



# User's Manual

# Contents

<b>Introduction</b> .....	<b>1</b>
<b>How it works</b> .....	<b>1</b>
<b>XP2i Operational Modes</b> .....	<b>1</b>
<b>Datalogger Terminology</b> .....	<b>2</b>
<b>Typical Usage</b> .....	<b>2</b>
<b>Installing the Software</b> .....	<b>3</b>
<b>Quick Start</b> .....	<b>3</b>
<b>XP2i Initial Setup</b> .....	<b>3</b>
<b>Recording Pressure</b> .....	<b>5</b>
<b>Downloading</b> .....	<b>6</b>
<b>Operation</b> .....	<b>6</b>
<b>DataLoggerXP Software Operation</b> .....	<b>6</b>
<b>The Main Window</b> .....	<b>6</b>
<b>Setting the Options</b> .....	<b>7</b>
<b>Setting the Default Unit</b> .....	<b>7</b>
<b>Changing Modes</b> .....	<b>8</b>
<b>Connecting to the Gauge</b> .....	<b>8</b>
<b>Password Protection</b> .....	<b>8</b>
<b>Data Logging Parameters</b> .....	<b>8</b>
<b>Logging Interval</b> .....	<b>9</b>
<b>Logging Type</b> .....	<b>9</b>
<b>Maximum Number of Readings</b> .....	<b>9</b>
<b>Data Management</b> .....	<b>10</b>
<b>Downloading</b> .....	<b>10</b>

Viewing . . . . .	10
Saving . . . . .	11
Clearing . . . . .	11
Authorizing a Gauge . . . . .	11
<b>XP2i DataLogger Gauge Operation . . . . .</b>	<b>12</b>
Differences Between the XP2i Data Logger and XP2i . . . . .	12
Logging Parameters . . . . .	12
Unit Operation . . . . .	12
Operating Behavior . . . . .	14
On/Off Control . . . . .	14
XP2i Reset or Battery Change . . . . .	14
<b>Excel Templates . . . . .</b>	<b>15</b>
Workbooks . . . . .	15
Templates . . . . .	15
Excel Password Protection . . . . .	15
Data . . . . .	16
Default Template File . . . . .	16
<b>Service and Support . . . . .</b>	<b>16</b>
Troubleshooting . . . . .	16
How to contact us: . . . . .	16
<b>Disclaimer of Warranty . . . . .</b>	<b>17</b>

## Introduction

**Thank you for buying DataLoggerXP!** With Datalogger XP you can record up to three thousand measurements, on an intrinsically safe, fully temperature compensated pressure gauge. With the XP2i's long battery life you can take measurements for up to three months, without the need for external power supplies or battery replacements.

With an **XP2i** and **DataLoggerXP** you can:

- Record up to 3000 pressure measurements (data points)
- Change data collection parameters, with or without a computer
- Start and stop multiple collection runs from the keypad
- Record pressure readings at intervals as quick as once per second or as slow as once every 18 hours.
- Record the averages, averages and peaks, or just the pressure indication.
- Store an indicated pressure by pushing one button.
- View the data on any Windows-equipped computer.
- Save the data files directly into Microsoft® Excel spreadsheets (Excel 95 through Excel 2003), or as comma separated text files.

## How it works

There are two parts of this solution—the **DataLoggerXP program** and the **XP2i Digital Test Gauge**. Both are required to form a data logging solution. The Windows application handles all the transfer and saving of data from the gauge to your computer's hard drive, while the XP2i performs all the actual data collection.

## XP2i Operational Modes

A data logger XP2i operates differently than a standard XP2i. When operating as a data logger, the software internal to the XP2i, called the *firmware*, is replaced. The firmware within the XP2i defines the mode of the gauge.

When the gauge is operating in standard mode, the XP2i provides all of the functionality documented in the XP2i's Operation Manual. This is the mode in which all gauges are shipped from the factory.

The DataLoggerXP program switches a gauge into **data logger mode**. Mode changes take less than a minute, and can be done an unlimited number of times. Datalogger mode adds the capability to record pressure readings. The accuracy of the gauge is unaffected by this change, but some capabilities (such as peak display and multiple pressure scales) are removed to allow for maximum memory availability. For information on the changes in gauge operation while operating in data logger mode, see "Differences Between the XP2i Datalogger and XP2i" on page 12.

**Note:** An evaluation mode allows up to 100 data points to be taken after which authorization is required. For unlimited operation, the gauge must be **authorized** for use as a data logger. The gauge can be authorized either by the factory, prior to shipment, or in the field, by the use of an authorization key. Gauges are always shipped from the factory in standard mode.

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## Datalogger Terminology

The XP2i stores data in **memory**. Memory is expressed in terms of bytes available, with each data point taking some number of bytes to store. A clear gauge (one without any data in memory) will have approximately 8,000 bytes available. How long a gauge can log data depends on several factors, each of which is described below.

The first factor is the **logging interval**. This is the time, in seconds, between each data point.

The second factor is the **logging type**. The logging type controls what kind of data is stored for each reading, with different modes requiring different amounts of memory for each reading.

The third factor is the **dynamics** of the input pressure. Data is compressed into memory whenever possible. Therefore, pressure that is changing slowly over time will require less memory as compared to large variations of input pressure. More information on how these factors affect the maximum number of readings can be found under "Maximum Number of Readings" on page 9.

Together, the logging interval and logging type are referred to in this document as the **logging parameters**. Logging parameters can be set up one of two ways: on a computer connected to an XP2i, or on an XP2i by itself. This second option allows the user to make changes in the logging parameters while in the field.

Once the logging parameters have been selected, the gauge can begin sampling data. A set of one or more readings taken by the gauge is called a **run**. The user can specify different logging parameters for each successive run. There is no limit to the number of runs a gauge can store, providing there is sufficient memory to store them.

After one or more runs have been stored on the gauge, DataLoggerXP can **download** the data to a computer for viewing and/or saving to the computer's hard drive. This is done by simply connecting the gauge to the computer via a serial cable and using the Download function of the application software.

Once the data is downloaded to the computer, you will typically **clear** the gauge. This removes any existing runs from the gauge's memory, so that all of the memory is available for the next sequence of runs.

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## Typical Usage

While there are a variety of ways in which the DataLogger software and XP2i digital test gauge can be used, a typical way to use the Datalogger might be like this:

- 1 You set up the logging parameters—either on the computer or directly on the XP2i keypad—and start recording data.

- 2 Once the logging is complete, the test gauge is connected to a computer.
- 3 Using the DataLoggerXP application, you download one or more runs to the computer.
- 4 You save one or more of the runs to Excel worksheets, or as text files.

## Installing the Software

DataLoggerXP can either be installed from a CD provided by Crystal Engineering, or downloaded from the Crystal Engineering web site; however, it's recommended to check the Crystal Engineering ([www.xp2i.com](http://www.xp2i.com)) web site for the latest version of the software.

To install from the CD, simply run the Setup.exe application located on the install CD. This is typically D:\Setup.exe, but may be different on your computer.

To install from the Internet, visit <http://www.crystalengineering.net> and select the DataLoggerXP software page to download the latest version of the software.

Once the setup application is started, simply follow the on-screen prompts to complete the installation.

If DataloggerXP is being upgraded, the prior version does not need to be uninstalled. The new version will be installed over any existing version.

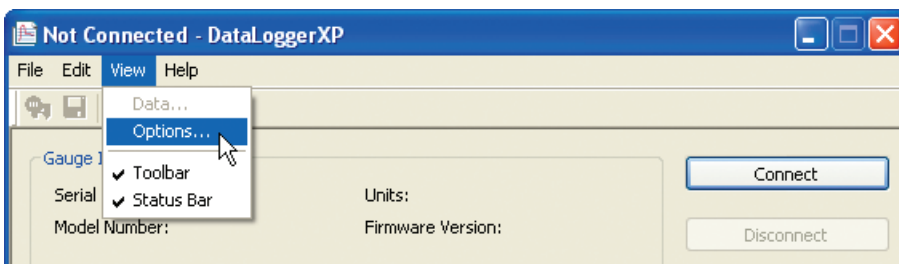
## Quick Start

For experienced users, the following quick-start should provide sufficient information to get up and running quickly:

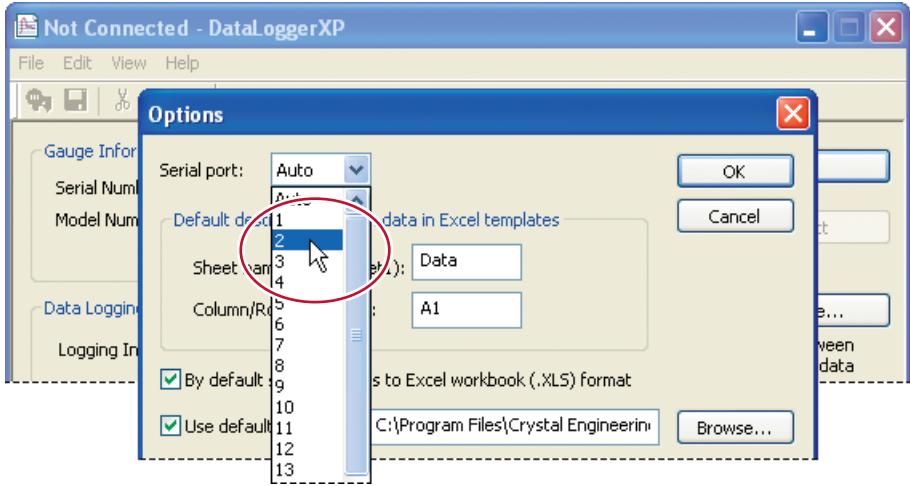
### XP2i Initial Setup

Because the gauge is not shipped in Datalogger mode, first time setup requires the use of a computer. Once the XP2i has been configured as a datalogger, settings can be changed from either the DataLoggerXP application, or from the XP2i's keypad.

- 1 Connect the gauge to the computer with a serial cable, P/N 2400 or equivalent.
- 2 By default, DataLoggerXP is configured for automatic serial port detection. If you need to set a specific port, select **View > Options** from the main menu.

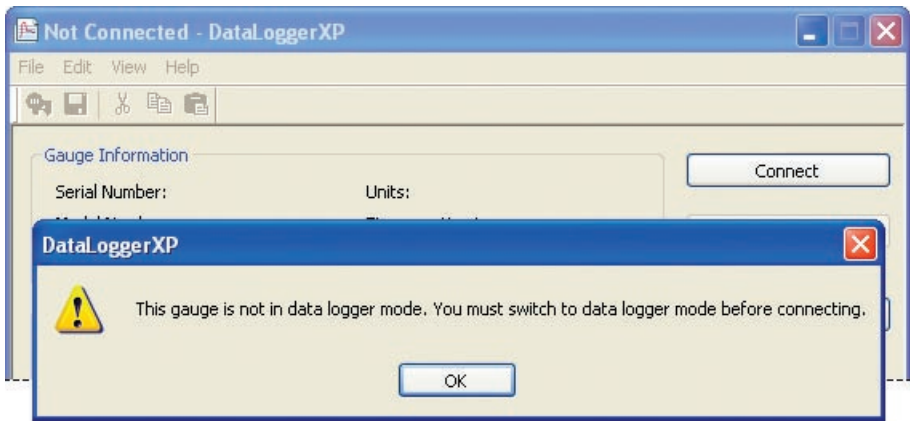


3 Then select the Serial port from the drop down list and click **OK**.

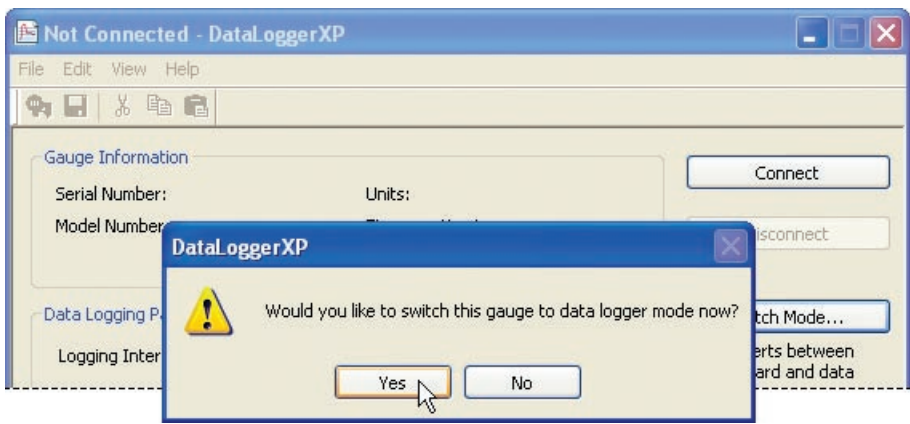


4 Click the **Connect** button to connect to the gauge.

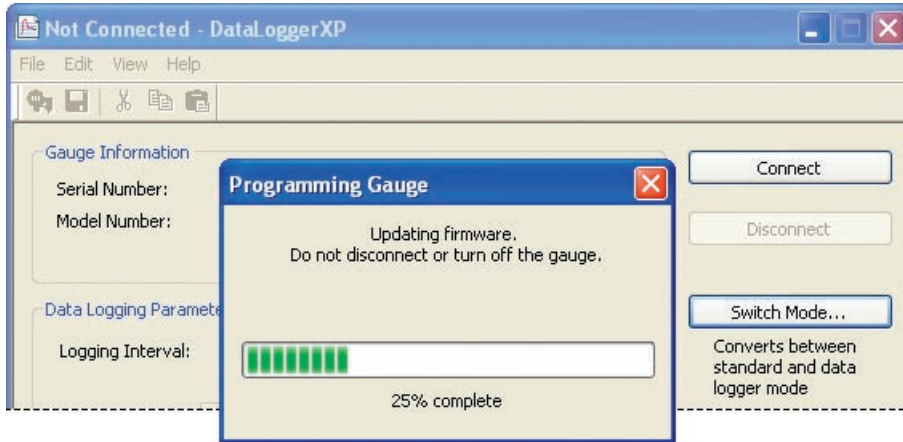
5 If the gauge is *not* in datalogger mode (as shipped from the factory) you will see this message:



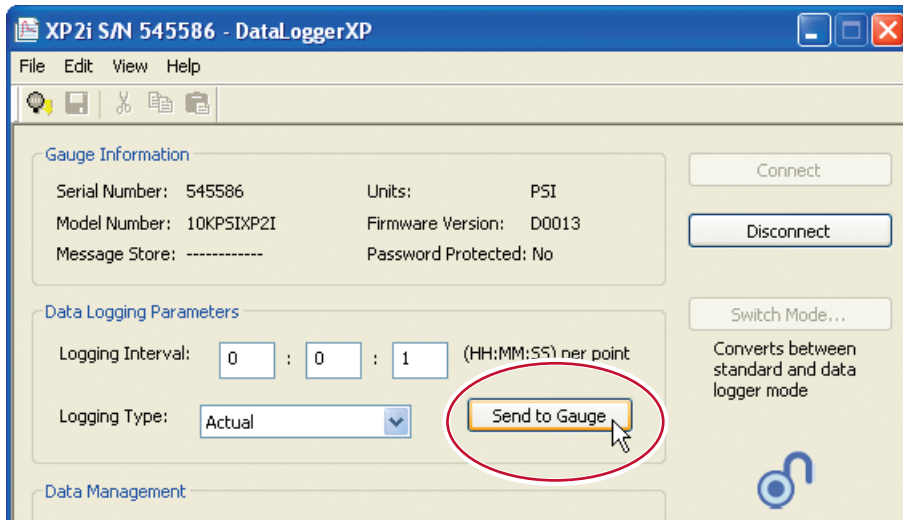
Press the **Switch Mode** button to convert it to datalogger mode, then press **Yes**.



Don't disconnect or turn off the gauge while it's being updated.



- After the gauge has been updated, press the **Connect** button again. Then set the logging parameters: The Logging Type, and the Logging Interval (if it applies). Click **Send to Gauge** to update the gauge parameters.



- When finished, click **Disconnect**.

## Recording Pressure

- Connect the gauge to the pressure line to be monitored and turn it on.
- Press and hold the **UNITS** button on the gauge until it says "Start"—data is now being logged.
- Once the test is complete, press and hold the **UNITS** button again until it says "Stop".



The gauge displays the current state, then the number of bytes available, and then the new state.

## Downloading



- 1 Reconnect the gauge to the serial cable and run DataloggerXP.
- 2 Click the **Connect** button to connect to the gauge.
- 3 Click **Download** to retrieve the data from the gauge.
- 4 Click **View** or **Save** to view or save the data, respectively.

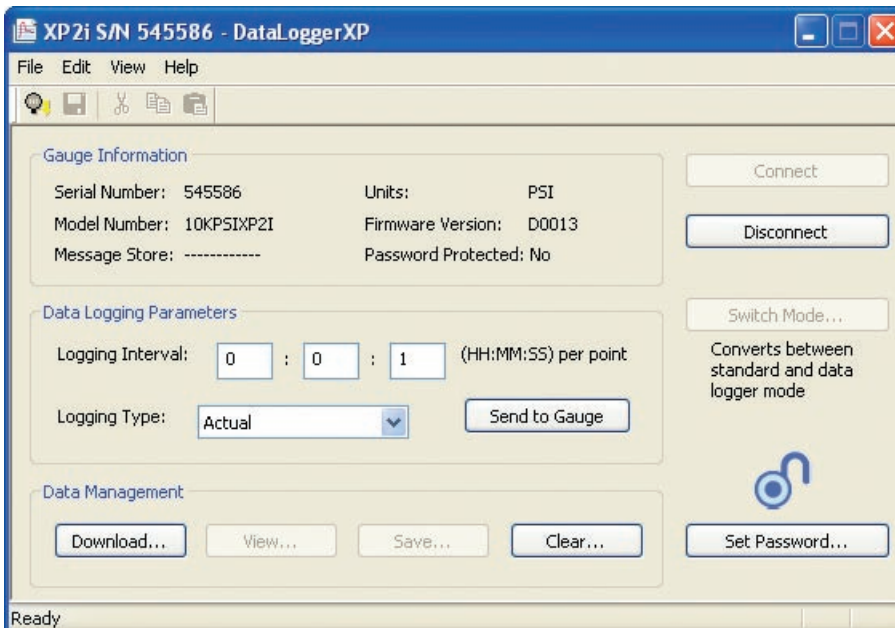
## Operation

Detailed operating instructions on the operation of the software and gauge can be found below.

## DataLoggerXP Software Operation

As described in the prior section, the DataLoggerXP application provides complete control of the XP2i digital test gauge. Logging parameters, downloading, and saving to disk are all done using the application. In this section, you will find a description of each of the functional areas of the application. For a guide to operation of the gauge itself, see "XP2i Datalogger Gauge Operation".

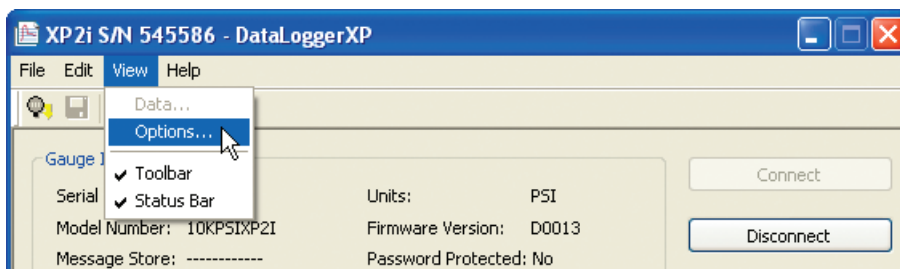
## The Main Window



The DataLoggerXP main window provides most of the functions of the application. From this window, connecting to a gauge, changing data collection parameters, downloading and viewing data, clearing data and switching operating modes can all be performed. The paragraphs below offer additional information on each of these features.

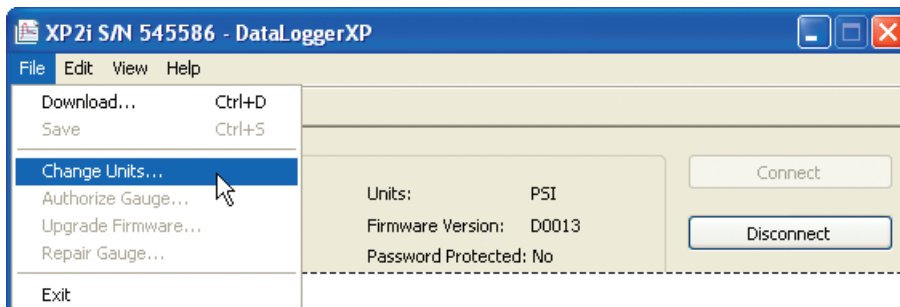
### ► Setting the Options

By default, DataLoggerXP is configured for automatic serial port detection. However, in some cases automatic serial port detection may not work or cause undesirable results. To select a specific serial port, open the Options dialog box, by choosing **View > Options**. Select the serial port, which is typically 1, and press **OK** to save any changes. If your installation supports additional languages, you can choose the language from the **Select Language** drop-down list. The settings for Excel templates are covered in “Excel Templates”, on page 15.

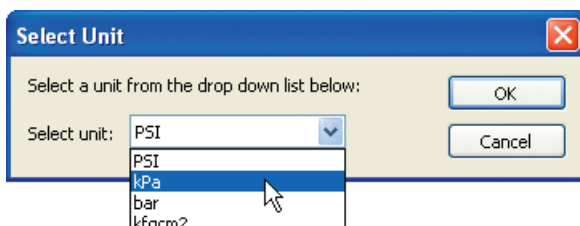


### ► Setting the Default Unit

When in data logger mode, the gauge always measures pressure in the default engineering unit of the gauge, such as PSI or kPa. Measuring in a different unit requires changing the default unit, which can be done by selecting the **File > Change Units** menu option. Ensure the gauge is in data logger mode prior to selecting this option, as the changing the default unit cannot be done while in standard mode.



The Select Units dialog will display a drop down list of the available units. Simply select the desired unit and click **OK**.



## ► Changing Modes

Changing modes on the XP2i is accomplished by clicking the **Switch Mode** button. The software will then proceed to make the appropriate mode change.

When converting to data logger mode, the gauge must be upgraded to operate as a data logger. The software will automatically detect whether or not the gauge is authorized. If it is not, and you have received an authorization key from your distributor or Crystal Engineering, the software will guide you through the process of upgrading your gauge. See “Authorizing a Gauge”, on page 11. If you do not have a authorization key, you can choose to use the gauge in an evaluation mode, but the gauge will be limited to taking 100 points before the evaluation expires and authorization is required.

If an error occurs during the programming process, and the gauge is left in a mode where the display is continuously flashing, use the **File > Repair Gauge** menu option to fix this problem.

When changing modes, the firmware of the gauge is changed. So, when a new version of firmware is released, the DataLoggerXP software should also be upgraded.

**Note:** DataLoggerXP will not work with a gauge if its firmware is newer than what is supported by the installed version of DataLoggerXP. See “Installing the Software” on page 3 for instructions on checking the version and upgrading the DataLoggerXP software.

## ► Connecting to the Gauge

Connecting to the gauge is very straightforward: once the correct serial port has been set in the Options dialog box (see section “Setting the Options”, above), simply plug the serial cable into the computer and XP2i gauge ports and click **Connect**. If the gauge is already in data logger mode, the program will retrieve the current logging parameters, and then allow downloading, viewing, and saving data, as well as updating the logging parameters.

## ► Password Protection

The password protection feature of the gauge allows you to prevent unauthorized changes to the data logging parameters. Once the password is set, the **Send to Gauge** and **Switch Mode** buttons will require the password, and changing logging parameters through the keypad will be disabled. Passwords can only be set or removed using DataLoggerXP or ConfigXP. In the event you lose the password, you will need to contact the factory for an unlock code, which will remove the password protection.



## ► Data Logging Parameters

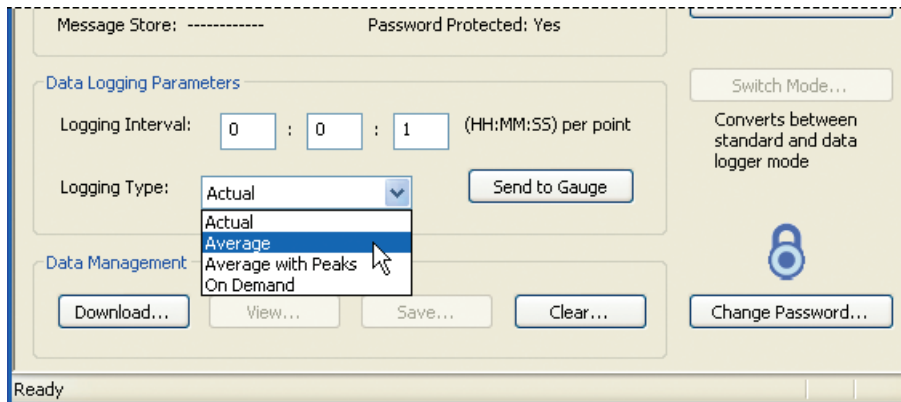
The two parameters that affect data logging (logging interval and logging type) are covered below.

### LOGGING INTERVAL

The logging interval controls how frequently the gauge takes a measurement. A logging interval can be as short as one second or as long as eighteen hours.

### LOGGING TYPE

There are four logging types in which the gauge is capable of operating:



- **Actual:** The gauge stores the value displayed on the gauge at each logging interval. No averaging is performed.
- **Average:** The gauge stores the average of all readings taken during the entire logging interval.
- **Average with Peaks:** Similar to Average, except the highest and lowest value throughout the logging interval is recorded along with the average value.
- **On Demand:** This mode differs from the other three, in that the logging interval does not apply. Instead, data is stored whenever the PEAK button on the XP2i is pressed. Each time the PEAK button is pressed, the displayed value is stored with a timestamp of when it was pressed.

### MAXIMUM NUMBER OF READINGS

The number of readings that can be stored on the XP2i is dependent on three factors: free memory, the logging type, and pressure dynamics.

Free memory can be determined by simply holding down the **UNITS** button until the available memory is displayed. Note that if the gauge contains any data, the free memory will be lower than the valued displayed on a cleared gauge.



Each logging type has a different storage requirement. The chart below provides the memory consumed per data point for each logging type:

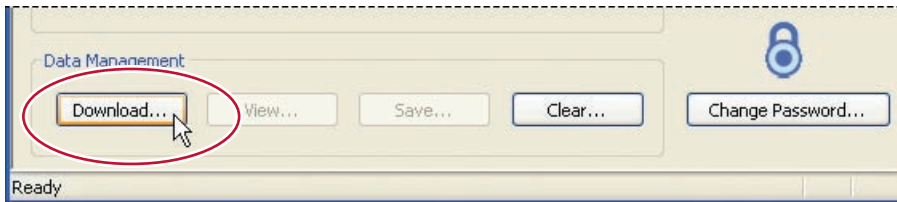
LOGGING TYPE	BYTES PER DATA POINT
ACTUAL OR AVERAGE	3
AVERAGE WITH PEAKS	9
ON DEMAND	7

The third factor, the pressure dynamic, can significantly impact the maximum number of readings recorded. The gauge employs a data compression mechanism to store a greater number of data points. The mechanism compares the current data point with the prior data point and only stores the difference between the two. This difference in pressure between the current and prior reading is the pressure dynamic. When the pressure dynamic is small, the difference is small, and less space is required to store the reading. Depending on the pressure dynamic of the input pressure, the gauge may only require 60% to 75% of the memory as compared to the requirements listed above for the same number of readings, allowing the remaining memory to be used for additional readings. However, the memory savings is application dependent, and should be tested in the actual application before assuming any increase in the maximum number of readings.

### ► Data Management

#### DOWNLOADING

To download data from the gauge, simply click the **Download** button after connecting to the gauge. Depending on the number of readings, it can take up to 15 seconds to download all the data. Once the data has been downloaded, the **View** and **Save** buttons will be available.



#### VIEWING

Clicking on the **View** button from the Main Window will bring up the View dialog box. In this dialog box, you can choose to select the data to display, as well as include or exclude events from the display. Events are non-data readings, such as tare values, low battery indications, or logging parameters. To save data from this window, simply click the **Save** button to open the Save dialog box.

## SAVING

Saving data can be accomplished from two places: clicking the **Save** button either directly from the main window or from the View dialog box. In either case, the application will first ask for the name of the file to save, and then which run data to save.

A file can be saved as either an Excel workbook or comma separated text file (".txt" or ".csv") format. To save a file in Excel format, select either an Excel template file (ending in ".xlt"), or an Excel workbook file (ending in ".xls") in the "Save as type:" dropdown box. If you use the Excel template (".xlt") a new Excel document will be created using that template. If you choose the Excel worksheet (".xls"), you must have already selected the default Excel template in the Options dialog box. The Excel file will be created and saved using this default template. For more information on Excel templates see page 15.

If the file name does not include a ".xlt" or ".xls" extension, the data will be saved as a comma separate text file (ending either ".txt" or ".csv") of that name.

## CLEARING

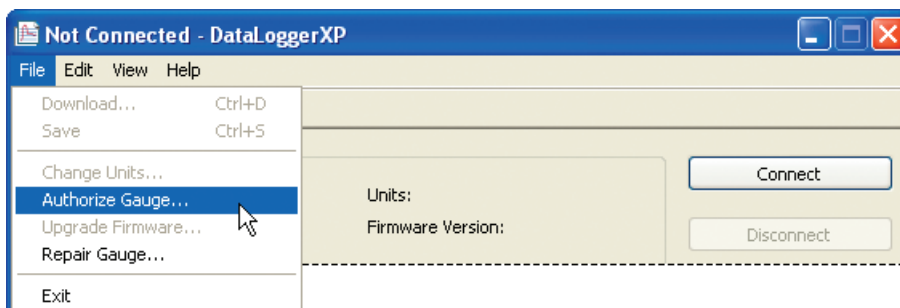
Pressing the **Clear** button erases all runs from the gauge, making all memory available for the next sequence of runs.

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## Authorizing a Gauge

Existing XP2i Digital Test Gauges that do not have the data logger option can be upgraded for data logger operation. The gauge can be authorized using a key provided by the local distributor or Crystal Engineering. The key is a small file that can be emailed or provided on CD and copied to a computer. The key is specific to a gauge's serial number, so the key can only be used with the gauge it was meant to authorize.

To authorize a gauge, connect the gauge to your computer, then select **File > Authorize Gauge** from the main menu. This starts the Authorization Wizard—follow the on screen instructions.



## XP2i DataLogger Gauge Operation

When in data logging mode, XP2i provides data logging capability along with the many of the features of a standard XP2i. In order to allow operation as a data logger, some of the functionality of the standard XP2i has been removed. However, using DataLoggerXP, it is possible to switch the XP2i's mode as needed.

### Differences Between the XP2i Data Logger and XP2i

Other than the data logging functionality itself, the changes in gauge behavior while in data logger mode is listed below:

- Units (PSI, kPA, etc.) are set to the gauge's default unit and cannot be changed\*.
- The **UNITS** button is used to start and stop runs
- The **PEAK** button is used to store data when in **on demand** logging type
- The standard mode serial commands are not supported
- The backlight will not automatically turn off
- "No Auto Off" mode does not apply – once the gauge is turned on, it remains on until the **ON** button is pressed to turn it off.
- Userspan and H<sub>2</sub>O reference cannot be changed.
- The unit never fully turns off, affecting storage life – see section 2.5 below for more details.

**\* Note:** The default unit can be changed by selecting Change Units... under the File menu, but this can only be done when the gauge is in data logger mode.

### Logging Parameters

When viewing the logging interval on the gauge, it will always be presented in seconds. Logging type is indicated by a digit—1 through 4 correspond to actual, average, average with peaks, and on demand types, respectively. These settings can be adjusted directly on the gauge, allowing changes in logging configurations without the need of the computer.

### Unit Operation

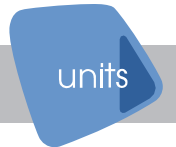
The following buttons and button combinations are used to control the XP2i. Where two keys are indicated, the operation is executed by pressing and holding down the first key indicated then pressing and holding down the second key until the action is completed.









**UNITS + ON:** Used only when the gauge is turned off, this causes the XP2i to enter logging type and logging interval selection mode.

The **PEAK** key will cycle through the types, where “Lt 1” is Actual, “Lt 2” is Average, “Lt 3” is Average with peaks, and “Lt 4” is on demand. The **UNITS** key accepts the format and the display advances to the logging interval, displayed in seconds.

The **PEAK** key decrements and the **ZERO** key increments the logging interval. The **UNITS** key accepts the logging interval and the display reverts to normal. Note that when in on demand logging type, the logging interval will not be displayed.



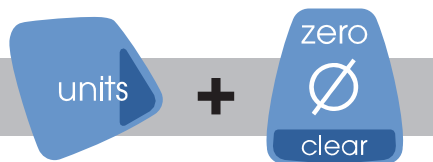
**UNITS:** Pressing and holding this button causes the XP2i to display information about the logging state, and to start or stop logging. Immediately after pressing the **UNITS** button, the gauge will display the operating mode as one of these values:

-  The logging memory is clear, data is empty, and the XP2i is idle.
-  The XP2i is logging data.
-  The XP2i is logging in on demand logging type.
-  The XP2i is not logging data but there is room for more data.
-  The XP2i is not logging data and memory is full.
-  Authorization is required before additional logging is allowed.

If you continue to hold the **UNITS** button, the number of bytes remaining in logging memory is displayed.

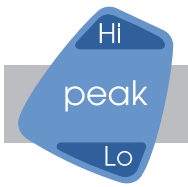
Holding the **UNITS** button even longer will then cause the operating state to change as follows:

- If the gauge is in a CLR or OFF state, the gauge will briefly display START, begin logging data, and change its state to ON.
- If the gauge is in an ON state, it will stop logging, briefly display STOP, and change its state to OFF.
- The FULL state will not change by holding the **UNITS** button. In order to get out of the FULL state, you must clear the logging memory as shown below.



**UNITS + ZERO:** Holding these two keys will clear the logging memory of the XP2i. If the gauge is in logging type (ON), you must first stop logging as described above. When these buttons are pressed, the gauge will first display its current

state (OFF, CLR, etc), then the number of bytes remaining, and then CLR, indicating the clear action was successful. Once cleared, the XP2i will be in the CLR state.



**PEAK:** When in data format 4, a reading is stored each time the **PEAK** key is pressed. When in this mode there is no need to press and hold **UNITS** to begin logging, although it is permissible to do so. If the unit has not already entered data logging type, “Start” is briefly displayed. The **PEAK** key has no function except as described above.

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## Operating Behavior

Each time a data point is stored, the peak HI and LOW icons will blink, giving you visual feedback as data points are recorded. While logging is active, the unit icon will blink. The blink rate indicates the logging type the unit is in. When the gauge is in on demand logging type, the units icon will blink on and off equally (i.e., on for the same amount of time as it is off). In all other modes, the gauge blinks at a 3:1 on/off rate (i.e., on for three times as long as it is off). Note that when the units of the gauge are user defined, no units icon will be lit at any time.

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## On/Off Control

While in data logger mode, the gauge never actually turns off (even if the display is blank). This is to maintain the accuracy of the real-time clock inside the unit. As a result, the operational life of the unit is affected accordingly. When the unit is off, or displaying “**d oFF**”, it still draws about one-half the power as it does in full operation. This means that a gauge in data logger mode displaying “**d oFF**” will continue to draw down the batteries to a BATT condition, though half as fast as if the gauge were left on continuously—approximately 3,000 hours. However, you cannot connect to the gauge if “**d oFF**” is displayed – you must turn on the gauge to connect.

In addition, during logging in modes 1, 2, or 3, the ON/OFF key is disabled. If the ON/OFF key is pressed, ON is displayed and the XP2i remains on. In logging type 4 (on demand), the ON/OFF key will turn the unit off as described above.

If the unit is not logging, or is logging in on demand logging type, it can be placed in standby mode as described above by pressing the ON/OFF button. If the unit has logged data, the display will show “**d oFF**” to indicate that the gauge is in an off state, but contains data not yet transferred to the computer.

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## XP2i Reset or Battery Change

Data collected by the XP2i will not be lost with a gauge reset or battery change, although any run in progress will be stopped. In addition, a reset or battery change will affect the operation of the gauge’s real-time clock. When the XP2i is connected to DataLoggerXP and the logging parameters are set, DataLoggerXP also sets the gauge’s real-time clock. However, if the gauge resets, or if the batteries are changed or become momentarily disconnected (if the gauge is dropped to the floor, for instance), the real-time clock can be reset. When this occurs, the time stamps of subsequently logged data will no longer be correct. DataLoggerXP reacts to this by attempting to resynchronize

the gauge's clock with the computer's clock which will allow the time stamps to be correctly read. However, if multiple resets have occurred with the gauge, only time stamps after the last reset will be fixed. When a reset occurs, it is stored as a run with a reset event and no data.

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## Excel Templates

In order to provide for a flexible reporting solution, DataLoggerXP is capable of directly interfacing with Microsoft® Excel to paste run data for reporting and graphing. DataLoggerXP supports Excel 95 through Excel 2003. This section assumes some familiarity with Excel.

**Note:** For information on how to save data to the different file types see "Saving", on pg 11.

DataLoggerXP works with two Excel file types: workbook (.xls) files and template (.xlt) files. The key difference is when using a template file, the template is loaded and data is copied to a specific location, whereas a workbook file is a new document with only the run data.

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## Workbooks

When using workbook files, Excel is started and a new workbook is created with the default worksheets. Data is then copied into the first worksheet at cell location A1. The file is then saved using the filename provided by the user. If the file already exists, it will be overwritten with the new workbook file. Any formatting or reporting is then done by the user after the document is created.

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## Templates

As opposed to workbooks, templates use an existing Excel template file to create the new workbook. This allows any amount of formatting or graphing to be done beforehand and stored as a template file. Then, when the Excel workbook is created, the template file is opened and data is copied to the location specified in the Options Dialog. When selecting the template file directly during the file save process, the new workbook is created with the Excel template using the name of the template file followed by a number, typically 1. The user must also save the file manually, making any changes to the file name as necessary. However, it is possible to save directly to the user provided file name, see section 3.2.2 below for more information.

As an example on how to use templates, a sample template file, DataLoggerXP.xlt, is located in the DataLoggerXP program directory, and can be used as-is or modified to meet the user's requirements.

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## Excel Password Protection

It is possible to password protect the Excel workbook by selecting the Password Protect Excel Documents checkbox in the Options dialog. Only the data sheet and first sheet of the workbook will be password protected. To protect other sheets, password protect them in the template itself.

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## Data

Data is copied to the location specified in the Options Dialog. The user must provide the sheet, row, and column reference. If the reference is invalid, the data will be copied to the default active cell when the template is opened (usually column A of row 1 in the first worksheet in the Excel workbook). When the data is copied, it will overwrite any existing cell contents, but cell formatting will not be modified.

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## Default Template File

It is possible to configure DataLoggerXP to always use a specific template file when saving data in Excel workbook format. By checking the **Use Excel template by default** checkbox in the Options Dialog and selecting the Excel template file to use, when saving data, the system will automatically open this template file to create the workbook. The **Use Excel template by default** option also changes the default save type from a Comma Separated Text File to an Excel Workbook.

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## Service and Support

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### Troubleshooting

This section provides possible solutions to common problems encountered when working with DataLoggerXP and the XP2i in data logging mode. For additional troubleshooting support, please see the troubleshooting section in the XP2i operation manual.

**Problem:** Gauge display is constantly flashing

**Solution:** This condition indicates the gauge's onboard program is corrupted. This is typically caused by a failure during a mode switch, and be recovered by using the **File/Repair Gauge...** menu option. If this process fails, contact customer service for support.

**Problem:** The XP2i will not connect with DataloggerXP

**Solution:** Make sure the gauge is on (and not displaying "d off").

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