared, the corresponding network drivers must be deployed. To simplify this procedure, a Network drivers (direct connection) sub-tab is available in the Configuration tab of Visual. This lists the network cards and offers the same control features as for serial port/RS232 drivers:

Figure 15 - Network driver configuration in Visual

Don't forget to click Save to confirm the configuration.
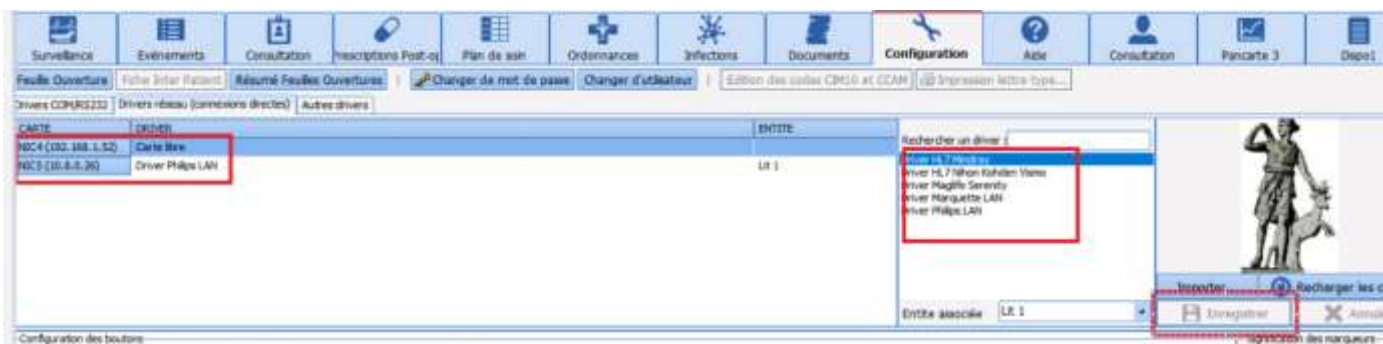
Note: if you wish to centralise the configuration (without accessing the end client computer), it is also possible to drag and drop these drivers from the list configuration tool in exactly the same way as for serial/RS232 drivers. The only difference is in how the driver network card is declared:
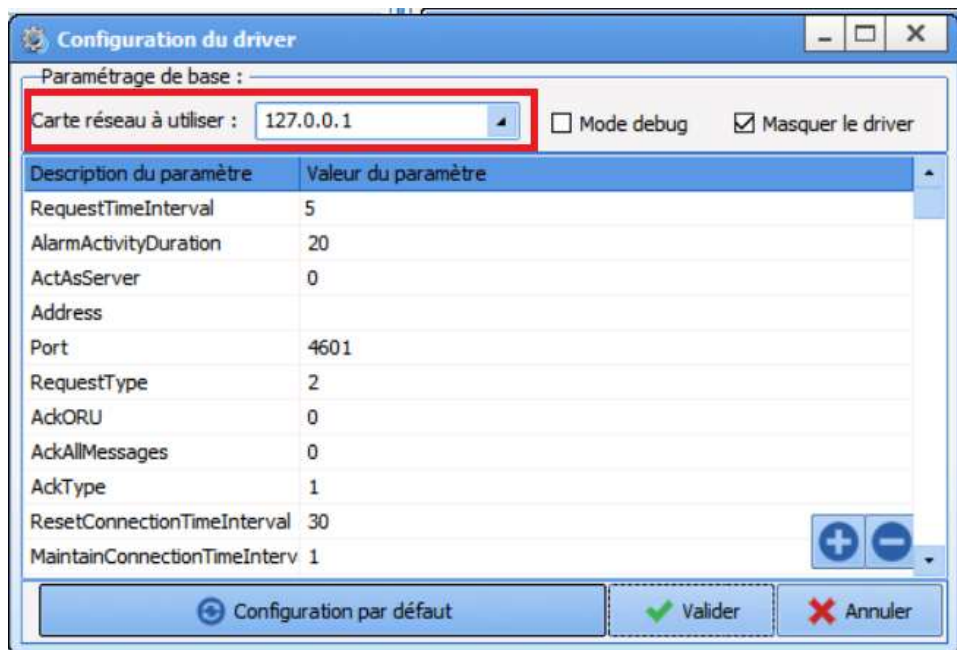
Figure 16 - Network driver configuration in configuration tool

5.3   Frequent errors

- Network cable unplugged.
- Communication between the two elements not available following incorrect IP address/mask or problem detecting second network card.
- HL7 configuration not active or incorrectly configured on the client computer.

6.   Annexes

6.1   DiaHL7NetToFileS content

Main parameters to be configured systematically in the file:

Address: Indicates the address of the distant HL7 system for the connection.

Port: Indicates the port number of the distant HL7 system for the connection.

ExportDirectory: Export folder for files containing HL7 messages retrieved by DIANE computers. The path must be the network path with read/write access for all DIANE computers.

Explanation of other parameters:

Debug: Set to 1 to activate debug mode, thus creating a log file containing the execution of the DIANE HL7 interface (0 by default).

AutoConnecteAndMinimizeAtStart: If = 1, the interface will automatically connect to the HL7 system on start-up. For the version with the graphic interface, the window will also minimise (otherwise it remains visible and you must connect to the central IT system manually using the 'Connect' button, 1 by default).

ActAsServer: Indicates whether the interface is working as a server (listening to connections) or a client (connecting to the remote system), not used at the moment (0 by default).

RequestType: Specifies the HL7 data request type (1 by default = no request).

RequestTimeInterval: Time interval in seconds between two HL7 data requests (10 by default).

DeleteExportFilesTimeInterval: time in seconds after which an unmodified export file is deleted (3600s by default).

AckAllMessages: Specifies if all messages are systematically acknowledged (0 by default).

AckORU: Specifies if ORU messages should be acknowledged (0 by default).

IdentificationType: Specifies the HL7 entity identification type (1 by default).

ResetConnectionTimeInterval: Indicates the time from which the connection is automatically reset, if = 0 the connection is never reset (300 by default).

MaintainConnectionType: indicates the mechanism used to maintain the connection. 1 = no mechanism, 2 - connection automatically reset if interrupted, ... (2 by default).

MaintainConnectionTimeInterval: indicates the time in seconds after which the connection maintenance mechanism is applied (10 by default).

StartDelimiter: Corresponds to the hexadecimal value(s) of the character(s) corresponding to the HL7 message start delimiter (0B by default).

EndDelimiter: As for StartDelimiter but for HL7 message end delimiter (1C0D by default).

NumberOfEntities: corresponds to the number of entities configured for the connections between "HL7 beds" and DIANE entities, use the graphic interface to configure this part and the following sections.

UnknowMessagesFileName: Indicates the prefixes of file names (without the path) in which HL7 messages that have not been processed as their type is unknown by the HL7 interface are stored ('UnknowHL7Messages' by default).

DeleteUnknowMessagesFilesOnStart: Indicates whether the files containing unknown HL7 messages should be deleted on service start-up. 0 = no, 1 = yes (1 by default).

 DeleteEntititesConfigTimeInterval: Indicates the time in seconds after which "HL7 bed" ⇔ "DIANE entity" connections are deleted. This value must be = 0 if the HL7 parameters are assigned to a HL7 bed (and the configuration was therefore done manually), otherwise it is set to 600 seconds as a lower value would not be useful and could even impair the performance of the interface (0 by default).

ShowExecution: Only used by the "visible" version (with the window), indicates if logging should appear as executed in the "memo" area. 0 = not activated, 1 = activated (0 by default).

6.2   HL7 File Driver Content

StartDelimiter: Must have the same values as in the DiaHL7NetToFile.ini DIANE HL7 interface file (0B by default).

EndDelimiter: Must have the same values as in the DiaHL7NetToFile.ini DIANE HL7 interface file (1C0D by default).

ParamCodageType: Corresponds to the parameter identification mechanism for the vital signs retrieved (2 = none by default).

UnitCodageType: Corresponds to the unit identification mechanism for the vital signs retrieved (2 = none by default).

ExportFileNameResolution:File name resolution: 1 (default) = based on DIANE entity, 2 = based on patient identity (UPI).

ExportPatientId:1 activates the patient identity record (in a file named "<entity_name>_PID.exp" and located in the export folder), 0: disables (default) patient identity export.

DeleteExportFileOnStart:1 (default) to activate automatic deletion of export files on driver start-up, 0 to disable (only to be used with DianePrint).

Debug:set to 1 to activate debug, otherwise 0 (default). It must be noted that in debug mode, log files are generated and the driver window appears in Visual.

Enabled: set to 1 to activate the driver, 0 (default) to disable it.

Visible: set to 1 to make the driver visible, 0 to hide it (default).

6.3 Dräger HL7 Gateway configuration

6.3.1 DiaHL7NetToFileS configuration

[BaseSettings]

Debug=0

AutoConnecteAndMinimizeAtStart=0

ShowExecution=1

HideOnceStarted=0

ActAsServer=1

[ServerSettings]

Address= **Gateway IP**

Port=2550

[ExportSettings]

RequestType=1

RequestTimeInterval=10

AckORU=1

AckAllMessages=0

AckType=2

IdentificationType=1

ResetConnectionTimeInterval=300

MaintainConnectionType=2

MaintainConnectionTimeInterval=10

DeleteEntititesConfigTimeInterval=0

UnknowMessagesFileName="UnknowHL7Messages.exp"

DeleteUnknowMessagesFilesOnStart=1

ExportDirectory="**Export Directory**"

StartDelimiter=0B

EndDelimiter=1C0D

6.3.2 DIANE HL7 file configuration

Settings to be changed versus default config.:

Enabled: 1

ParamCodageType: 0

UnitCodageType: 0

StartDelimiter=0B

EndDelimiter=1C0D

ExportDirectory: folder to which DIANE HL7 interface exports files. Exp

6.4 Philips HL7 Gateway configuration

6.4.1 DiaHL7NetToFileS configuration

[BaseSettings]

Debug=0

AutoConnecteAndMinimizeAtStart=0

ShowExecution=1

HideOnceStarted=0

ActAsServer=0

[ServerSettings]

Address= **Gateway IP**

Port=8000

 [ExportSettings]

RequestType=1

RequestTimeInterval=10

AckORU=0

AckAllMessages=0

AckType=1

IdentificationType=1

ResetConnectionTimeInterval=300

MaintainConnectionType=2

MaintainConnectionTimeInterval=10

DeleteEntititesConfigTimeInterval=0

UnknowMessagesFileName="UnknowHL7Messages.exp"

DeleteUnknowMessagesFilesOnStart=1

ExportDirectory="**Export Directory**"

StartDelimiter=0B

EndDelimiter=1C0D

6.4.2   DIANE HL7 file configuration

Modify the export directory part <u>only</u>.

6.5   Mindray HL7 Gateway configuration

6.5.1   DiaHL7NetToFileS configuration

[BaseSettings]

Debug=0

AutoConnecteAndMinimizeAtStart=0

ShowExecution=0

HideOnceStarted=0

ActAsServer=1

[ServerSettings]

Address="0.0.0.0"

Port=8000

[ExportSettings]

RequestType=1

RequestTimeInterval=10

AckORU=1

AckAllMessages=0

AckType=1

IdentificationType=1

ResetConnectionTimeInterval=300

MaintainConnectionType=2

MaintainConnectionTimeInterval=30

DeleteEntititesConfigTimeInterval=0

UnknowMessagesFileName="UnknowHL7Messages.exp"

DeleteUnknowMessagesFilesOnStart=1

ExportDirectory="**Export Directory**"

StartDelimiter=0B

EndDelimiter=1C0D

6.5.2   DIANE HL7 file configuration:

Modify the export directory part <u>only</u>.

6.6   Nihon Kohden HL7 gateway configuration

6.6.1   DiaHL7NetToFileS configuration

[BaseSettings]

Debug=0

AutoConnecteAndMinimizeAtStart=0

ShowExecution=1

HideOnceStarted=0

ActAsServer=0

[ServerSettings]

Address= **Gateway IP**

Port=8000

[ExportSettings]

RequestType=1

RequestTimeInterval=10

AckORU=1

AckAllMessages=0

AckType=2

IdentificationType=1

ResetConnectionTimeInterval=300

MaintainConnectionType=2

MaintainConnectionTimeInterval=10

DeleteEntititesConfigTimeInterval=0

UnknowMessagesFileName="UnknowHL7Messages.exp"

DeleteUnknowMessagesFilesOnStart=1

ExportDirectory="**Export Directory**"

StartDelimiter=

EndDelimiter=0D1C

6.6.2 DIANE HL7 file configuration

Settings to be changed versus default config.:

Enabled: 1

ParamCodageType: 6

UnitCodageType: 6

StartDelimiter=

EndDelimiter=0D1C

ExportDirectory: folder to which DIANE HL7 interface exports files. Exp