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National Sensor Evaluation (SensorEval) 1.2.0
Software User's Guide

This package includes the SensorEval software and documentation as well as documentation for the evaluation board hardware. The ADCS9888, LM32, LM40, LM41, LM63, LM64, LM71, LM73, LM75, LM85, LM86, LM89, LM89-1, LM90, LM93, LM99, LM99-1, LM95010, LM95071, LM95172, LM95213, LM95214, LM95221, LM95231, LM95233, LM95234, LM95235, LM95241, LM95245, LM96000, LM96063, LM96080, LM96163 and ADC128D818 are supported as noted for the following hardware for Windows 2000/XP/Vista:
1) USB Evaluation Boards (except for the LM93)
2) Intel ICH interface (except for the ADCS9888, LM32, LM40, LM41, LM71, LM95010, and LM95071)
3) "No hardware" mode to run the software without any hardware

To view the documentation, Adobe Acrobat Reader 4.05 or later is required (download it from www.adobe.com if needed).

I. Installation Steps

1) If using the evaluation board, unplug the USB cable from the board

2) Run SensorEval_1.2.0_Setup.exe (depending on the media you have, this may be on the SensorEval CD or in the SensorEval_1.2.0.zip file)

NOTE: If you previously installed an older version of the software (LmxxEval or SensorEval), you will be asked to uninstall it to avoid conflicts. Any log and register files you generated with the older version will be left in the original directory if you wish to access them later.

3) If using the evaluation board, plug the USB cable into the board and wait for the board to install. If you are installing under Windows XP, the New Hardware Wizard will appear; enter "No, not this time" for Windows Update, then "Next", "Continue Anyway" (you should ignore the Windows Logo warning), and "Finish". It is not required to reboot after the installation.

4) Go to Programs->National Semiconductor->National SensorEval (or use the desktop icon National SensorEval) to execute the software. Select the desired device. Under Windows 2000/XP you will be prompted to select either the USB evaluation board or the Intel ICH or no hardware mode. (No hardware mode bypasses the device connection so that the software can be viewed without any device). Select the desired hardware and wait for the software to start. This may take a few seconds the first time the evaluation board is connected. If you wish to change the device or hardware later, select the device again under the Device menu.

NOTE: If you are unable to connect to the USB evaluation board and have previously installed a driver for the board, do the following to uninstall and reinstall the driver. Go to the Windows Control Panel and select System. If you are using Windows 2000/XP select the Hardware tab. Then click on Device Manager and go down to the Universal Serial Bus controllers. With the evaluation board connected, you will see it listed. Right click on it and uninstall the driver. Then unplug and plug in the board again to reinstall the driver.

NOTE: If you accidentally select an invalid device file and encounter a read/write file error, the workaround is to exit the program and edit the lmxxeval.def file in the install directory (typically C:\program files\National Semiconductor\SensorEval) to set device="none". Then restart SensorEval.

5) To view the documentation for the software or hardware, select Help->Manual. If you have the CD, you may also view the documentation there. Datasheets can be viewed at or downloaded from www.national.com.

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II. Description of SensorEval Software

The interface of the software displays the registers of the selected device. The software remembers the last selected device and associated settings and restarts with those values. If the device is not found on startup, the device selection dialog will appear. The hardware selection dialog appears next to allow selection of the desired hardware (USB evaluation board or Intel ICH or No hardware). It is possible to invoke the software more than once, and have different devices displayed at the same time.

Tabs/Buttons/Checkboxes

Upon startup, the register values are read and displayed. To view a particular register, click the tab for the desired range of registers. By default, the *"Write On Change"* checkbox is checked which writes a new register value to the device whenever a display register is updated by the user. Also by default, the *"Read After Write"* checkbox is checked which causes all the registers to be read after any write. Thus the display will always reflect the current register values of the device. Note that the textbox entries are not considered complete until the mouse cursor leaves the box or the enter key is pressed. A special case is the LM63 write-once register 19h, which is not written and read back until another register is written or the *"Write Regs"* button is pressed. Note that the *"Write Regs"* button will be enabled whenever there is an incomplete write operation (for example a partial textbox entry).

If desired, the "*Write on Change"* checkbox may be unchecked. The display then only reflects the state of the device after the registers are read. The *"Write Regs"* button only writes the modified registers. After every write, the current register values are read back only if the *"Read After Write"* checkbox is checked. The state of the "*Write on Change*" and "*Read After Write*" checkboxes is saved upon program exit or selection of another device.

The *"Read Regs"* button reads all the registers. The *"Read Cont"* combo box allows continuous reading of either all registers or only the value registers such as temperature, voltage, and RPM; the continuous read is at the rate selected by the menu item "*File->Set Read Time"* (the default is one second).

The *"Start Log"* button allows selection of a log file where the value registers are logged. The register values are converted to the appropriate units. The button changes to *"Stop Log"* when the log is in progress. At the start of the log, all the register values are listed, followed by the log data each second. The timing of the read of the log data can be modified through the "*File->Set Read Time"* menu item. The log file can be viewed by the menu item "*File->View Log"*. The log file name is saved upon program exit or when another device is selected.

The *"Start Plot"* button plots the value registers selected by the "*File->Select Plot*" menu item. Each plot can show multiple value registers of the same type, such as temperature. The button changes to "*Stop Plot*" while the plotting is in progress. The windows may be resized or closed while the plotting is occurring. The timing of the plotting can be modified through the "*File->Set Read Time"* menu item.

The device address of the part is shown for parts with the I2C or SensorPath interface. The label of the combo box is "*I2C Addr*" for the I2C parts, and "*Device #*" for the SensorPath parts. If multiple addresses are supported by the part, they may be selected through the combo box. The value is saved upon program exit or when another device is selected. The value is blank for other interfaces.

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Register/Bit Field Display

The register display shows bit fields organized by register. Each bit field has the following display data:
1) Adr
This is the address of the bit field in hex. This field is blank when the address of the bit field is the same as the prior bit field.
NOTE: This field is also blank for the LM71, which does not have register addresses.

2) Attr
This shows the attributes of the bit field. R indicates read, W indicates write. Read only bit fields are grayed out but may still be written by user entry. Note that some registers are read only if they are locked out by other register bits. The register display updates to reflect this.

3) Register Bit Field
This is the name of the bit field. A bit field may be from 1 to 8 bits.

4) Register Bits
This shows the bits of the bit field. White bits indicate the bit positions for this bit field. These bits (if not read only) may be clicked to toggle the bit. Black bits indicate unused bits for this bit field. The first bit field of a register shows the bit values of the whole register.
NOTE: The LM71 locks out entry for these bits in the configuration register to prevent erroneous value entries; the combo box must be used to modify the value.

5) Hex
This is the register value in hex. The first bit field of a register contains this textbox where the register value is displayed or entered. When an entry is made, the value is validated when the mouse cursor leaves the box or the enter key is pressed. Valid hex characters (0 to F) must be entered.
NOTE: The LM71 locks out entry for this textbox in the configuration register to prevent erroneous value entries; the combo box must be used to modify the value.

6)Bit Field Value
These controls may optionally appear and allow optional entry/display of the bit field. They provide more detailed information on the particular bit field. There are three possible controls here:
a) Combo box to display/select the particular bit field value
b) Textbox to display/enter in decimal either the whole register or only a selected bit field. A textbox on the first line of a register is typically for the whole register, while textboxes on following lines are for a particular bit field. When an entry is made, the value is validated when the mouse cursor leaves the box or the enter key is pressed. Valid decimal characters (0 to 9) or "-" or "." must be entered.
c) Scroll bar to provide an alternative way to enter the decimal textbox information

Note that the Register Bits/Hex/Bit Field Value fields all update when an entry is made for any of the controls in the three fields.

If you want to save and reload the register values, see the menu items "*Save Regs*" and "*Open Regs*" below.

Menu Items

1)File->Open Reg
This opens a previously saved register data file. The file name is displayed in the File: field below the menu. When you open a file, it is requested if you want to save the current register display values to a file before loading the new data. Note that if the *"Write On Change"* box is checked, the values are automatically written to the device after the file is opened. The file name is saved upon program exit or selection of another device.
NOTE: The file format is not compatible with LmxxEval version 4.07 or older. If you used these versions and saved register files, see the change history for a procedure to upgrade your files.
NOTE: This menu item is not implemented for the LM71 due to the limited registers of the device.

2)File->Save Reg
This saves the register display values to the specified file.
NOTE: This menu item is not implemented for the LM71 due to the limited registers of the device.

3)File->Select Plot
This allows modification of the plot windows shown by "*Start Plot*". The dialog shows one tab for each plot window, along with the selected value registers to plot in that window. The "*Select All*" and "*Select None*" buttons allow selection of all or none of the displayed registers. The "*Disable Plot*" button disables this window from display. The "*Add Plot*" button adds a new plot window of the same type as the current tab; this allows multiple values to be spread over more windows if desired. The "*Delete Plot*" button is disabled until a new plot window is added; then the button may be used to delete the new window. The "*Exit*" button allows the dialog to be closed; a dialog prompts for saving the changes or not. The plot selections are saved upon program exit or selection of another device.
NOTE: This menu item is not implemented for the LM71 due to the limited registers of the device.

4)File->Set Read Time
This sets the number of seconds between value register reads when *"Read Cont"* and/or *"Start Log"* and/or *"Start Plot"* is selected. Tenths of seconds may be entered. A minimum time of 0.1 second and a maximum of 1 second are allowed. This time should be set greater than the conversion time of the device, else duplicate entries may be read. This time is saved upon program exit or selection of another device.
NOTE: For most accurate timing, avoid any window operations while the continuous registers reads are occurring.

5)File->Set Log Limit
This limits the number of data lines captured in a log file. When the limit is reached, the logging will terminate. If the log limit is "none", continuous logging is enabled. This limit is saved upon program exit or selection of another device.

5)File->View Log
This allows a log file generated by "*Start Log*" to be viewed. If the viewed file is currently being updated by logging, the view will lag behind the logging by several lines.

6)File->Exit
This exits the program. If the register display has been modified, it is requested if you want to save the data.

7)Device
This allows selection of a different device. You will be prompted to select either the USB evaluation board or the Intel ICH interface or the no hardware (no connection) mode

8)Help->About
This displays the version number of the program

9)Help->Manual
This allows selection of this manual and the evaluation board manual for this device.

III. Change History

Version 1.2.0 vs. 1.1.0v
1) Add support for ADC128D818

Version 1.1.0v vs. 1.1.0u
1) Add support for LM96080

Version 1.1.0u vs. 1.1.0t
1) Improve support for localization

Version 1.1.0t vs. 1.1.0s
1) Modifications to LM75 device file

Version 1.1.0s vs. 1.1.0r
1) Add support for LM75

Version 1.1.0r vs. 1.1.0q
1) Add support for LM95172

Version 1.1.0q vs. 1.1.0p
1) Add support for LM96000EVAL/NOPB
2) Add support for LM95071EVAL/NOPB

Version 1.1.0p vs. 1.1.0n
1) Add support for LM96163NOPB

Version 1.1.0n vs. 1.1.0m
1) Add support for LM63RoHS and LM64RoHS

Version 1.1.0m vs. 1.1.0d
1) Add support for LM96063 and LM96163.
2) Add support for TCrit signals on the LM95213, LM95214, LM95233 and LM95234.
3) Add support for LM75
4) Add support for LM95245

Version 1.1.0d vs. 1.1.0b
1) Add USB 2.0 support for the LM86, LM89, LM89-1, LM90, LM99, LM99-1 and LM95235
2) Add ICH8 and 631xESB support
3) Add Vista support, remove 98/ME support
4) Add LM95233 and LM95234 support

Version 1.1.0b vs. 1.1.0a
1) Add LM95241

Version 1.1.0a vs. 1.1.0
1) Add LM95235

Version 1.1.0 vs. 1.0.9
1) Start of log file now displays all registers
2) Fixed "Read Cont" to properly update register display
3) Optional grouping of tabs is supported in register files

Version 1.0.9 vs. 1.0.8

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1) LM73 is added

Version 1.0.8 vs. 1.0.7a
1) Changed "Read Cont" to a combo box with option of off/value registers/all registers.
2) The "RW" attribute is now displayed as "R/W"
3) A bug is fixed which displayed more tabs than needed when reloading a device file

Version 1.0.7a vs. 1.0.6
1) If the number of register tabs does not fit on one line, multi-row tabs are used in place of scrolling tabs
2) Menu item to limit number of log file data lines is added

Version 1.0.6 vs. 1.04b
1) ADCS9888 and LM96000 evaluation board support is added
2) The width of columns in the log file is changed to 16 characters to allow for long data
3) The default maximum of values per plot is set to 6 instead of 8
4) Version number changed to x.y.z format
5) For LM95223/4, plot windows by default separate signed and unsigned temps
6) The hex display is increased to allow for display of "DD"

Version 1.04b vs. 1.04a
1) LM32, LM40, LM41, and LM95221 evaluation board support is added

Version 1.04a vs. 1.04
1) The Intel ICH driver is updated for ICH5-CH (device ID 0x25a4)

Version 1.04 vs. 1.03
1) LM95071 evaluation board support is added
2) LM95221 and LM96000 ICH support is added
3) All files can be viewed on Open or View log

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Version 1.03 vs. 1.02
1) Multiple values can be plotted; the "*Select Plot*" menu selects which values
2) Upon exit of the program, the plot selections and other values are saved
3) The installation is updated to provide a cleaner install and uninstall.
4) The "*Write Changed Regs*" button is renamed to "*Write Regs*"

Version 1.02 vs. 1.01
1) The menu items "*Open Reg*" and "*Save Reg*" are disabled for the LM71, which has limited registers

Version 1.01 vs. LmxxEval 4.15
1) The hardware documentation for the evaluation boards is added
2) A "No Hardware" mode is added to allow software use when no evaluation board or device is present. Register reads/writes are disabled, with zero register values shown initially
3) The LM64, LM89, LM89-1, LM90, LM93, LM99, LM99-1, LM95010 are added
4) The LM63 target PWM pseudo register does not update the PWM register if the PWM Program bit in register 4A is 0
5) Registers are now written only once each time a value is changed in the interface
6) All bits of a register are now written, including unused bits
7) LmxxEval is renamed to SensorEval
8) A plot of one temperature is shown for all devices except the LM93 on *"Read Cont"*
9) Both the USB evaluation board and the Intel ICH are now supported

Version 4.15 vs. 4.11
1) A checkbox is added to enable or disable reading of the registers after a write. By default, reading is enabled.
2) Read only registers may now be written, even if the chip does not support this.
3) A check for the correct Manufacturer and Device ID is added
4) A target PWM pseudo register is added to the LM63 to allow the PWM value register to track this target value when the PWM frequency is modified. This same target register contains an enable/disable bit for this function
5) Most chips now include a plot for a single remote temperature when "*Read Cont*" is selected.

Version 4.11 vs. 4.10
1) The display of the unused register bits now shows the current values instead of only zero.
2) The LM71 has the plot temperature range scale down as needed.
3) The LM71 shows the plot only when *"Read Cont"* is selected.
4) The LM71 no longer displays the shutdown register in decimal.

Version 4.10 vs. 4.09
1) The timer for logging and display update is more accurate.
2) The LM63/LM85 have the MSB shown first for the tach registers.
3) The LM63/LM85 have the tach scrollbar direction reversed to reflect the direction of the change in RPM value.
4) The LM85 has the RPM corrected to reflect 2 pulses per revolution.
5) The LM86/LM63 have the register reading corrected to eliminate occasional incorrect readings for temperature and RPM.

Version 4.09 vs. 4.08
1) The LM85 has improved descriptions for registers 28 to 2F.
2) The LM63 has the duty cycle displayed for the PWM registers.
3) This manual is displayed by the Help menu.
4) The LM71 is added, including a real-time plot of temperature.
5) "*Set Read Time*" is modified to use seconds instead of milliseconds.

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Version 4.08 vs. 4.07

1) This software allows selection of the LM63/LM85/LM86. Previously each device had its own software install. **LMxxEval** may be invoked more than once to display more than one device at the same time.

2) The register data files are changed to a standardized format, which will allow compatibility with future versions. The extension is now .dat. If you used the older LM63Eval, LM85Eval, or LM86Eval to save register files with the extension .xml, you can move your files to version 4.08 with the following procedure:

a) run this new **LMxxEval** software and select the desired device

b) run your old software (LM85Eval, LM63Eval, or LM86Eval)

c) use the *"Open"* menu to load your old register .xml file

d) in **LMxxEval**, click *"Read Regs"* and then use the *"Save Reg"* menu to save the new format file

e) repeat c) and d) until all the files are done

Version 4.07 vs. 4.05

1) The *"Read Cont"* checkbox is added to read and display registers every x msec, where x is determined by the *"Set Read Msec"* menu (default is 1000 msec). This same time is also used for the log file read time.

2) The log file now only continuously reads the temperature, status and RPM. The other registers values are read and saved once at the start of the log.

3) The *"Write Regs"* button is changed to the *"Write Changed Regs"* button, which is only active when there are modified registers to write. Only the modified registers are written by the button. If the *"Write on Change"* checkbox is checked then the *"Write Changed Regs" button* is only enabled for the special case of register 19 (see 4. below)

4) Register 19 Remote T_CRIT Limit is no longer written automatically when the *"Write On Change"* checkbox is enabled; in this case, the entry is only written when the *"Write Changed Regs"* button is pressed or another register is written. This prevents a partial value being written to the LM63 register 19 which is a write once register.

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