Introduction

ICUMeter.OCX
Integrated Control Units - Meter
Version 2.1

ICUMeters are designed to mimic the digital meters typically used in industrial control applications.   A value fed into the meter's input is passed through a scaling function and then is displayed on the digital readout with appropriate units.   The displayed value is then passed through another scaling function to the output property where it may be used for feedback and control.   This is where ICUMeters leave normal meters behind by including all of the other common features that users would need in most control applications.   Below is a list of features:

    · **Input and Output Scaling Functions**
    · **User Selectable Units**
    · **Ascending or Descending Limits**
    · **Configurable Lower, Caution, Warning, and Upper Limits**
    · **Limit Triggered Normal, Caution, and Warning Lights**
    · **Limit Triggered Alarm Sounds**
    · **Limit Triggered Messages/Prompts**
    · **The Ability to run other Applications, Display Bitmaps, etc. at Limits**
    · **Automatic Logging of System, User, and Limit Events**
    · **Filtering of Displayed Event Log**
    · **Automatic Logging of the Displayed Data Value at Selected Intervals**
    · **Multiple Graph Types for Logged Data Values**
    · **Ability to Print Logs and Data Graphs**
    · **Hold Button for Displayed and Output Values**
    · **Selectable Scan Rates**
    · **Selectable Display Colors**
    · **Password Protection to Prevent Unwanted End User Changes**

  ICUMeters excel in applications where you need a complete data acquisition system with limited feedback for control.   Most control applications today require alarming, logging, and other features that may take hours or days to program separately.   By dropping this one integrated control onto your form, you instantly have a complete data acquisition system.   You can use the limit triggered events to warn end users about control conditions (lights and sounds), prompt them with a text message, and even run a utility program or pop up a document, schematic, or video to help them work through the condition.   At the end of the day, supervisors can print a copy of the Event Log and Data Graphs to get a complete understanding of what transpired in their process for that time period.   ICUMeters provide lots of functionality without taking up lots of your development time.

Installation

1. To install the ICUMeter.OCX, simply run SETUP.EXE located on the ICUMeter distribution disks.   If you downloaded the installation file set, you will need to UnZip it to a temporary directory and run SETUP from there.
2. After SETUP is complete, right click on the Visual Basic Toolbox.
3. Left click on Components.
4. Select the check box for ICU_DigitalMeter.
5. Left click on the OK Button.
6. Double left click on the ICU_DigitalMeter icon that is now in your toolbox.

Note: Do Not distribute the ICUMeter license file with your programs.   Registered users may use the ICUMeter.OCX with no run time or royalty fees so long as the license file remains on the registered user's development PC.   Distribution of the ICUMeter license file may subject the distributing developer to registration fees for every instance of improper distribution.

Note: Multiple development system installations from a single registered copy of this software are allowable only if the registered user ensures that no two system containing the ICUMeter.OCX with its license file are used for development at the same time.

Control Features
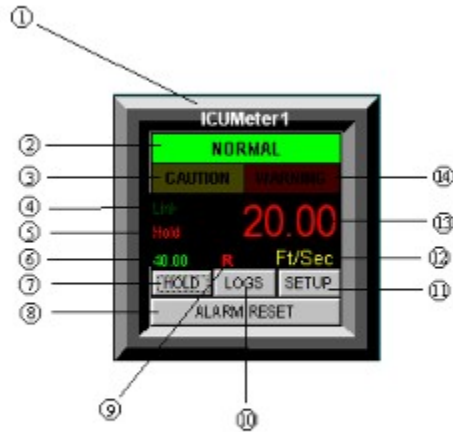
1. Control Name - Used as the Visual Basic control name and for end user identification.
2. Normal Indicator Light - Illuminated when Displayed Value is between Lower and Caution Limits. Flashes when the Displayed Value has gone below the Lower Limit.
3. Caution Indicator Light - Illuminated when Displayed Value is between Caution and Warning Limits.
4. Communications Link Light - Not Used in this version.
5. Output Value - Displays the Output Value which is equal to the Displayed Value * Output Multiplier + Output Offset.
6. Hold Light - Illuminated when User selects the HOLD Button to freeze Display Value.
7. HOLD Button - Alternately holds and releases the Displayed and Output Values.
8. ALARM RESET Button - Resets/Silences Alarm sounds.
9. Recording Indicator - Illuminates when Data Value recording is in effect.
10. LOGS Button - Displays the Event Log /Data Graph Form for Viewing and Printing.
11. CONFIG Button - Displays the Password form and then the Config Form to allow for control configuration changes.
12. Units Display - Displays the User set Units. Ex. FT, FPM, Gal, Lb., MB, etc.
13. Displayed Value - Displays the Displayed Value which is equal to the Input Value * Input Multiplier + Input Offset.
14. Warning Indicator Light - Illuminated when Displayed Value is between Warning and Upper Limits. Flashes when Displayed Value has exceeded the Upper Limit.
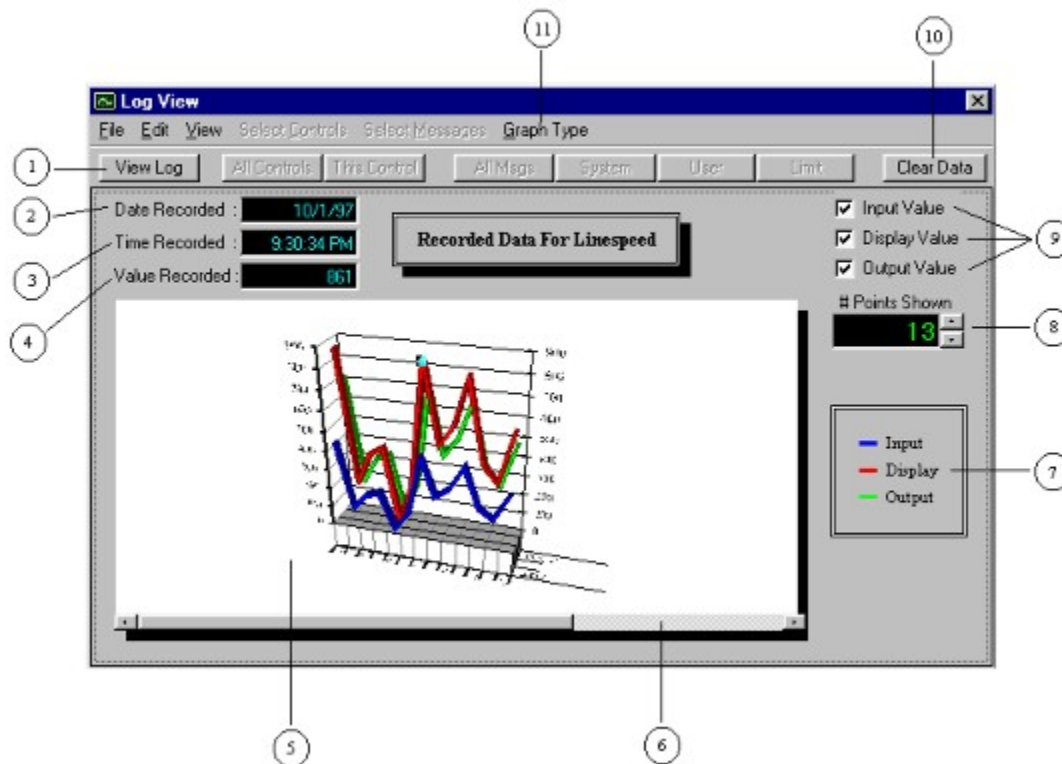
Log Features (Event Log View Mode)
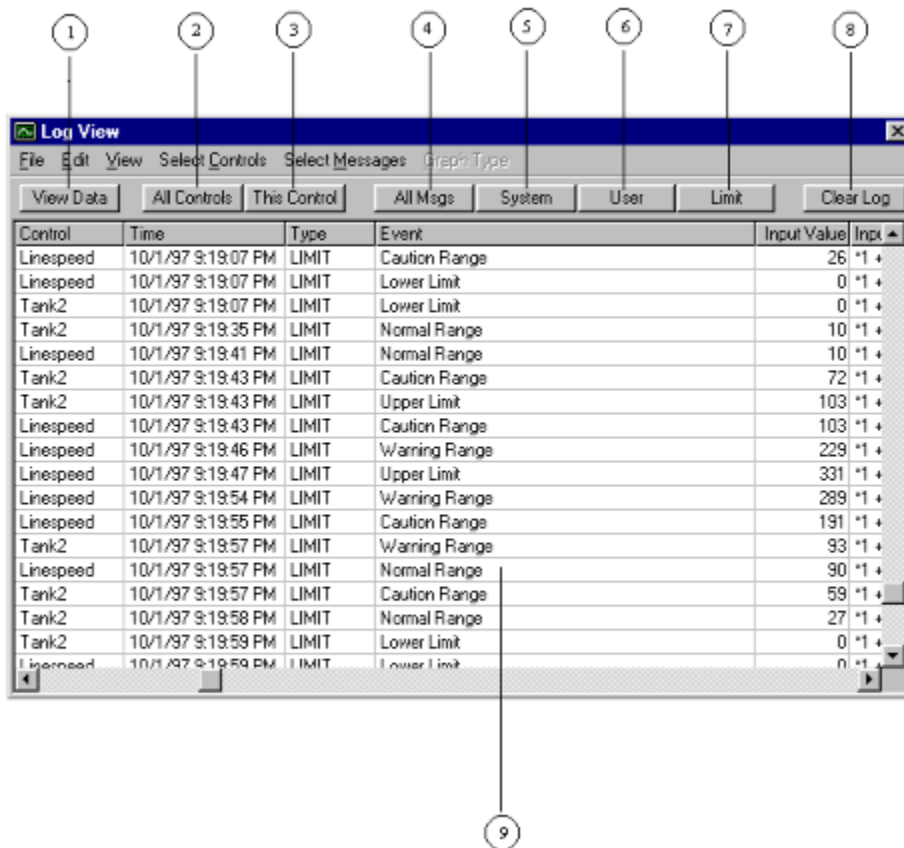
1. View Data/View Log Button - Toggles between Log View and Data Graph View.   Button Caption changes with view mode change.
2. All Controls Button - Selects messages for all controls to be displayed.
3. This Control Button - Selects messages for only the current control displayed.
4. All Msgs Button - Selects messages for all Events to be displayed.
5. System Button - Selects messages for System Events only to be displayed.
6. User Button - Selects messages for User Events only to be displayed.
7. Limit Button - Selects messages for Limit Events only to be displayed.
8. Clear Log/Clear Data Button - Clears the appropriate data from either the Log grid or the Data graph depending on which is being viewed.   Button Caption changes with view mode change.
9. Log Grid/Data Graph viewing area - (For Log view mode shown above) Displays the event data that was recorded.   The fields in the Log from left to right are as follows:

· Num - Sequencing number for the event.   (Used for sorting only)
· Control - Shows which control hosted the event.
· Time - Date and Time the event transpired.
· Type - Shows the type of event that occurred… System, User, or Limit.
· Event - Provides a text description of the event (such as which limit was reached or an alarm reset).
· Input Value - Shows the Input Value of the control at the time of the event.
· Input Function - Shows the Input Function at the time of the event.
· Display Value - Shows the Displayed Value of the control at the time of the event.

· Output Function - Shows the Output Function of the control at the time of the event.
· Output Value - Shows the Output Value of the control at the time of the event.
· Hold Status - Shows if the control was in display hold at the time of the event.
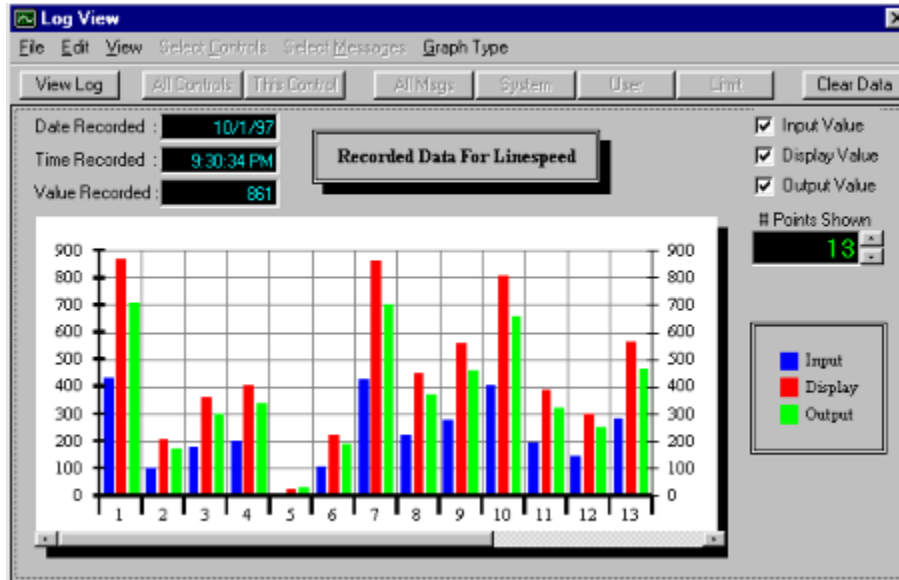
Log Features (Data View Mode)

1. View Log/View Data Button - Toggles between Log View and Data Graph View.   Button Caption changes with view mode change.

2. Data Recorded - Displays the Date the Data Point was recorded.   The user must select a specific Data Point by clicking on the Lines/Bars on the graph.   This Indicator is hidden when no data point is selected.

3. Time Recorded - Displays the Time the Data Point was recorded.   The user must select a specific Data Point by clicking on the Lines/Bars on the graph.   This Indicator is hidden when no data point is selected.

4. Value Recorded - Displays the recorded Value of the Data Point.   The user must select a specific Data Point by clicking on the Lines/Bars on the graph.   This Indicator is hidden when no data point is selected.

5. Data Graph/Log Grid viewing area - (For Data view mode shown above) Displays the Graph of the recorded data using the graph type selected with item 11 below.

6. Data Graph Scroll Bar - Allows for scrolling of the complete data graph if less than the total number of recorded points is selected with item 8 below.

7. Legend - Used to distinguish each data set from another.   Possible data sets are Input, Display, and Output (For the 2Dline graph, Lower, Caution, Warning, and Upper Limit Lines will also display).

8. Number of Points Shown Selector - Used to limit the number of data points that are displayed on the graph at a time.   This is useful to narrow down to specific data of interest or when hundreds of recorded data points congest the graph.

9. Input, Display, and Output Value Selectors - Used to Enable/Disable the displaying of one or more of the data sets.

10. Clear Data/Clear Log Button - Clears the appropriate data from either the Log grid or the Data graph depending on which is being viewed.   Button Caption changes with view mode change.

11. Graph Type Menu - Allows selection of   several graph types for display of the data.   The possible selections are 2DArea, 3DArea, 2DBar, 3DBar, 2DCombination, 3DCombination, 2DLine (includes Limit
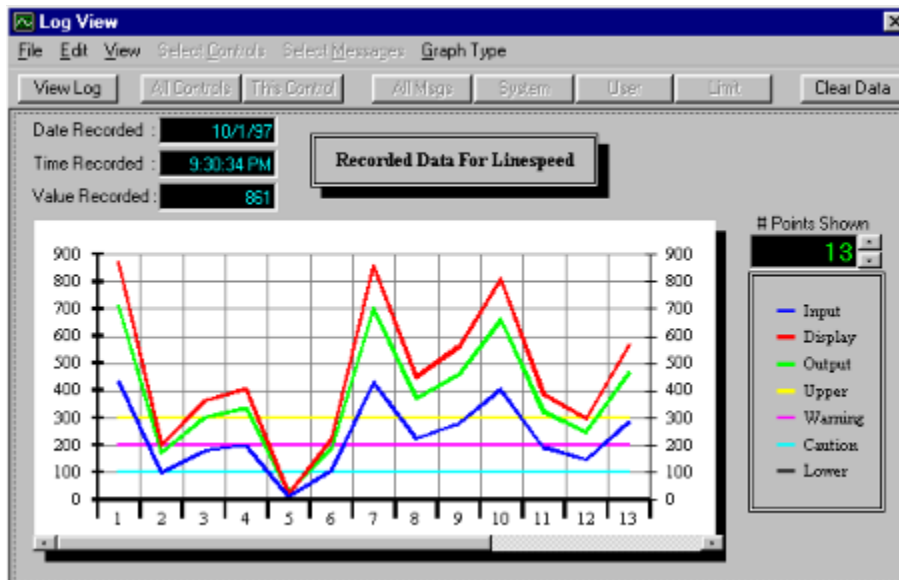
Lines), 3DLine, 2DStep, and 3DStep.

Some of the possible Data Graph Types are displayed below.

2DBar

2DLine

3DBar

NOTE: Holding the Control Key and left clicking on the white portion of a 3D graph will allow Users to rotate the graph around its axis for better viewing.

Config Features

Each ICUMeter's properties may be set by the programmer at design time or run time. This will allow for initial setup and periodic adjustments of the system but does little to allow end users or supervisors to take ownership of the system by customizing it to suit their needs. Traditionally, users would have to request changes from the programmer that would require many hours of reprogramming to fully customize an application. Many times this involved a great deal of trial and error and a lot of frustration on both sides. To help combat this problem, ICUMeters have a complete set of configuration screens located on the Config form that may be viewed at run time by clicking on the CONFIG button. These screens contain most, if not all, of the settings that end users will want to adjust to fit their particular installation. The best part of this is that no reprogramming will be required and supervisors can password protect this form if they wish to reserve setting changes for management and development personnel.

    To go to the Config Form, click on the CONFIG button on the control's face. You will be prompted for your password before proceeding to the CONFIG form.
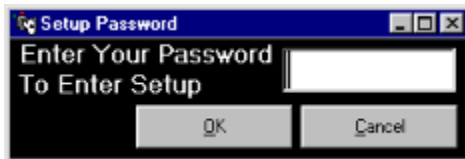

Note: The default password is "password".

Simply type your password into the box provided and click OK. The Config form will be displayed. The following pages cover each tab screen on the Config form.

Limits Tab

The Limits tab is the most important of all of the Config tabs.   This is where you either enable or disable each of the four available limits.   By unchecking and disabling any limit, you effectively prevent any light, sound, message, etc. alarm event from being processed for this alarm.   Select only the limits that you wish to process and then set the other properties such as sound, prompt, etc.
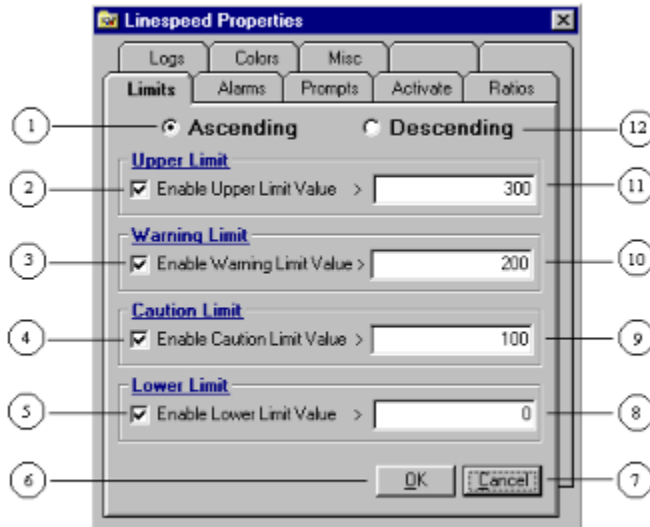
1. Ascending Limits Selector - Selects ascending alarm limits.   The limit value for the Lower Limit will be numerically less than the value for the Caution Limit which will be lower that the Warning Limit etc. The Warning Limit and Caution Limit frames will change places to indicate your selection of either ascending or descending limits.
2. Enable Upper Limit Checkbox - Turns Upper Limit processing on if checked.
3. Enable Warning Limit Checkbox - Turns Warning Limit processing on if checked.
4. Enable Caution Limit Checkbox - Turns Caution Limit processing on if checked.
5. Enable Lower Limit Checkbox - Turns Lower Limit processing on if checked.
6. OK Button - Accepts changes and exits the Config form.
7. Cancel Button - Rejects changes and exits the Config form.
8. Lower Limit Value - Changes and displays the value of the Lower Limit.
9. Caution Limit Value - Changes and displays the value of the Caution Limit.
10. Warning Limit Value - Changes and displays the value of the Warning Limit.
11. Upper Limit Value - Changes and displays the value of the Upper Limit.
12. Descending Limits Selector - Selects descending alarm limits.   The limit value for the Lower Limit will be numerically less than the value for the Warning Limit which will be lower that the Caution Limit etc.   The Warning Limit and Caution Limit frames will change places to indicate your selection of either ascending or descending limits.

Alarms Tab

The Alarms Tab is designed to allow users to quickly enable/disable limit alarm lights and sounds.   The individual limit must be checked/enabled on the Limits tab before these events will be processed.   The lights are designed to notify users of conditions in noisy environments or where sounds from many meters begin to become confusing.   The sounds are included mainly for quiet environments in applications with fewer meters where the sounds won't be annoying.


1. Alarm Light Checkbox - Enables/disables the associated alarm light for this limit.
2. Alarm Sound Checkbox - Enables/disables alarm sounds for this limit.
3. OK Button - Accepts changes and exits Config form.
4. Cancel Button - Rejects changes and exits form.
5. Sound Selection Box - Displays selected sound for this event.   Click on the down arrow to select from the list.

Prompts Tab & Message Display

The Prompts tab allows users to enable/disable and enter text for the message prompts for each of the enabled limit events. The individual limit must be checked/enabled on the Limits tab before these events will be processed.   Each enabled limit prompt will cause a flashing message box to be displayed in the center top of the screen with each occurrence of the limit.   This is designed to give brief but important messages to the operator to inform them of alarm conditions.   This can also be used to tell operators what to do in these instances.


1. Control/Meter Limit Message - Tells operators which meter has alarmed and which limit was reached or exceeded.
2. Message Prompt - Displays the message entered in the Config Tab shown below.
3. Acknowledge Button - Should be pressed by the operator to acknowledge receipt of the message. The message form will close and a user acknowledgement event will be logged if logging of user events is selected.
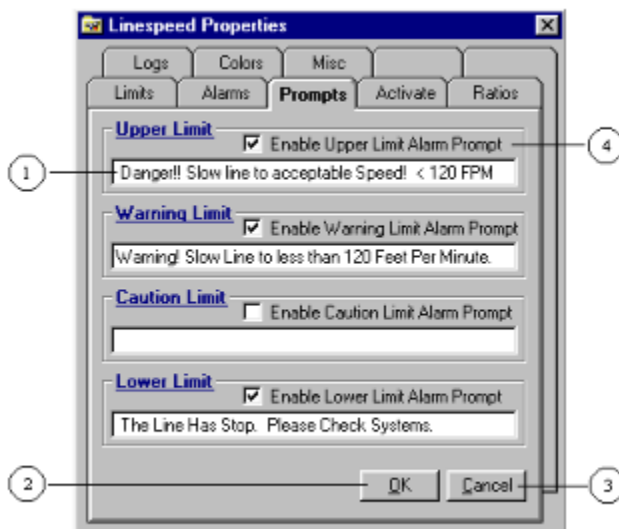
1. Message Prompt Entry Box - Accepts and displays the message to be displayed for this limit.
2. OK Button - Accepts changes and exits the Config form.
3. Cancel Button - Rejects changes and exits the Config form.
4. Limit Alarm Prompt Checkbox - Enables/disables alarm message prompts for this limit.

Activate Tab & Browse Form

The Activate tab is designed to allow users to enable/disable and select program, bitmap, wave file, etc. activation for the enabled limits. The individual limit must be checked/enabled on the Limits tab before these events will be processed.
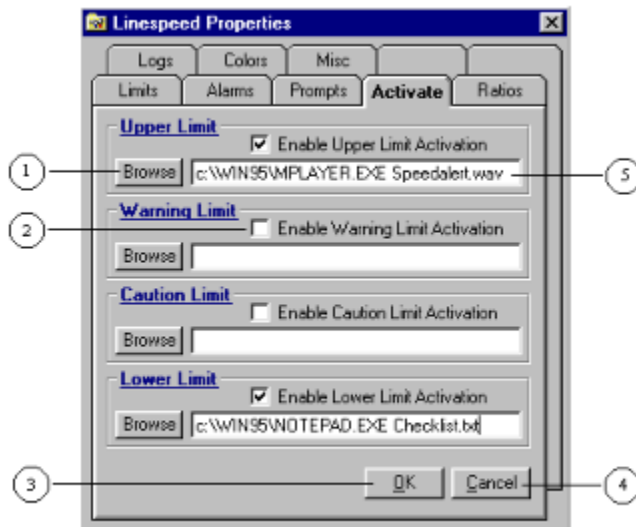
1. Browse Button - Calls up the Browse form shown below.   This allows users to browse through their directories to find the desired applications to activate.
2. Activation Checkbox - Enables/disables activation for this limit.
3. OK Button - Accepts changes and exits the Config form.
4. Cancel Button - Rejects Changes and exits the Config form.
5. Activation String Entry Box - Accepts and displays the string that will be activated when this limit is reached.   This string can contain only the path and file name for an executable program or may also include the file path and name to be opened by the application.   In the upper limit example shown above, the wave file "Speedalert.wav" will be opened and played by Mplayer.exe in the C:\Win95 directory whenever the upper limit is reached or exceeded.   In the lower limit example above, the text file "Checklist.txt" will be opened by Notepad when the lower limit is reached or exceeded.

Browse Form

The Browse form allows users to browse through their directories to find the desired applications to activate.   For files such as bitmaps, waves, AVIs, text files, etc., browse to the host application and then type in the path and file name for the file you want opened.
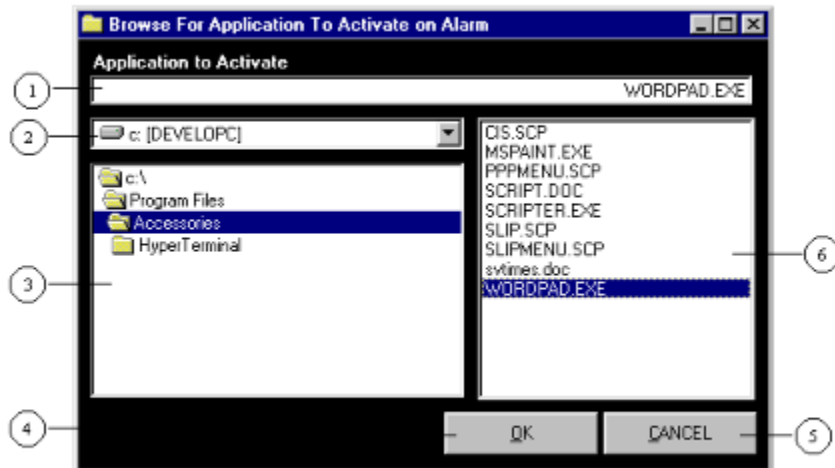
1. Application Name Box - Displays the selected application.

2. Drive Selection Box - Selects and displays the harddrive selected for browsing.

3. Directory Selection Box - Allows browsing to specific directories on the selected harddrive.

4. OK Button - Sends the path and application name back to the appropriate box on the Activate tab and exits the Browse form.

5. Cancel Button - Exits the Browse form without sending a path or application name back to the Activate tab.

6. File Selection Box - Allows users to select a specific application by simply clicking on it.

Ratios Tab

The Ratios tab is designed to allow quick entry of multipliers and offsets that make up the input and output functions.   Simply place the desired numbers into the boxes and observe the change in the function.   The number in the multiplier box will be multiplied by the original input or display value.   The number in the offset box will be added to the original input or display value.   The default is multipliers of one and offsets of zero.   Multipliers less than one but greater than zero serve as dividers.   Offsets less than zero are subtracted from the value.
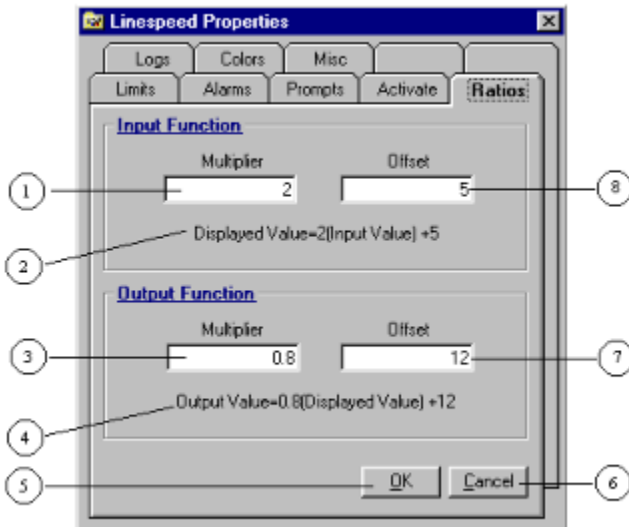
1. Input Multiplier Box - Accepts and displays the multiplier for the input function.
2. Input Function Display - Shows the entire Input function.
3. Output Multiplier Box - Accepts and displays the multiplier for the output function.
4. Output Function Display - Shows the entire output function.
5. OK Button - Accepts changes and exits the Config form.
6. Cancel Button - Rejects changes and exits the Config form.
7. Output Offset Box - Accepts and displays the offset for the output function.
8. Input Offset Box - Accepts and displays the offset for the input function.

Logs Tab

The Logs tab allows quick selection of the events, limits, and values to be recorded in the Event and Data Logs.   Logging of these events will begin anytime the control is enabled and will continue at every selected event until the control is disabled, the form is unloaded, or the individual logging checkbox is unchecked.   Users may then view this recorded data by clicking on the LOGS button on the control's face.
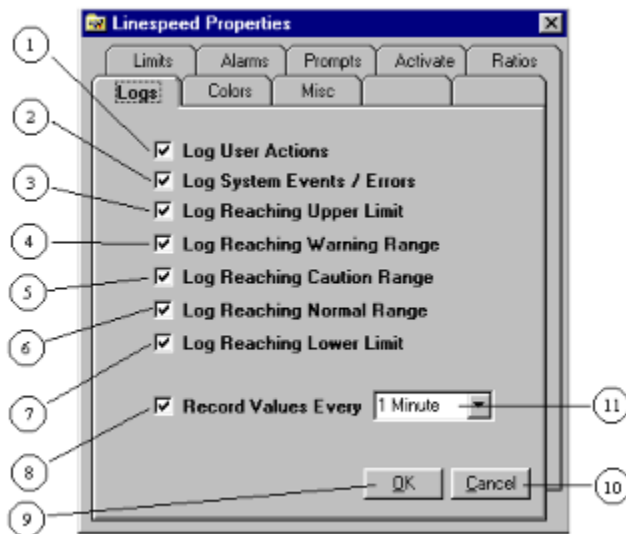
1. Log User Actions Checkbox - Causes user actions such as message acknowledgements, holding, etc. to be recorded in the Event Log.
2. Log System Events/Errors Checkbox - Causes system events such as errors, startup, shutdown, etc. to be recorded in the Event Log.
3. Log Reaching Upper Limit Checkbox - Causes an entry to be recorded in the Event Log whenever the control's displayed value reaches or exceeds the upper limit.
4. Log Reaching Warning Range Checkbox - Causes an entry to be recorded in the Event Log whenever the control's displayed value reaches the warning range.
5. Log Reaching Caution Range Checkbox - Causes an entry to be recorded in the Event Log whenever the control's displayed value reaches the caution range.
6. Log Reaching Normal Range Checkbox - Causes an entry to be recorded in the Event Log whenever the control's displayed value reaches the normal range.
7. Log Reaching Lower Limit Checkbox - Causes an entry to be recorded in the Event Log whenever the control's displayed value reaches or exceeds the lower limit.
8. Record Values Checkbox - Causes the displayed data value to be recorded in the Data Log at every time interval specified in the box to the right.
9. OK Button - Accepts changes and exits the Config form.
10. Cancel Button - Rejects changes and exits the Config form.
11. Data Record Time Interval Box - Selects and displays the time interval for the displayed value data logging if enabled.

Misc. Tab

This tab contains several items that did not belong with other items.
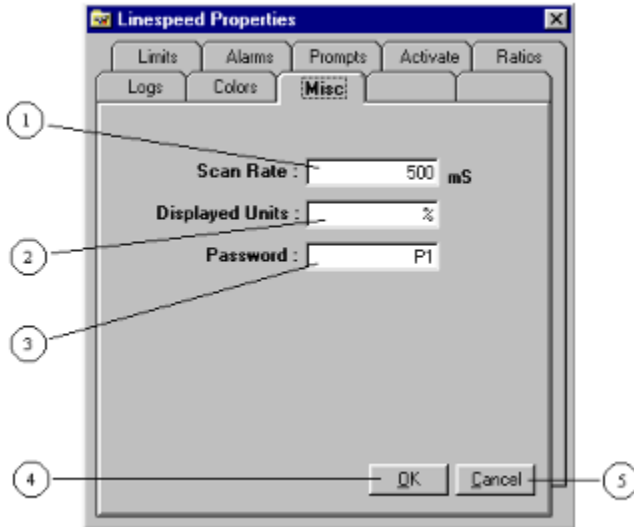
1. Scan Rate Entry Box - Accepts and displays the scan rate value in milliseconds (1000 mS = 1 Sec.). Use longer values for meters that are less critical or whose value changes less often to increase overall system response and performance.
2. Displayed Units Entry Box - Accepts and displays the units for the displayed value.   Examples would be FPM, MPH, lb, in, Gals, etc.   This is for display purposes only and in no way affects the display of function calculations of the displayed or output values.
3. Password Entry Box - Accepts and displays the developer/manager's password.   This is used by programmers and developers to prevent end users from entering the Config page and from clearing the Event and Data logs.   The default password is "Password".
4. OK Button - Accepts changes and exits the Config form.
5. Cancel Button - Rejects changes and exits the Config form.

Properties

Name - Sets or returns the name used in code to identify this object.   The name is used by programmers to identify a specific object and is also displayed at the top of each ICUMeter during runtime for operator identification.   These names should be short but descriptive words relating to the meter's use in the application.

Ascending - Sets or returns the limit direction. A value of True sets ascending limits; while a value of False sets descending limits.

AutoRedraw - Sets or returns the output from a graphic method to a persistent bitmap.

CautionLimit - Sets or returns the Caution Limit Value.   This is the value at which the Displayed Value will cause a caution limit event to occur.

DisplayValue - Sets or returns the main (refer to item 13 on Control Features page) value that is displayed on the meter's face.   This value is normally obtained by multiplying the Input Value by the Input Multiplier and then adding the Input Offset.   This allows for automatic conversion and display from one set of units to another more convenient set of units. For example, you may be taking input from an electronic pulse encoder which sends pulses per revolution and you need to convert to display in feet per minute (FPM).

DragIcon - Sets or returns the icon to be displayed in a drag-drop operation.

DragMode - Sets or returns a value which determines if manual or automatic drag mode is to be used.

Enabled - Sets or returns a value that determines if an object can respond to user generated events.

Height - Sets or returns the height of an object.

HelpContextID - Specifies the default help file context identification for an object.

Index   - Sets or returns the number that identifies an object in a control array.

InputMultiplier - Sets or returns the value that is multiplied by the Input Value to obtain the Display Value.   Use this property along with the Input Offset to define a complete Input Function.

InputOffset - Sets or returns the value that is added to the Input Value to obtain the Display Value.   Use this property along with the Input Multiplier to define a complete Input Function.

InputValue - Sets or returns the Input Value of the object.   This value is the raw value that is fed into the object to be scaled by the Input Function for display as the Display Value.   This property is not needed if no scaling is required before display.

Left - Sets or returns the distance between the internal left edge of an object and the left edge of its container.

LowerLimit - Sets or returns the Lower Limit value of the object.   This is the value at which the Displayed Value will cause a lower limit event to occur.

OutputMultiplier - Sets or returns the value that is multiplied by the Display Value to obtain the Output Value.   Use this property along with the Input Offset to define a complete Output Function.

OutputOffset - Sets or returns the value that is added to the Display Value to obtain the Output Value. Use this property along with the Output Multiplier to define a complete Output Function.

OutputValue - Sets or returns the Output Value for this object.   The Output Value is obtained by multiplying the Display Value by the Output Multiplier and adding the Output Offset.   This is useful when the meter is used for feedback in a control loop.

Password - Sets or returns the Password for this object.   The password is used to protect the application against unwanted changes by unauthorized users.   The password will be required to enter the Config Form or to clear either the Event or Data logs. The default password is "Password".

Scanrate - Sets or returns the Scanrate of the object.   The Scanrate is the time interval, in milliseconds, between object updates.   Example: Setting the Scanrate to 500 will cause the object to be updated every 500 milliseconds (500mS = ½ Second).

TabIndex - Sets or returns the tab order of an object within its parent form.

TabStop - Sets or returns a boolean value that determines if the user can give focus to the object by using the TAB key.

Tag - Stores any extra data needed by the program.

ToolTipText - Sets or returns the text to be displayed when the mouse is paused over this object.

Top - Sets or returns the distance between the internal top edge of an object and the top edge of its container.

Units - Sets or returns the displayed Units for the object.   The Input Function and Units should be used together to display the data in a easy to understand format.

UpperLimit - Sets or returns the Upper Limit value of the object.   This is the value at which the Displayed Value will cause an upper limit event to occur.

Visible - Sets or returns a boolean value that determines if an object is visible or not.   ICUMeter objects that are made invisible are still fully functioning objects.   All updates will be performed unless the object is unloaded or has its Enabled property set to false.

WarningLimit - Sets or return the Warning Limit value of the object.   This is the value at which the Displayed Value will cause a warning limit event to occur.

WhatsThisHelpID - Sets or returns an associated context number for an object.

Width - Sets or returns the width of the object.

Events

Below is a list of events for each ICUMeter object.   Only events specific to ICUMeters are described.

Common Events

Change
Click
DblClick
Drag Drop
Drag Over
Got Focus
Hide
Lost Focus
Mouse Move
Refresh
Resize
Show

ICUMeter Events

Display Change - Occurs when the Display Value changes for any reason.

Hold Off - Occurs when the meter is taken off hold by hitting the Hold button with the meter already in hold.

Hold On - Occurs when the meter is placed in Hold by hitting the Hold button.

Input Change - Occurs when the Input Value changes for any reason.

Output Change - Occurs when the Output Value changes for any reason.

Reach Caution Limit - Occurs when the Display Value reaches the Caution Limit Value.   This event will only occur in a positive going direction for ascending limits or in a negative going direction for descending limits.

Reach Lower Limit - Occurs when the Display Value reaches the Lower Limit Value. This event will always occur in a negative going direction for ascending and descending limits.

Reach Normal Range - Occurs when the Display Value is between the Lower Limit Value and the Caution Limit Value.   This event will occur in both positive and negative going directions.

Reach Upper Limit - Occurs when the Display Value reaches the Upper Limit Value.   This event will always occur in a positive going direction for ascending and descending limits.

Reach Warning Range - Occurs when the Display Value reaches the Warning Limit Value.   This event will only occur in a positive going direction for ascending limits or in a negative going direction for descending limits.

ScanComplete - Occurs at the end of each scan cycle whos time interval is determined by the Scanrate.   This allows programmers to use the Scanrate of   these objects as periodic triggers for other events.