DinaWin Software
Instructions for Use
DinaWin Software Version 1.2.0.3

Purpose / Intended Use

This Dynamically Linked Library (DLL) is provided to enable a host application running on a PC with Microsoft Windows® XP/2K to interface with a GE Medical Systems *Information Technologies* DINAMAP® PRO Series 100-400 Monitor or DINAMAP® *ProCare* Monitor without requiring knowledge of the low level protocol. This product may be used to extract the most recent values for blood pressure, saturation, and predictive temperature.

Warnings / Recommendations

These warnings/recommendations are being supplied as mitigations to the hazards identified in the risk analysis of this software.

End User Warnings / Recommendations

GE Medical Systems *Information Technologies* strongly recommends that the following warnings be supplied to the end user of this software.

- The specified adapter and cables (See "Adapter and Cables" in the System Requirements section below) electrically isolate the monitor from the host PC and MUST be used to protect the patient and clinician from electrical shock.

- The system time settings on the host PC must be properly adjusted to assure that the time stamps on the parameter values are accurate.

- If not implemented as an automatic process in the host application, the resetMonitor function must be manually initiated by the end user between each patient to reduce the likelihood of associating the data with the wrong patient. The user must also be warned if this function fails.

- The blood pressure remote operations feature of the monitor must be disabled to prevent inadvertent control of the blood pressure parameter. See the monitor's user's manual for instructions to disable this feature.

- Monitor mode temperature values are not reported by the communications protocol, so the end user must be warned not to expect these values when using this software.

- The user must be warned not to connect multiple monitors to the same PC, since the DLL will only report values from the first monitor it finds.

- The user must be warned not to connect any other device to the same PC because DinaWin's search feature may interfere with the other device's operation.

Implementation and System Warnings / Recommendations

- A confirmation step must be added that allows the end users to confirm that the values were accurately transferred from the monitor. The confirmation step reduces the likelihood of associating the wrong data with the current patient.

- The resetMonitor function reduces the likelihood of associating the data with the wrong patient by disallowing data older than the PC's time when the function was called. GE Medical Systems *Information Technologies* recommends that the host application automatically call this function when a new patient is identified.

- The host system must provide anti-virus protection and restrict remote access to prevent malicious or unintended interference with the operation of this software.

System Requirements

Operating System:

- Microsoft Windows® XP or Windows® 2000

Free Disk Space:

- 100 KB

Adapter and Cables:

- 001926 Isolated Line Converter (ILC) Adapter
- 683235 Cable (Monitor to ILC Adapter)
- 683242 Cable (PC to ILC Adapter)

Release Notes

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- DinaWin will not return monitor values older than the system time when resetMonitor() was called, monitor values older than the system time when the DLL was loaded, or monitor values older than 30 minutes.

- resetMonitor() intentionally does not clear the displays on the monitor.

- DinaWin does not return the serial number of the monitor.

- By default, DinaWin sequentially searches COM1-COM10 for the monitor. When the DLL loads, DinaWin checks for a configuration file that can change the default COM port search range to COM 255 and initial port to search.

Software Installation

1. Insert the DinaWin CD into the CDROM drive.

2. Double-click on "Setup.exe" to proceed to the following Welcome dialog box.

3. Click "Next >" to proceed to the following select destination folder dialog box.
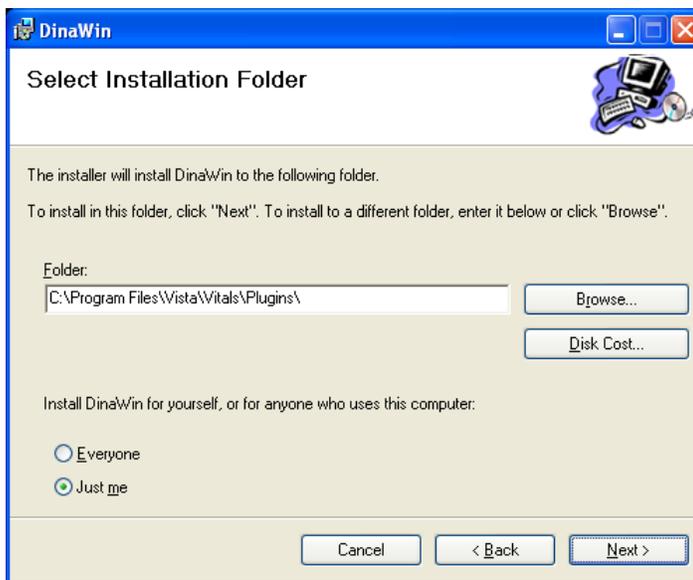
4. Select the destination folder, or accept the default destination folder [Program Files]\Vista\Vitals\Plugins\ and leave "Just me" if only you will use this DLL or select "Everyone" if other users will use the DLL.

5. When you are done click "Next >" to proceed to the following Confirm Installation dialog box.
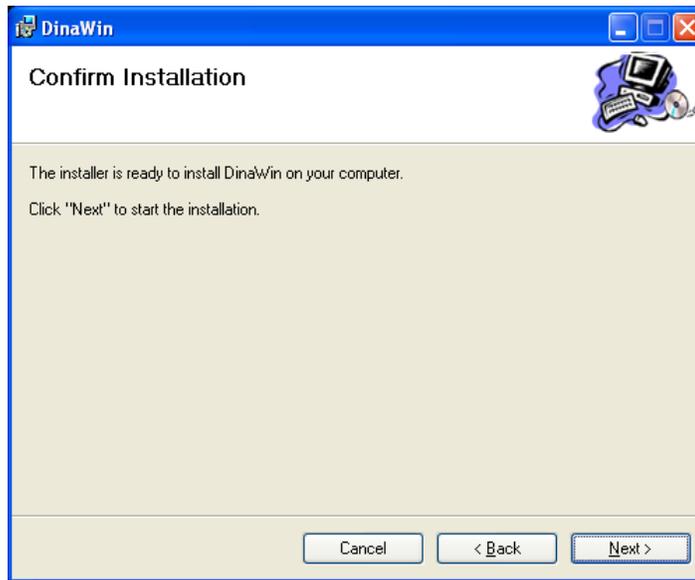
6. Click "Next >" to proceed to the following Installation Complete dialog box.
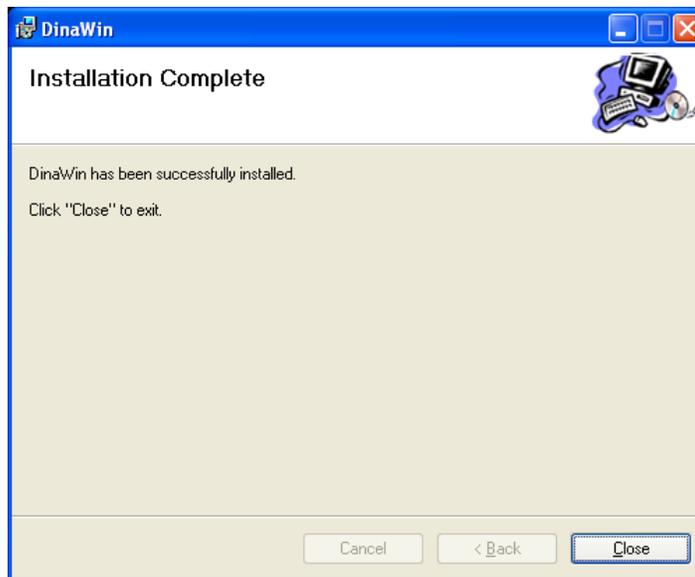
7. Click "Close" to finish the DinaWin installation.
8. Verify that the DinaWin.dll file was created in the installation folder specified during Step 4.

Software Removal

1. Insert the DinaWin CD into the CDROM drive.
2. Double-click on "Setup.exe" to proceed to the following Welcome dialog box.
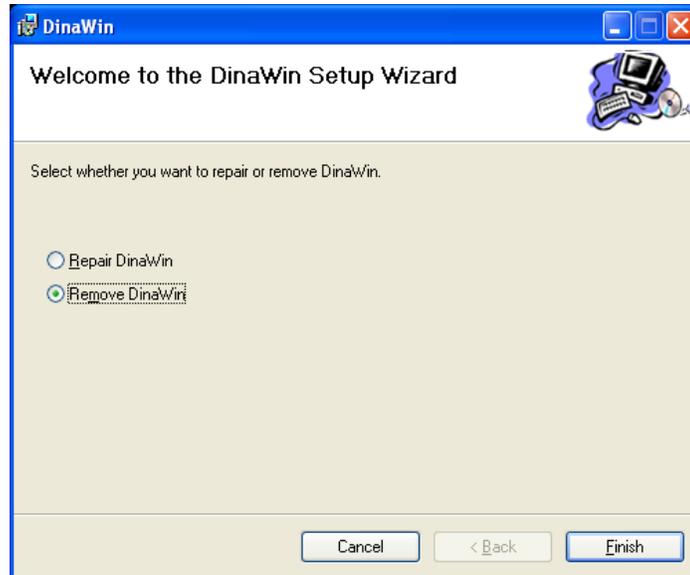
3. Select "Remove DinaWin" and click "Finish" to proceed to the following Installation Complete dialog box.
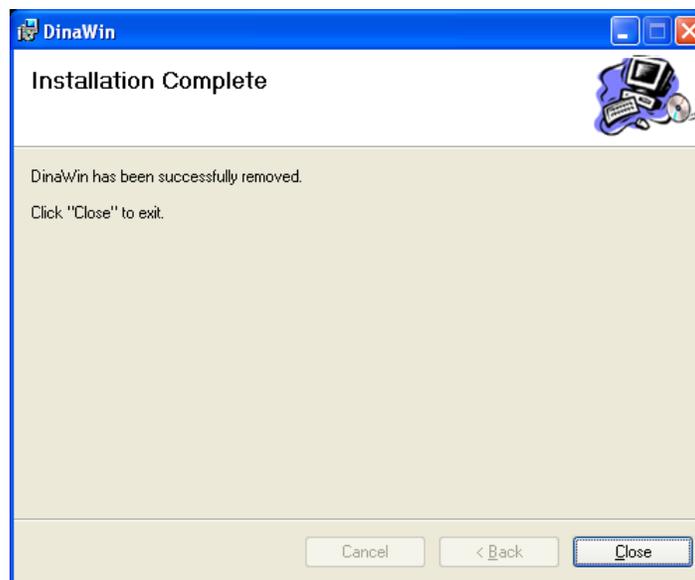
4. Click "Close" to complete the removal.

Checking the Installed DLL Version

1. Use Windows explorer to navigate to DinaWin installation folder, [Program Files\\Vista\Vitals\Plugins\, and use the mouse right-click on DinaWin.dll file.

2. Then click on the "Version" tab to view DinaWin "File version" on the first line from the top.

Monitor Connections and Settings

1. Connect the cable (683235) between the monitor's communications port and the ILC adapter (001926).

2. Connect the cable (683242) between the ILC adapter (001926) and the RS232 port on the PC or the RS232 port on a USB/RS232 adapter.
   NOTE: IF using a USB/RS232 adapter, the adapter must be configured for COM1-COM10. If the adapter requires a port greater than COM10, call GE Medical Systems technical support (800) 558-7044, Option 2.

3. Configure the monitor for a baud rate of 9600. Refer to the monitor's service manual for instructions on how to configure the baud rate.

Programming Reference

The host application issues commands to the DinaWin DLL. The DLL then issues appropriate commands to the monitor. The monitor returns results to the DLL and the DLL then returns appropriately formatted results to the host application.

If the host application requests vital signs measurements, the DLL responds with a small XML document representing the results of the request. The XML document conforms to the Document Type Definition (DTD) supplied in this specification.

The XML document shall not include any result sections that were not measured or not supported by the monitor. If, for example, temperature, SpO_2, and pulse are taken but not blood pressure, the result sections pertaining to blood pressure are to be omitted altogether as opposed to sending a value of 0.

Commands

- checkReadiness

  Description: This command determines whether the software can communicate with the monitor and whether the monitor can appropriately respond.
  Parameters: None.
  Return type: Boolean (32bit signed integer; 0=FALSE, 0≠TRUE).
  Return values: True if the software can properly communicate with the monitor; false otherwise.

- getBufferLength

  Description: This command returns the XML message buffer in a maximum length of 8bit characters.
  Parameters: None.
  Return type: Boolean? 32bit signed integer.
  Return values: The (unchanging) maximum size of the buffer the DLL has allocated for XML return strings.

- getState

  Description: This command is a request to retrieve the current values from the monitor. The values are returned in an XML formatted buffer per the DTD specification section of this document.
  Parameters: None.
  Return type: Pointer.
  Return value: A pointer to the beginning of the buffer containing the string that is an XML document conforming to this specification and containing the information about the current state of the monitor, i.e., the vital signs currently in the monitor. The string is represented by a null terminated character array and is encoded as ASCII text.

- resetMonitor

  Description: The monitors retain the last temperature and blood pressure values for 90-120 minutes. This function prohibits monitor values older than the function's invocation time from being returned with the getState function. This provides the host application a means to avoid confusing readings from a prior patient with the current patient's readings. This function must be called between patients.
  Parameters: None
  Return type: Boolean (32bit signed integer; 0=FALSE, 0≠TRUE)
  Return value: True if the monitor was reset; false otherwise.

DTD for Vital Signs Results

Below is the XML DTD:

```
<?xml version="1.0>
    <!ELEMENT Vitals (Vendor,Model,Result*)>
    <!ELEMENT Vendor (#PCDATA)>
    <!ELEMENT Model (#PCDATA)>
    <!ELEMENT Result (Value,units,Time_stamp)>
    <!ATTLIST Result name(Systolic_blood_pressure|
                          Diastolic_blood_pressure|
                          Mean_arterial_pressure|
                          Oxygen_saturation|
                          Body_temperature|Pulse) #REQUIRED
                          >
    <!ELEMENT Value (#PCDATA)>
    <!ELEMENT Units (#PCDATA)>
    <!ATTLIST Units name (F|C|mmHg|BPM|%) #REQUIRED>
    <!ELEMENT Time_stamp (#PCDATA)>
    <!ATTLIST Time_stamp year CDATA #REQUIRED
                          month CDATA #REQUIRED
                          day CDATA #REQUIRED
                          hour CDATA #REQUIRED
                          minute CDATA #REQUIRED
                          second CDATA #REQUIRED
                          >
    <!ELEMENT Method (#PCDATA)>
    <!ATTLIST Method        name CDATA #REQUIRED>
```

Workflow Example

1. Host loads DinaWin.dll at startup
2. Host calls getBufferLength to determine memory allocation for the returned XML string
3. Host calls checkReadiness to verify that the monitor is connected and powered
4. Host prompts user to identify the patient
5. Host prompts user to measure the patient's vitals with the monitor
6. Host prompts user to hit a button to retrieve the patient's vitals from the monitor
7. Host calls getState when the retrieve button is hit
8. Host parses the returned XML string and displays the data on the screen with the patient's identity
9. Host prompts the user to verify the information and to hit a send/save button for confirmation
10. Host sends/saves the information when the send/save button is hit
11. Host calls resetMonitor to prevent the data in the monitor from being retrieved the next time getState is called
12. Repeat steps 4-11 for each patient

Example Results Document

This is an example of the results document that is returned by the getState command:

```xml
<?xml version="1.0" encoding="ASCII"?>
<Vitals>
    <Vendor>General Electric Healthcare</Vendor>
    <Model>Pro/Procare</Model>
    <Result name="Systolic_blood_pressure">
            <Value>120</Value>
            <Units name="mmHg"></units>
            <Time_stamp year="2004" month="7" day="30" hour="13" minute="12" second="30"></Time_stamp>
    </Result>
    <Result name="Diastolic_blood_pressure">
            <Value>80</Value>
            <Units name="mmHg"></units>
            <Time_stamp year="2004" month="7" day="30" hour="13" minute="12" second="54"></Time_stamp>
    </Result>
    <Result name="Mean_arterial_pressure">
            <Value>103</Value>
            <Units name="mmHg"></units>
            <Time_stamp year="2004" month="7" day="30" hour="13" minute="13" second="12"></Time_stamp>
    </Result>
    <Result name="Oxygen_saturation">
            <Value>95</Value>
            <Units name="%"></units>
            <Time_stamp year="2004" month="7" day="30" hour="13" minute="15" second="05"></Time_stamp>
    </Result>
    <Result name="Body_temperature">
            <Value>98.6</Value>
            <Units name="F"></units>
```

```
            <Method>predicted</Method>
            <Time_stamp year="2004" month="7" day="30" hour="13" minute="2" second="04"></Time_stamp>
    </Result>
    <Result name="Pulse">
            <Value>84</Value>
            <units name="BPM"></units>
            <Method>pulse_ox</Method>
            <Time_stamp year="2004" month="7" day="30" hour="13" minute="15" second="23"></Time_stamp>
    </Result>
</Vitals>
```

Additional Information on Results XML

- Vendor tag: Monitor Manufacturer, "General Electric Healthcare".

- Model tag: PCDATA within this tag indicates the model name or number of the monitor.

- Result tag: This is the parent tag of all elements that, taken together, describe the result of a single vital sign measurement.

  Name attribute: Contains CDATA indicating the name of the vital sign.

  Possible names:
  Systolic_blood_pressure
  Diastolic_blood_pressure
  Mean_arterial_pressure
  Oxygen_saturation
  Body_temperature
  Pulse

- Value tag: This contains PCDATA representing the value of the measurement. It shall be text for the decimal number of the value. None of these measurements require scientific notation and it is not intended that the program encode the binary value of the number in any way. It shall be represented as human readable text.

- Units tag: This contains PCDATA indicating the units that apply to the value of the measurement. The DTD specifies these units.

  Possible units tags:
  F – Temperature in Fahrenheit
  C – Temperature in Celsius
  mmHg – Blood pressure in millimeters of mercury
  BPM – Pulse rate in beats per minute
  % - Percent of blood oxygen saturation

- Method tag: This contains PCDATA that represents the method used to produce the result.

  Possible method tags:
  Predicted - The temperature operational mode (Monitor mode is not supported).
  pulse_ox or blood_pressure – The parameter that derived the reported pulse rate.

- Time_stamp tag: The time tag for the results is calculated from the age of the result and the PC system time, which is independent of the monitor's system time. Therefore, the monitor's time is not required to be synchronized with the PC's system time.

Multi-Threading

The host application is expected to interface with DinaWin DLL using single-threaded interface where each request will be processed and returned in the same order that is was transmitted.

Operating Mode

Request-Response Mode - In this mode DinaWin DLL waits for a request from the host application before sending a response. This involves the DLL listening for incoming commands and responding to valid ones.

Troubleshooting

This section provides a basic troubleshooting guide.

Connections:

- Check the connections at the monitor, at both ends of the ILC adapter, and at the PC.
- Assure that the opposite end of the cable connected to the monitor is connected to the end of the ILC marked "Dinamap® Monitor."

Monitor Configuration:

- Assure that the monitor's baud rate is set to 9600. (See the service manual for detailed instructions).

Power:

- The ILC is powered from the monitor's host communications port. Verify that 4.5Vdc-5.5Vdc is measured between pin 4(+) and pin 1(-) on the monitor's comm. port. If the voltage is not present, call GE Medical Systems technical support (800) 558-7044, Option 2.

Loop-Back Test:

- If using a USB/RS232 adapter, short pins 2 & 3 on the USB/RS232 adapter's RS232 connection.
- Start the HyperTerminal application on the PC and configure it for the port being used to connect the monitor and a baud rate of 9600.
- If typed characters are echoed, check the connections to the ILC or the ILC may be connected backwards.
- If typed characters are not echoed, the USB/RS232 adapter may not be properly installed or the adapter is configured to use a COM port greater than COM10. If a COM port greater than COM10 is required, call GE Medical Systems technical support (800) 558-7044.