User's Manual

Level Monitor V1.00.00

User's Manual

Target Device
RX Family

Renesas Electronics
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How to Use This Manual

This manual describes the role of Level Monitor for monitoring applications that supports Capacitive Level Sensor.

Readers	This manual is intended for users who develop the Capacitive Level Sensor.	
Purpose	This manual is intended to give users an understanding of the functions of the Capacitive Level Sensor to use for reference in developing the hardware or software of systems using these devices.	
Organization	This manual can be broadly divided into the following units. 1. Summary 2. Main Window 3. Dialog 4. Log File	
How to Read This Manual	It is assumed that the readers of this manual have general knowledge of electricity, logic circuits, and microcontrollers.	
Conventions	Data significance:	Higher digits on the left and lower digits on the right
	Active low representation:	XXX (overscore over pin or signal name)
	Note:	Footnote for item marked with Note in the text
	Caution:	Information requiring particular attention
	Remarks:	Supplementary information
	Numeric representation:	Decimal ... XXXX Hexadecimal ... 0xXXXX

Table of Contents

1. Summary

Level Monitor is a tool to monitor various types of measurement value detected by Target Board supporting to Capacitive Level Sensor.

1.1 System Requirements

Supported OS for Level Monitor are as follows.

Table 1-1 Supported OS

OS	Remarks
Windows® 8	Microsoft .NET Framework 4 or later
Windows® 10	Microsoft .NET Framework 4 or later

1.2 Install

Extract downloaded file that is compressed “Level_Monitor.exe” to any folder that has write permission and execute “Level_Monitor.exe” in the folder.

1.3 System Configuration

Connect Target Board supporting to Capacitive Level Sensor and your PC with USB cable and execute Level Monitor. Specify Serial Port connecting to the Target Board and supported Serial Port Baudrate to Level Monitor and start monitoring.

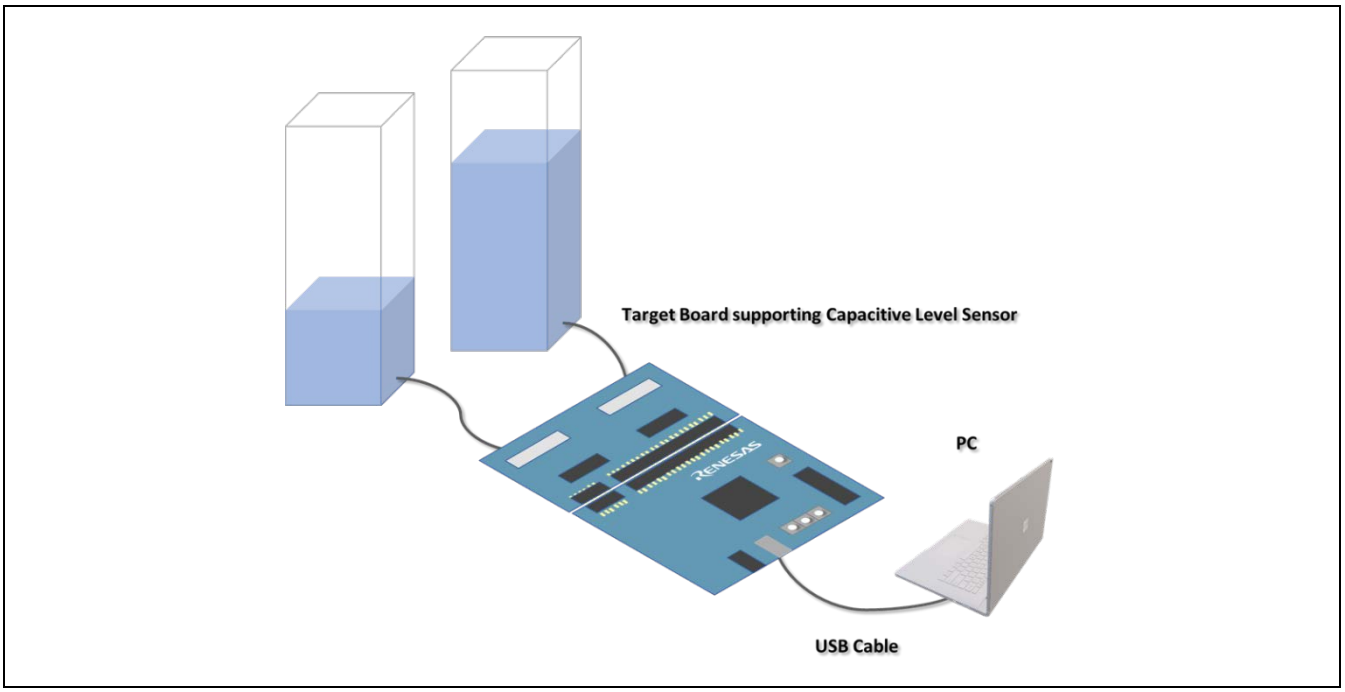


Figure 1-1 System Configuration

2. Main Window

This chapter explains Main Window of Level Monitor.

2.1 Main Window

Main Window is shown as follows.

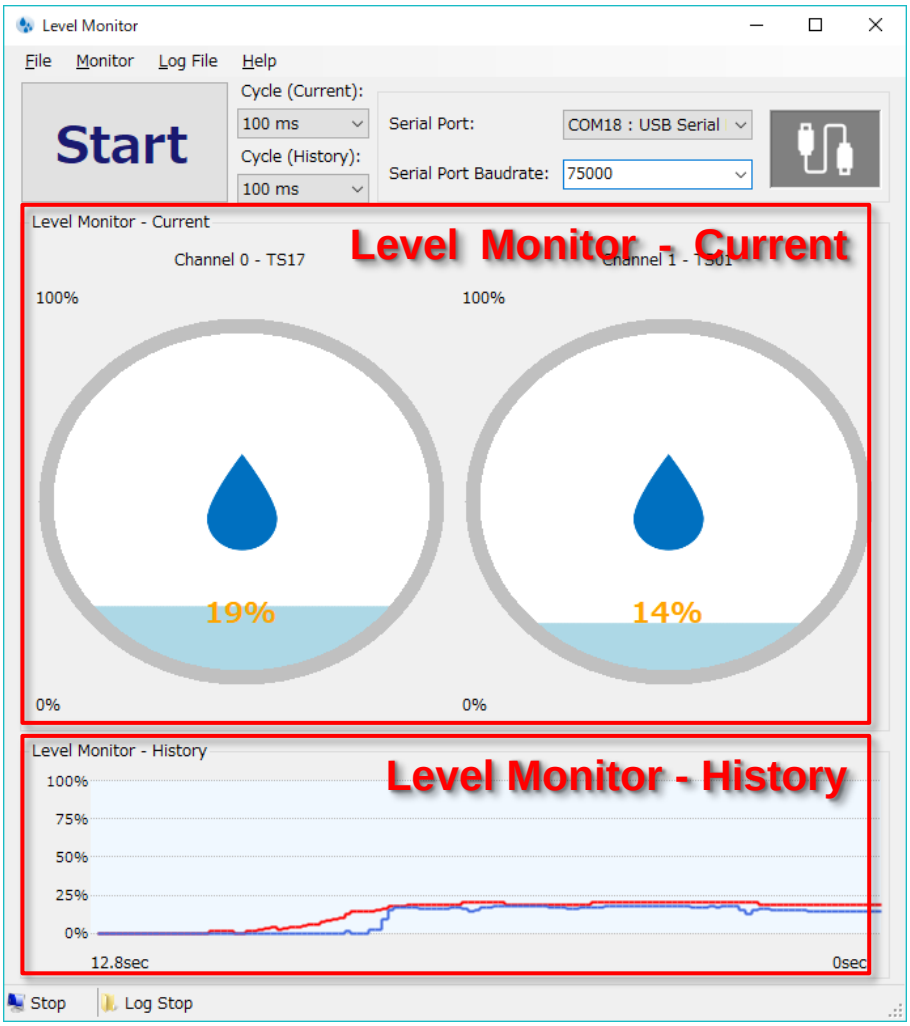


Figure 2-1 Main Window

Start	Start monitoring Target Board with the specified Serial Port and Serial Port Baudrate. [Start] is switched [Stop] during Monitoring or Log Play and click [Stop] to stop the monitoring or the Log Play.
Cycle (Current):	Choice the cycle for update the display of [Level Monitor – Current] from the followings. 100ms: Update the display every 100 milli seconds. 500ms: Update the display every 500 milli seconds. 1sec: Update the display every 1 second.
Cycle (History):	Choice the cycle for update the display of [Level Monitor – History] from the followings. 100ms: Update the display every 100 milli seconds. 500ms: Update the display every 500 milli seconds. 1sec: Update the display every 1 second.
Serial Port:	Choice Serial Port that is connecting to Target Board.
Serial Port Baudrate:	Choice Serial Port Baudrate that Target Board supports.
	Follow monitoring status to switch the icon to the following: Monitoring in progress: Color display Monitoring stopped: Monochrome display
Level Monitor – Current	Display the measurement value measured by Capacitive Level Sensor.
Level Monitor – History	Display the measurement value measured by Capacitive Level Sensor in time series.

2.2 Level Monitor – Current

This chapter explains about [Level Monitor – Current].

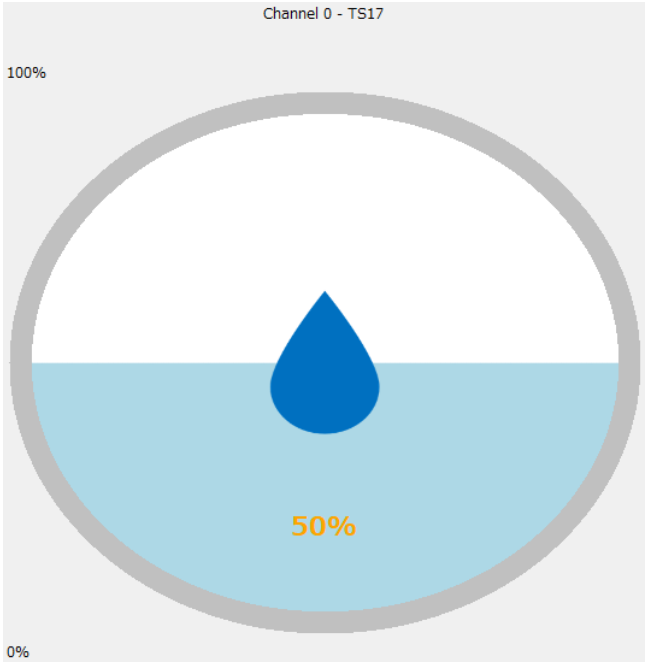
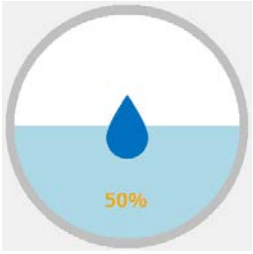
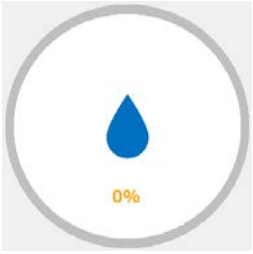
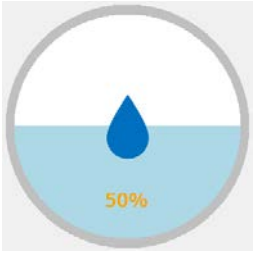


Figure 2.1 Level Monitor - Current

Channel N – TSnn (N: 0 - 3、nn: 0 - 35)	Show Channel Number and Touch Sensor Number (TS Number). The Channel Number shows unit to work the sensor as Capacitive Level Sensor and is be able to define maximum four cannels from Channel 0 to Channel 3. The TS Number shows Touch Sensor in the Channel.
0% - 100%	Show maximum value and minimum value in Y-axis in [Level Monitor – Current]. According to display unit, this value is shown as the followings. Display Unit – percent: 0% - 100% Display Unit – Millimeter: 0mm – Nmm (N shows height of target container to be measured by Capacitive Level Sensor.) Display Unit – Milliliter: 0ml – Nml (N shows maximum volume of target container to be measured by Capacitive Level Sensor.)
	Show icon. The icon is be able to change using [Setup Color] dialog. Refer to [3.3 Setup Color] for details about [Setup Color] dialog.

N%	Show the numerical value as measurement value of the Channel. According to Display Unit, these values are shown as the followings. Display Unit – percent: N% Display Unit – Millimeter: Nmm Display Unit – Milliliter: Nml N shows the measurement value.
	The measurement value of the Channel shows in a graph. The followings are the image of 0%, 50% and 100% when the Display Unit is percent. 0% 50% 100%   

2.3 Level Monitor – History

This chapter explains about [Level Monitor – History].

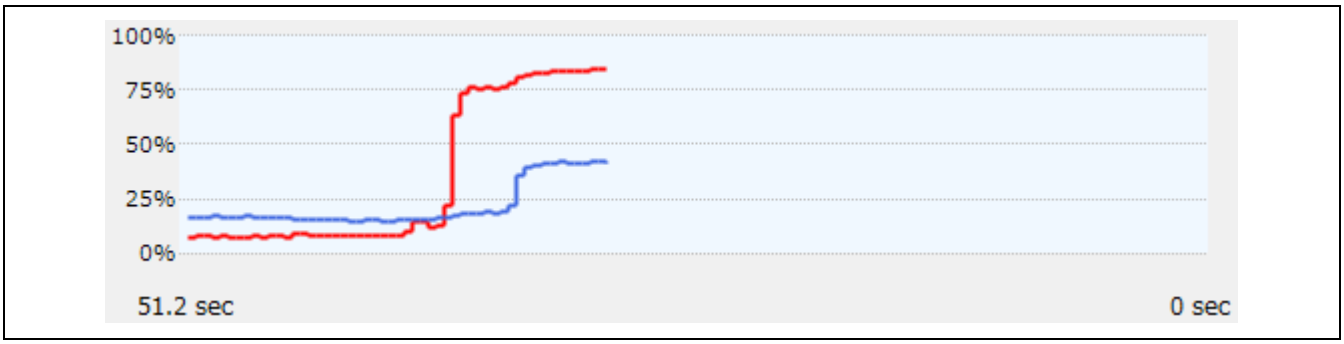
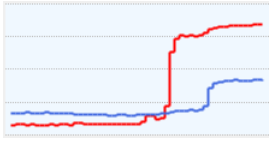


Figure 2.2 Level Monitor - History

0sec - 51.2sec	Show X-axis in [Level Monitor – History]. According to the Display Unit, these values are shown as follows. Display Cycle – 100 milli seconds: 0sec – 12.8sec Display Cycle – 500 milli seconds: 0sec – 64 sec Display Cycle – 1 second: 0sec – 128sec
0%, 25%, 50%, 75%, 100%	Show Y-axis in [Level Monitor – History]. According to the Display Unit, these values are shown in 1/4 increments as follows. Display Unit – percent: 0%, 25%, 50%, 75%, 100% Display Unit – millimeter: 0mm, 50mm, 100mm, 150mm, 200mm (Height of container to be measured by Capacitive Level Sensor – 200m) Display Unit – milliliter: 0ml, 125ml, 250ml, 375ml, 500ml (Maximum Value of container to be measured by Capacitive Level Sensor – 500ml)
	Show measurement value of channels in a line graph. Line color of each channels are as follows. : Channel 0 : Channel 1 : Channel 2 : Channel 3

2.4 Menu

This chapter explains the menu on the top of Main Window.

2.4.1 File

(1) Setup Color

Display [Setup Window Color] dialog. Refer to [3.3 Setup Color] for details about [Setup Window Color] dialog.

(2) Exit

Quit Level Monitor.

2.4.2 Monitor

(1) Status Monitor

Display [Status Monitor] dialog. Refer to [3.1 Status Monitor] for details about [Status Monitor] dialog.

(2) Show Level Monitor - History

Show or hides [Level Monitor – History].

(3) Unit

Change the Display Unit as follows.

- Percentage

  Change the Display Unit to “%”.

- Millimeter

  Change the Display Unit to Milli-meter.

- Millililiter

  Change the Display Unit to Milli-liter.

(4) Setup Parameter

Display [Setup Parameter] dialog. Refer to [3.2 Setup Parameter] for details about [Setup Parameter] dialog.

2.4.3 Log File

(1) Replay Log File

Select Log File to play. Display [File Open] dialog by click of this menu. Select any Log File in the dialog and click [Open] to start Log Play. Refer to [4 Log File] for details about Log File.

(2) Record to Log File

Record the measurement value received from Target Board to Log File. Display [Save As] dialog by click of this menu. Select any file in the dialog and click [Save] to start to Log Recording. Refer to [4 Log File] for details about Log File.

(3) Stop

Stop Log Play or Log Recording. This menu is enabled during Log Play or Log Recording and stop Log Play or Log Recording by click of this menu. Refer to [4 Log File] for details about Log File.

2.4.4 Help

(1) Version

Display [Version Information] dialog. Refer to [3.4 Version Information] for details about [Version Information] dialog.

2.5 Status Bar

Show status of the Monitoring, the Log Play and the Log Recording.

	Status of Monitoring is displayed as follows: Monitoring in progress: Monitor Monitoring stopped: Stop
	Status of Log Play and Log Recording are displayed as follows: Log Play in progress: Log Playing Log Recording in progress: Log Recording Other than the above: Log Stop

2.6 Mouse Pointer Action

Change the Display Unit in order to “%”, “Milli-meter” and “Milli-liter” in [Level Monitor – Current] by the double click of icon on [Level Monitor – Current].

3. Dialog

This chapter explains dialogs of Level Monitor.

3.1 Status Monitor

Show waveform of Count Value of touch electrodes that compose Capacitive Level Sensor.

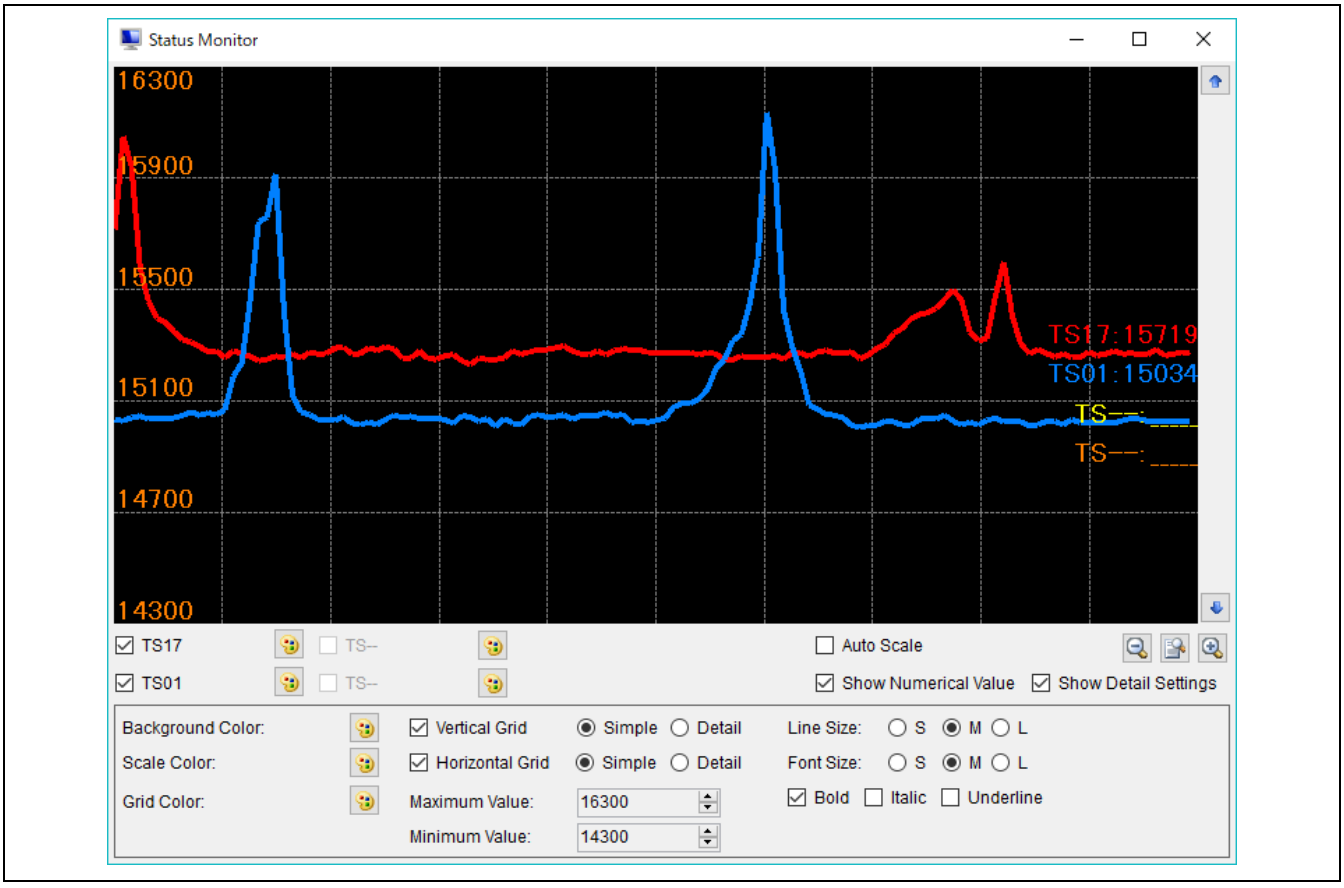


Figure 3.1 Status Monitor

	Show Count Value of Touch Sensor on Channel 0.
	Show Count Value of Touch Sensor on Channel 1.
	Show Count Value of Touch Sensor on Channel 2.
	Show Count Value of Touch Sensor on Channel 3.
17000	Show Count Value of grid line nearby this value.
☑ TSnn	Switch show or hide the waveform of TSnn. nn is from 0 to 35.
	Change color of item on the left. Click this button to display [Color] dialog. When [OK] on [Color] dialog is clicked, selected color on [Color] dialog is enabled to Status Monitor.

Auto Scale	Switch enable or disable automatic scale adjustment of waveform. The Auto Scale adjusts the scale to show all of the waveform in graph area.
Show Numerical Value	Switch show or hide labels on the line graph.
	Move up the waveform. It cannot be used when [Auto Scale] is enabled.
	Move down the waveform. It cannot be used when [Auto Scale] is enabled.
	Enlarge the waveform. It cannot be used when [Auto Scale] is enabled.
	Shrink the waveform. It cannot be used when [Auto Scale] is enabled.
	Tune scale to show all of waveform in line graph. It cannot be used when [Auto Scale] is enabled.
Show Detail Settings	Switch show or hide the detail settings on the under of Status Monitor.
Vertical Grid	Switch show or hide vertical grid line in the line graph. When the vertical grid line is shown, [Simple] and [Detail] on the right is enabled. Simple: Divide line graph vertically into 5. Detail: Divide line graph vertically into 10.
Horizontal Grid	Switch show or hide horizontal grid line in the line graph. When the horizontal grid line is shown, [Simple] and [Detail] on the right is enabled. Simple: Divide line graph horizontally into 10. Detail: Divide line graph horizontally into 20.
Maximum Value	Tune maximum value of vertical axis on the line graph. It cannot be used when [Auto Scale] is enabled.
Minimum Value	Tune minimum value of vertical axis on the line graph. It cannot be used when [Auto Scale] is enabled.
Line Size	Tune width of waveform. The width becomes thicker in the order of [S] -> [M] -> [L].
Font Size:	Tune width of label on the line graph. The width becomes thicker in the order of [S] -> [M] -> [L]. Bold: Bold font style is enabled Italic: Italic font style is enabled Underline: Underline font style is enabled

3.1.1 Cursor function

Show cursor on the line graph at the stop of monitoring and show the Count Value of waveform on the cursor to the right of line graph.

3.1.2 Mouse Wheel Action

When pointing device such as a mouse has wheel function, enlarge or shrink the line graph by rotation of the wheel.

3.2 Setup Parameter

Tunes the Capacitive Level Sensor Parameter.

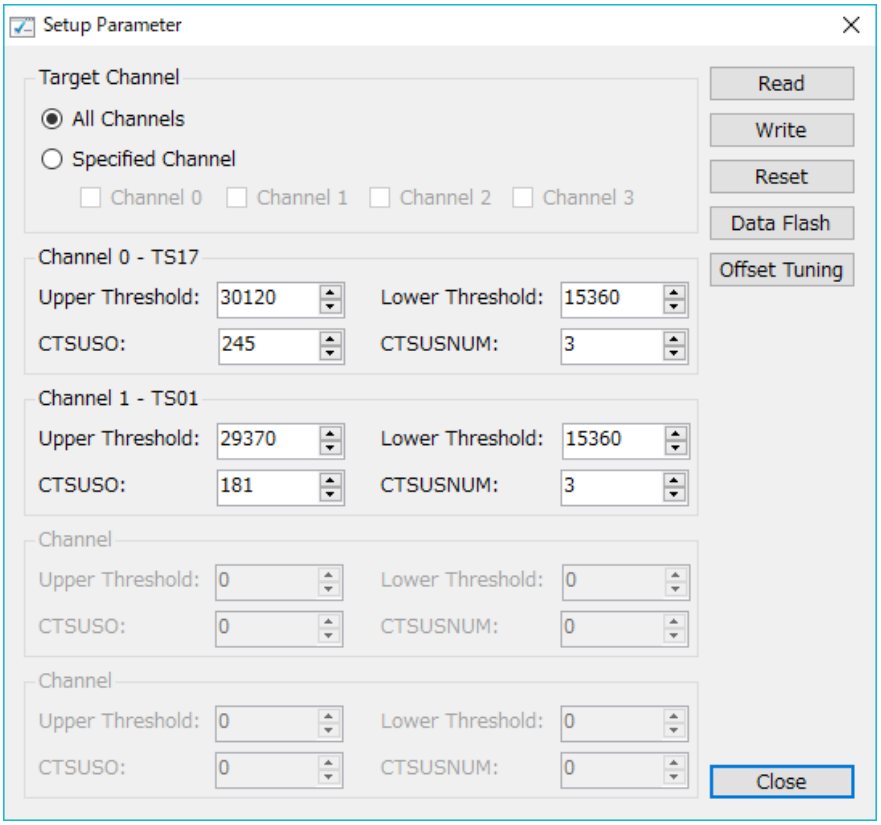


Figure 3.2 Setup Parameter dialog

All Channels	Tune the Touch Sensor on all channels.
Specified Channel	Tune the Touch Sensor of the specified channel.
Upper Threshold	Tune Upper Threshold.
Lower Threshold	Tune Lower Threshold.
CTSUSO	Tune CTSU Sensor Offset Adjustment (hereinafter CTSUSO).
CTSUSNUM	Tune CTSU Measurement Count Setting (hereinafter CTSUSNUM).
Read	Read Capacitive Level Sensor Parameters and CTSU Registers (CTSUSO and CTSUSNUM) from Target Board and show the parameters and the registers.
Write	Write Capacitive Level Sensor Parameters and CTSU Registers to Target Board.
Reset	Read Capacitive Level Sensor Parameters and CTSU Registers from Data Flash on Target Board.
Data Flash	Save Capacitive Level Sensor Parameters and CTSU Registers to Data Flash on Target Board.
Offset Tuning	Execute Offset Tuning and save Capacitive Level Sensor Parameters, tuned CTSUSO and CTSUSNUM to Data Flash on Target Board.
Close	Exit [Setup Parameter].

3.2.1 Save Capacitive Level Sensor Parameters and CTSU Registers

Tuned Capacitive Level Sensor Parameters and registers are enabled in restart after power-off by saving these parameters and registers to Data Flash on Target Board. The method to write to Data Flash is as follows:

1. Tune any Capacitive Level Sensor Parameters and CTSU Registers.
2. Click [Write] to write Capacitive Level Sensor Parameters and CTSU Registers to Target Board.
3. Monitor the Level and Count Value using [Level Monitor – Current] and [Status Monitor] to check result of the tuning as intended.
4. Click [Data Flash].

3.2.2 Initialize Capacitive Level Sensor Parameters and CTSU Registers

This section describes method to initialize Capacitive Level Sensor Parameters and CTSU Registers, when you wrote illegal CTSUSO value to Data Flash on Target Board and CTSU Measurement does not work correctly.

1. Input 1023 to CTSUSO one of the channels.
2. Click [Write] to write Capacitive Level Sensor Parameters and CTSU Registers to Target Board.
3. Click [Read] to read Capacitive Level Sensor Parameters and CTSU Registers from Target Board.
4. If necessary, click [Offset Tuning] to execute Offset Tuning.

3.3 Setup Color

Set the color of Main Window.

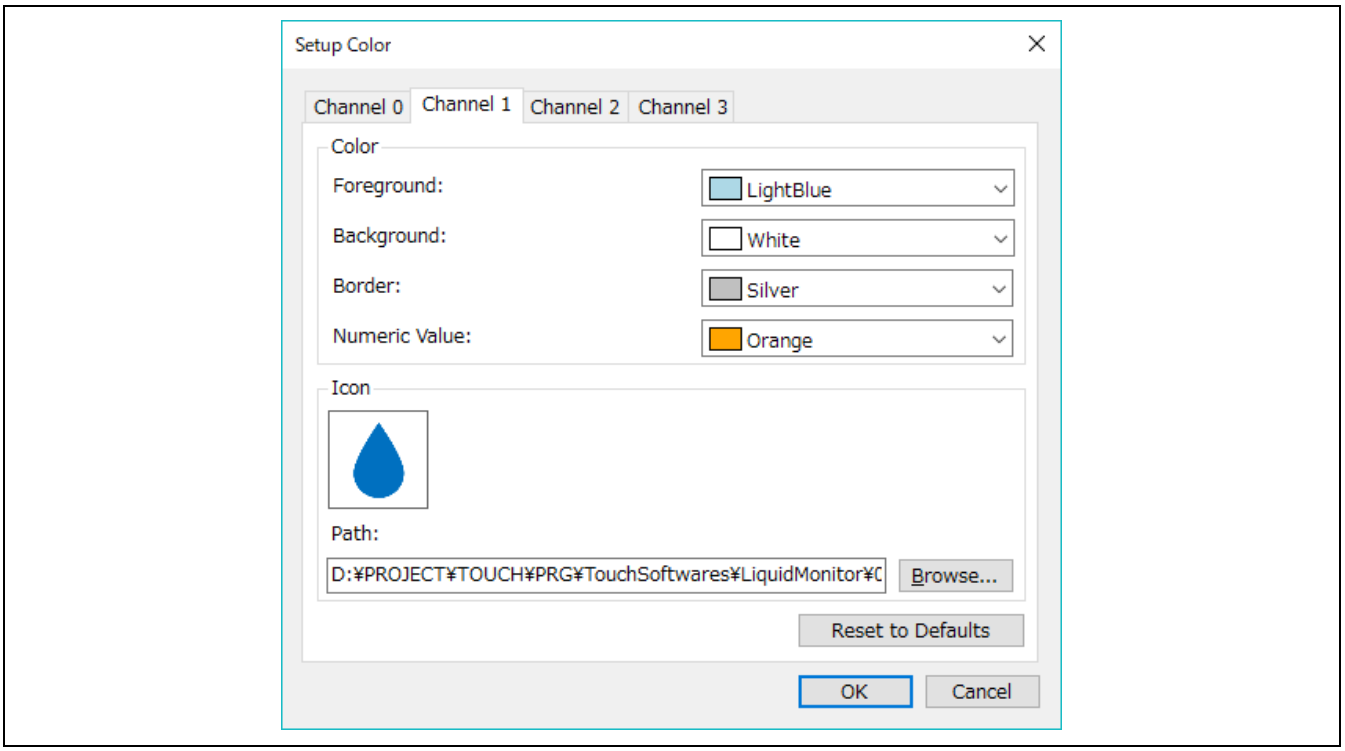


Figure 3.3 Setup Color dialog

Channel N	Choice the Channel to change color.
Foreground	Choice the color of the foreground.
Background	Choice the color of the background.
Border	Choice the color of the border.
Numerical Value	Choice the color of numerical value.
Icon	Show the chosen icon.
Path	Show the path of the chosen icon.
Browse	Display [Open File] dialog to select any icon.
Reset to defaults	Reset the current color setting to the default setting.
OK	Enable the current setting and exit [Setup Color].
Cancel	Disable the current setting and exit [Setup Color].

The relationship between [Level Monitor – Current] and color setting items is as follows.

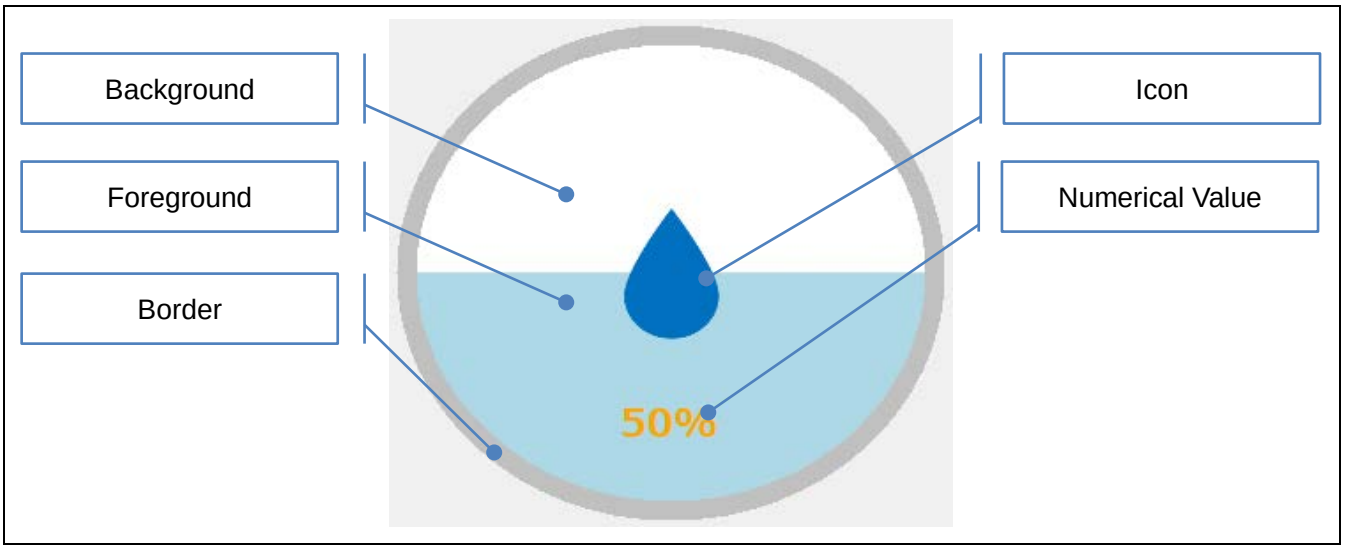


Figure 3.4 Relationship between [Level Monitor - Current] and color settings

3.4 Version Information

Show version information of Level Monitor.

Figure 3.5 Version Information dialog

Close	Exit [Version information].

4. Log File

This chapter explains about Log File output by Level Monitor.

4.1 Summary

Format of the Log File that the Level Monitor outputs is CSV, and the measurement value, Count Value and Capacitive Level Sensor Parameter are output.

4.2 Format

Header of records is output in first line and the measurement value, Count Value and Capacitive Level Sensor Parameter got from Target Board are output after the second line.

The configuration of the Header and the Record on four channels is as follows.

```
ID – Header, Channel 0 – Header, Channel 1 – Header, Channel 2 Header, Channel 3
– Header
ID, Channel 0 – Record, Channel 1 – Record, Channel 2 – Record, Channel 3 – Record
ID, Channel 0 – Record, Channel 1 – Record, Channel 2 – Record, Channel 3 – Record
                                        :
```

Figure 4.1 Log File Configuration

4.2.1 Header

Header in first line is shown as the follow.

```
ID,Ch 0,Level 0,Height 0,Volume 0,Count Value 0,Max Height 0,Max Volume 0,Low Thr
0,Upp Thr 0,Raw Data 0,CTSUSO0 0,Clock 0,Status 0,Filter 0,Ch 1,Level 1,Height
1,Volume 1,Count Value 1,Max Height 1,Max Volume 1,Low Thr 1,Upp Thr 1,Raw Data
1,CTSUSO0 1,Clock 1,Status 1,Filter 1,Ch 2,Level 2,Height 2,Volume 2,Count Value
2,Max Height 2,Max Volume 2,Low Thr 2,Upp Thr 2,Raw Data 2,CTSUSO0 2,Clock 2,Status
2,Filter 2,Ch 3,Level 3,Height 3,Volume 3,Count Value 3,Max Height 3,Max Volume 3,Low
Thr 3,Upp Thr 3,Raw Data 3,CTSUSO0 3,Clock 3,Status 3,Filter 3,
```

Figure 4.2 Log File - Header

4.2.2 Records

This chapter explains about Capacitive Level Sensor measurement value and Parameter after second line in the Log File.

Table 4-1 Log File - Record Data (1/2)

Header	Record data
ID	Send ID This record shows the Send ID from 0 to 255. The Send ID is incremented from 0 and returns to 0 when the ID exceeds 255.
Ch N	Touch Sensor Number This record shows the Touch Sensor Number on Channel N.
Level N	Capacitive Level Sensor – Measurement Value - Level This record shows the value of Level on Channel N.
Height N	Capacitive Level Sensor – Measurement Value – Height This record shows the value of Height on Channel N.
Volume N	Capacitive Level Sensor – Measurement Value – Volume This record shows the value of Volume on Channel N.
Count Value N	Capacitive Level Sensor – Measurement Value – Count Value This record shows the value of Count Value on Channel N.
Max Height N	Capacitive Level Sensor – Parameter – Height of container This record shows the height of the container measured by Channel N.
Max Volume N	Capacitive Level Sensor – Parameter - Maximum Volume of container This record shows the maximum volume of the container measured by Channel N.
Low Thr N	Capacitive Level Sensor – Parameter – Lower Threshold This record shows Lower Threshold on Channel N.
Upp Thr N	Capacitive Level Sensor – Parameter – Upper Threshold This record shows Upper Threshold on Chanel N.
Raw Data N	Capacitive Level Sensor – Measurement Value – Raw Data This record shows CTSU Sensor Counter on Channel N.

N shows the channel number (0 – 3).

Table 4-2 Log File - Record Data (2/2)

Header	Record data
CTSUSO0 N	CTSU Sensor Offset Register 0 This record shows CTSUSO0 (CTSU Sensor Offset Register 0) on Channel N.
Clock N	CTSU Base Clock This record shows CTSU Base Clock on Channel N. Unit of The CTSU Base Clock is KHz.
Status N	CTSU Status This record shows CTSU Status on Channel N. The status is shown by bits and each bit is as follows: Bit 0: CTSU Sensor Counter Overflow Flag (0: No overflow, 1: An overflow) Bit 2: TSCAP Voltage (0: Normal TSCAP voltage, 1: Abnormal TSCAP voltage) Bit 3: CTSU Measurement status (0: Under measurement, 1: Finished)
Filter N	Moving Average Filter Value This record shows the value of Moving Average Filter on Channel N.

N shows the channel number (0 – 3).

4.3 Sample

A sample of the Log File is shown below.

```
ID,Ch 0,Level 0,Height 0,Volume 0,Count Value 0,Max Height 0,Max Volume 0,Low Thr
0,Upp Thr 0,Raw Data 0,CTSUSO0 0,Clock 0,Status 0,Filter 0,Ch 1,Level 1,Height
1,Volume 1,Count Value 1,Max Height 1,Max Volume 1,Low Thr 1,Upp Thr 1,Raw Data
1,CTSUSO0 1,Clock 1,Status 1,Filter 1,Ch 2,Level 2,Height 2,Volume 2,Count Value
2,Max Height 2,Max Volume 2,Low Thr 2,Upp Thr 2,Raw Data 2,CTSUSO0 2,Clock 2,Status
2,Filter 2,Ch 3,Level 3,Height 3,Volume 3,Count Value 3,Max Height 3,Max Volume 3,Low
Thr 3,Upp Thr 3,Raw Data 3,CTSUSO0 3,Clock 3,Status 3,Filter 3,
0,17,0,0,0,15265,200,500,15360,30120,17107,34,500,8,4,1,0,0,0,15460,200,500,153
60,29370,17249,55,500,8,4,255,0,0,0,4704,0,0,0,0,4704,4704,842,4704,4,255,0,0,0
,4704,0,0,0,0,4704,4704,842,4704,4,
1,17,0,0,0,15267,200,500,15360,30120,17063,34,500,8,4,1,0,0,0,15454,200,500,153
60,29370,17224,55,500,8,4,255,0,0,0,4704,0,0,0,0,4704,4704,842,4704,4,255,0,0,0
,4704,0,0,0,0,4704,4704,842,4704,4,
2,17,0,0,0,15265,200,500,15360,30120,17051,34,500,8,4,1,0,0,0,15461,200,500,153
60,29370,17266,55,500,8,4,255,0,0,0,4704,0,0,0,0,4704,4704,842,4704,4,255,0,0,0
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60,29370,17263,55,500,8,4,255,0,0,0,4704,0,0,0,0,4704,4704,842,4704,4,255,0,0,0
,4704,0,0,0,0,4704,4704,842,4704,4,
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Figure 4.3 Log File - Sample

Revision Record

Rev.	Date	Description	
		Page	Summary
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