UM0925
User manual

Using the M24LR64-R datalogger reference design

Introduction

The M24LR64-R is a Dual Interface EEPROM which targets a wide range of applications such as industrial or medical equipment and consumer electronics. It provides extra flexibility for the design of electronic devices and for upgrading equipment parameters.

Because it features an RFID and a serial interface, the M24LR64-R is also a good fit for RFID-enabled sensors, for which ST has developed a reference design. This user guide describes how to use the "M24LR64-R data logger reference design", an autonomous battery-powered RFID tag with data logger capability for recording and storing 64 Kbits of temperature data (~4000 values).

The M24LR64-R provides:

- I²C serial interface operating at 400 kHz, from 1.8 V to 5.5 V
- ISO15693 / ISO 18000-3 mode 1 RF interface operating at 13.56 MHz
- 64 Kbit EEPROM user memory
- 32-bit password protection (not used in this reference design)

M24LR64-R powered data loggers can use different types of sensors such as temperature, pressure, shock, humidity or other environmental factors. The transported articles can be tracked throughout the supply chain, and the data can be scanned at any point using an RFID reader.

The "M24LR64-R data logger reference design" is intended to help you get started with your own data logger design. It uses a temperature sensor and and enables the user to start and stop temperature acquisition and to set the acquisition frequency.

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1 System description

1.1 M24LR64-R datalogger hardware

The M24LR64-R datalogger hardware is implemented using the following components:

- Dual Interface EEPROM (M24LR64-R)
- 8-bit microcontroller (STM8L)
- Temperature sensor (STTS75)
- RF antenna, size : 75 mm x 45 mm (2.9 in x 1.77 in)

Refer to *Figure 1*.

1.2 Compatible RF readers

The M24LR64-R data logger reference design is able to work with following readers :

- **Development kit reader (DEVKIT-M24LR-A)**: mid-range RF reader (ISO 15693, RF 13.56 MHz) interfaced via the USB bus (ref: FEIG ID ISC.MR10 A) connected to an external pad antenna (FEIG ID ISC.ANT340/240) and an external power supply for increased read range. See *Figure 2*
- **Demonstration kit reader (DEMOKIT-M24LR-A)**: mid-range RF reader (ISO 15693, RF 13.56 MHz) interfaced via the USB bus (ref: FEIG ID ISC.MR101 USB). See *Figure 3*
- **Starter kit Reader (STARTERKIT-M24LR-A)**: mid-range RF reader (ISO 15693, RF 13.56 MHz) interfaced via the USB bus. See *Figure 4*.

Note: The serial EEPROM USB reader is not suitable for use with the M24LR64-R datalogger*.*

Figure 1. Data logger format ANT 1

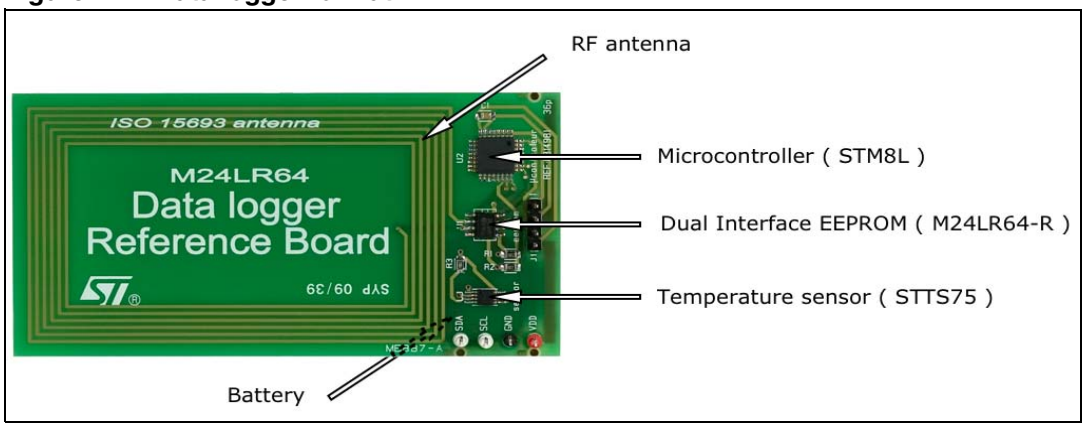


Figure 2. Development kit USB RF reader with external antenna



Figure 3. “Demonstration kit RF reader (ISO 15693, RF 13.56 MHz)



Figure 4. Starter kit mid-range RF reader (ISO 15693, RF 13.56 MHz)



2 Getting started

2.1 System prerequisites

The data logger application software can be started from:

- a suite of Dual Interface EEPROM software called "M24LRxx_Application_Software"
- or from the standalone M24LR64-R Data Logger Application.

The user interface is almost the same in both cases.

Before starting you must first:

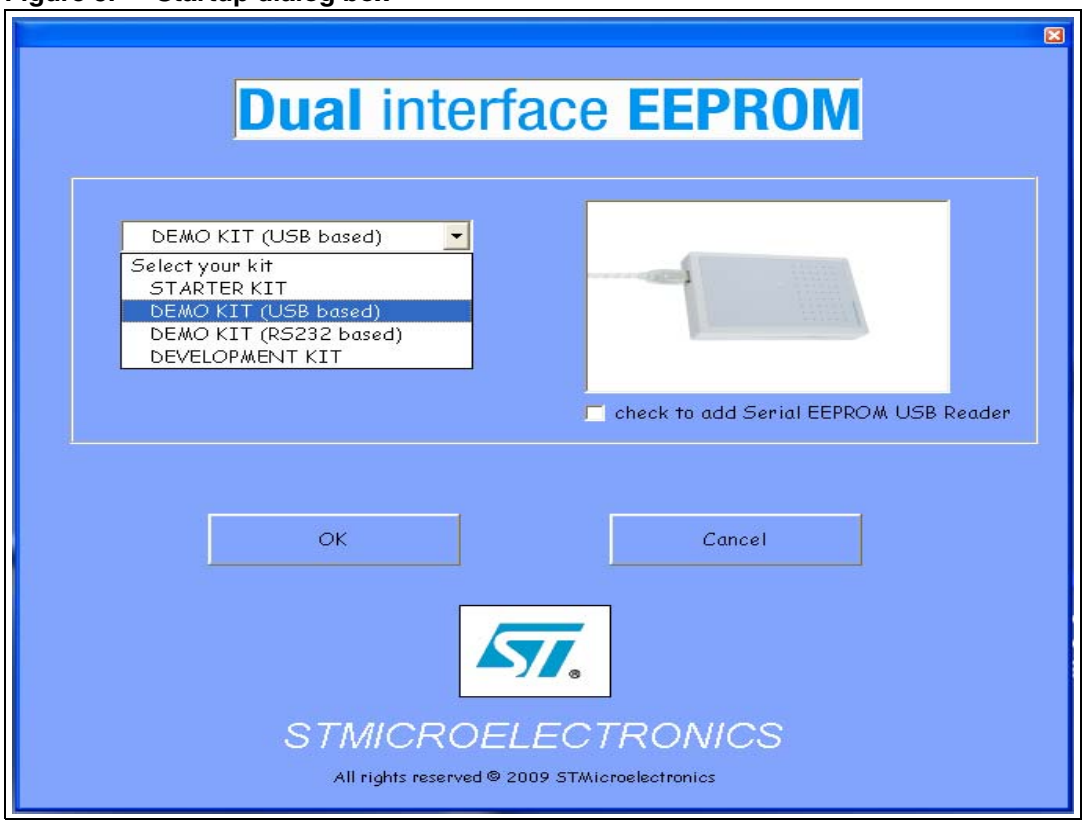
- Install the setup.exe file.
- Install the corresponding drivers
- Connect the reader via cable to the PC.

Please refer to Install Guide if you encounter problems during installation.

In Windows Desktop, double click the M24LRxx_Application_Software icon.

When the application starts, you will be prompted to select the kit you wish to use as shown in *Figure 5*.

Figure 5. Startup dialog box



You must select one of the three following kits to work with the M24LR64-R datalogger:

- Starter kit
- Demo kit (USB based)
- Demo kit (based on the RS232 port - old version)
- Development kit

Then press the OK button.

If you have a Development kit, choose one of the following methods.

First method:

Choose a Demo kit (USB or RS232) depending on the connection that you want to use.

Do not check the option: add Serial EEPROM USB Reader.

Second method:

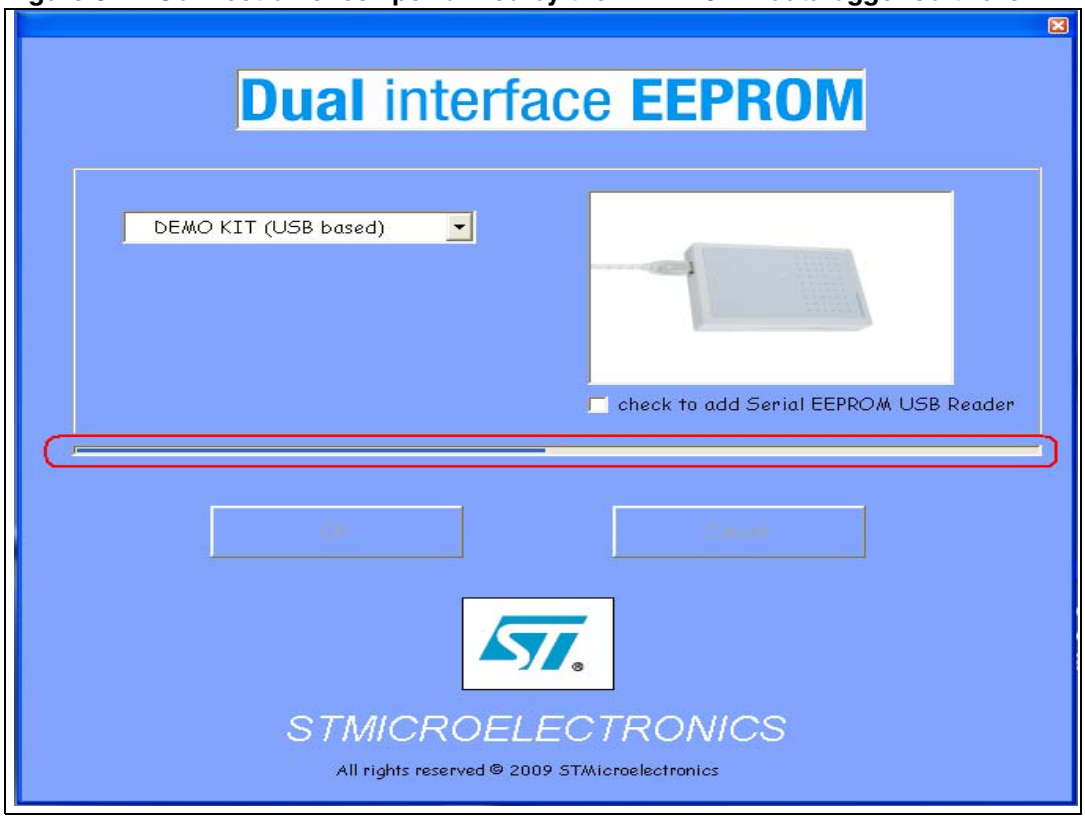
Plug the USB RF Reader to the PC.

Plug the USB serial EEPROM reader to the PC.

Note: The serial EEPROM USB reader (I2C connection) is not suitable for use with the data logger application. Do not connect I2C cable to the data logger.

Once the kit has been selected, the software checks that the selected readers are properly connected. A progress bar appears during the check as shown in *Figure 6*.

Figure 6. Connection check performed by the M24LR64-R datalogger software



If a problem occurs, a message box is displayed to indicate what the problem is:

- If the development kit is used, the problem could be:
  - medium-range RF reader not plugged in the USB port
  - medium-range RF reader driver not installed
  - I2C bus reader not plugged in the USB port
  - I2C bus reader driver not installed
- If the demo kit is used, the problem could be:
  - medium-range RF reader not plugged in the USB port
  - medium-range RF reader driver not installed
- If the starter kit is used, the problem could be:
  - Short-range RF reader not plugged in the USB port
  - Short-range RF reader driver not installed

2.2 Main menu

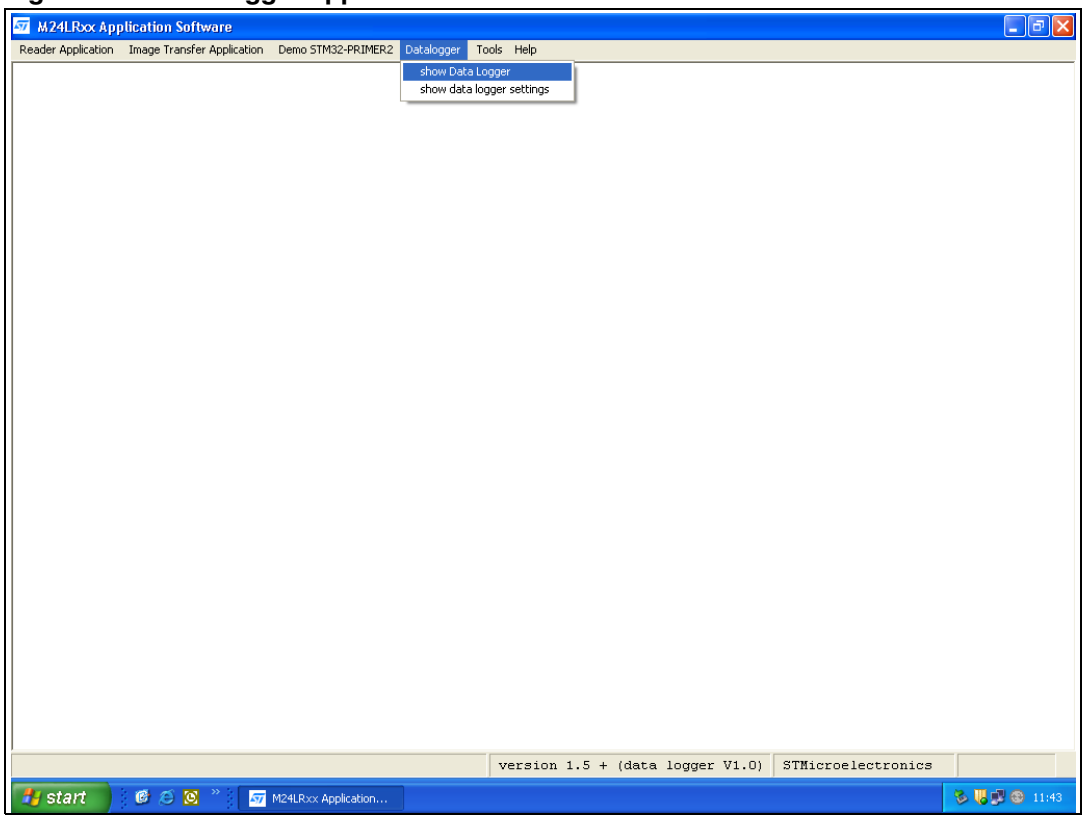
When drivers have been installed correctly, and the selected reader has been connected to the PC, the application main menu appears.

2.2.1 Data logger application menu

Use the menu at the top to start the data logger application.

See *Figure 7*

Figure 7. Data logger application main menu



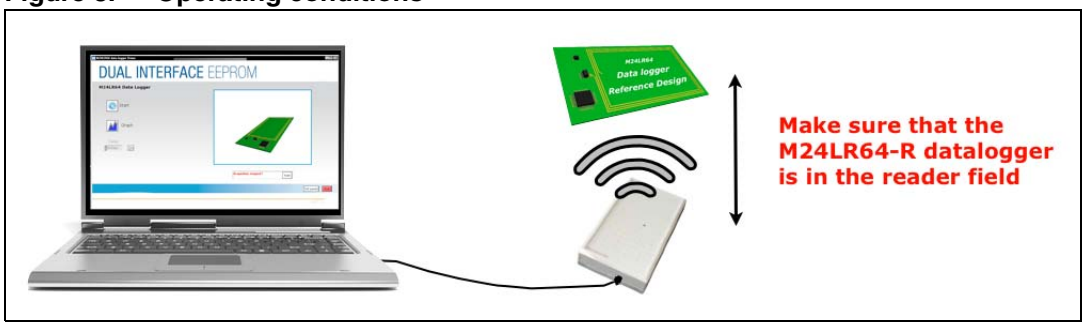
3 Using the data logger application

3.1 Operating conditions

For the application to work properly, you must respect the following conditions:

- When you perform the START, STOP or TRACE GRAPH functions, make sure that the M24LR64-R datalogger is in the reader field as shown in *Figure 8*.
- Once the acquisition has started, the M24LR64-R datalogger does not need to remain within the reader field to acquire and save temperatures.

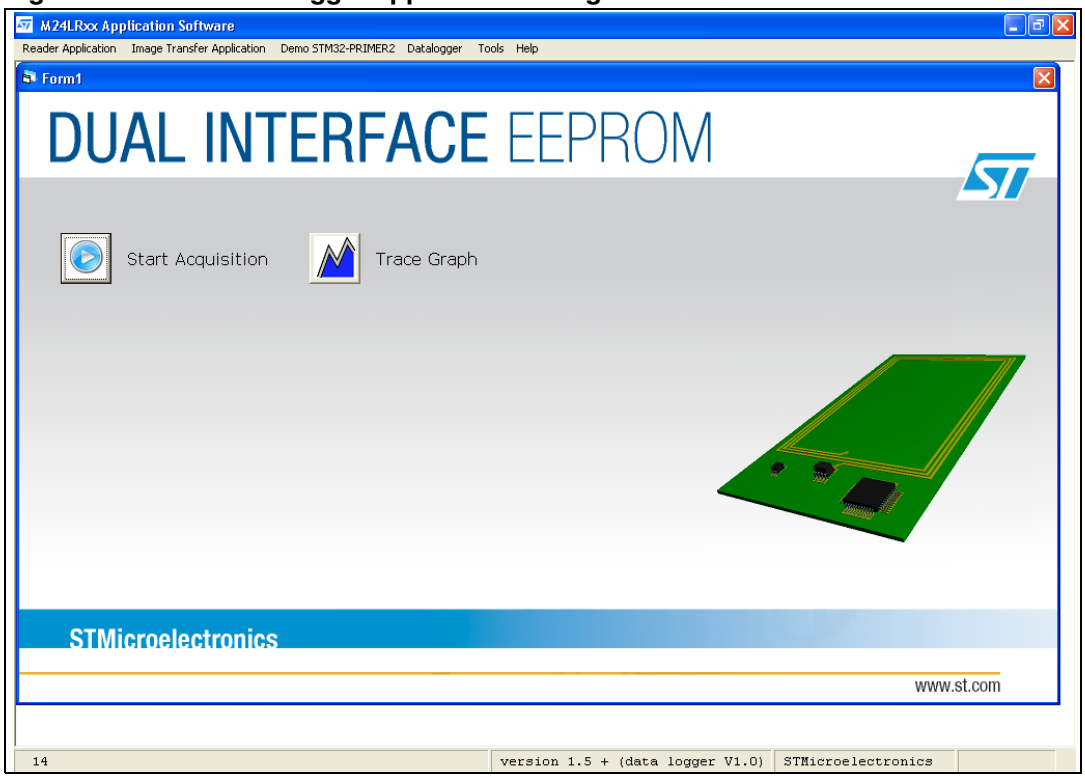
Figure 8. Operating conditions



3.2 User interface

The first interface displayed when you launch the Data Logger application, is the main dialog box shown in *Figure 9*.

Figure 9. Main data logger application dialog box



At this stage, the dialog box displays an illustration of the M24LR64-R datalogger and prompts you to select one of the following choices:

- Click on Start to send a RF condition to the data logger. Once the start condition has been sent, the M24LR64-R datalogger begins to acquire temperatures. See *Figure 10*.
- Click on Graph to read out the temperature data stored in the M24LR64-R datalogger and display it in a graph. See *Figure 10*

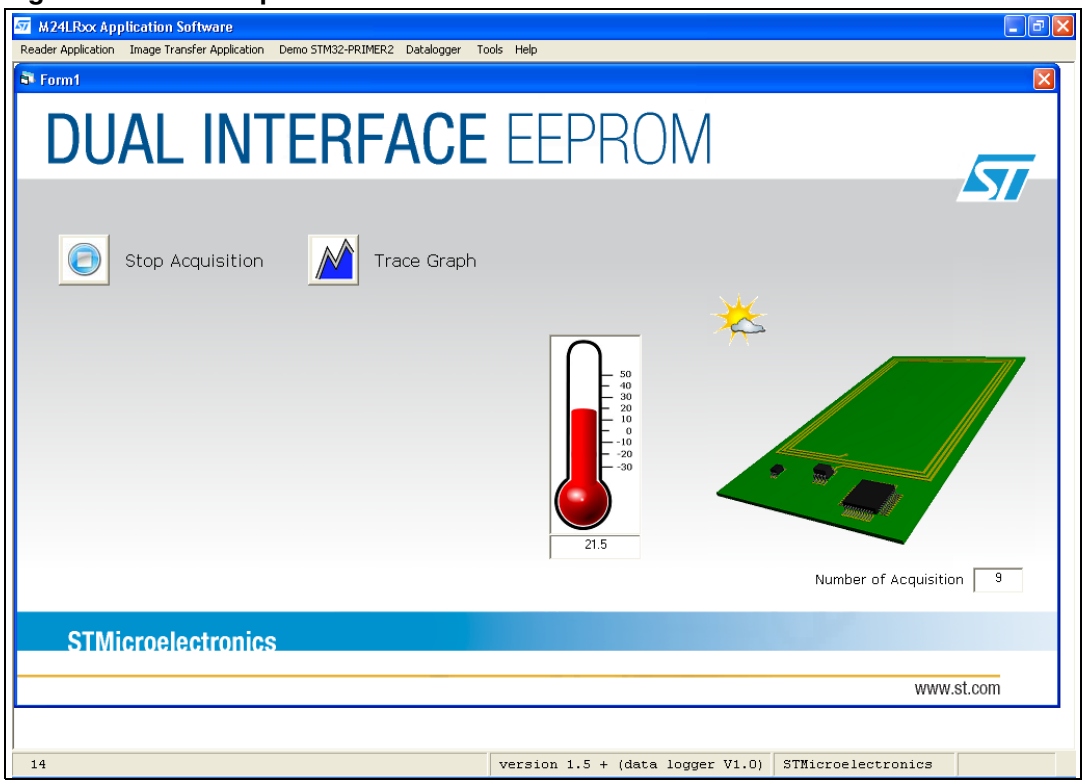
3.3 Data acquisition mode

In this mode, the user interface display is modified:

– Additional indicators and buttons appear

– An animation starts on the M24LR64-R datalogger image

Figure 10. Data acquisition mode

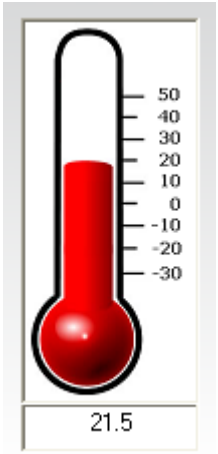


3.3.1 Status indicators

Thermometer display

If the M24LR64-R datalogger is in the reader field, the thermometer indicates the temperature measurement in real time. If the M24LR64-R datalogger is out of range, an error message is displayed. See *Figure 11*.

Figure 11. Thermometer

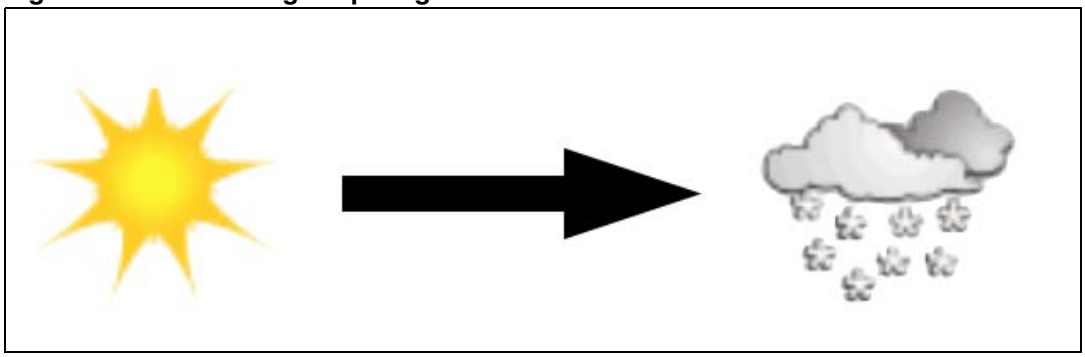


Meteorological pictograms

The meteorological pictograms indicate the measured temperature trend (rising or falling temperatures).

See *Figure 12*.

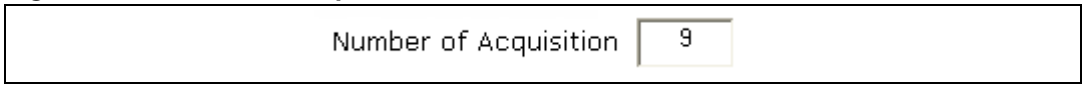
Figure 12. Meteorological pictograms



Number of acquisitions

Number of acquisitions: Shows in real time how many temperature measurement values have been recorded.

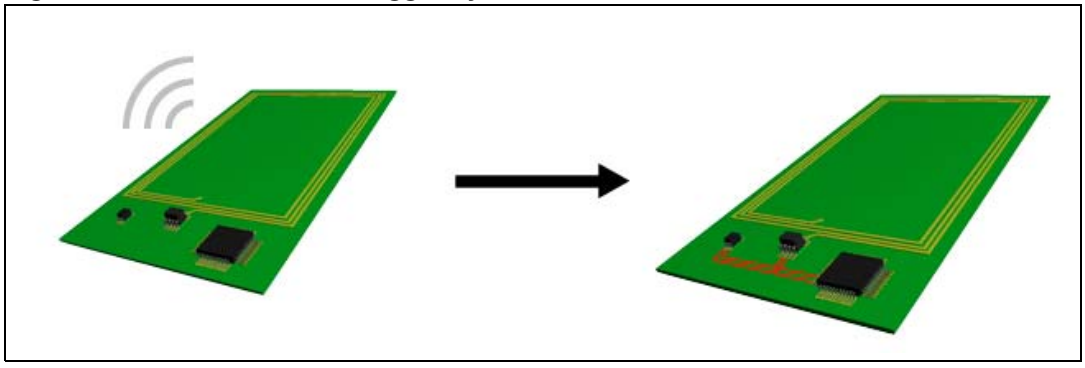
Figure 13. Number of acquisitions



M24LR64-R datalogger system status

This animated graphic displays the system state and the active communications interfaces (left: RF communication / right: I2C communication).

Figure 14. M24LR64-R datalogger system status



Note: As soon as acquisition mode starts, the start button changes into a stop button, which allows you to stop the acquisition at any time.

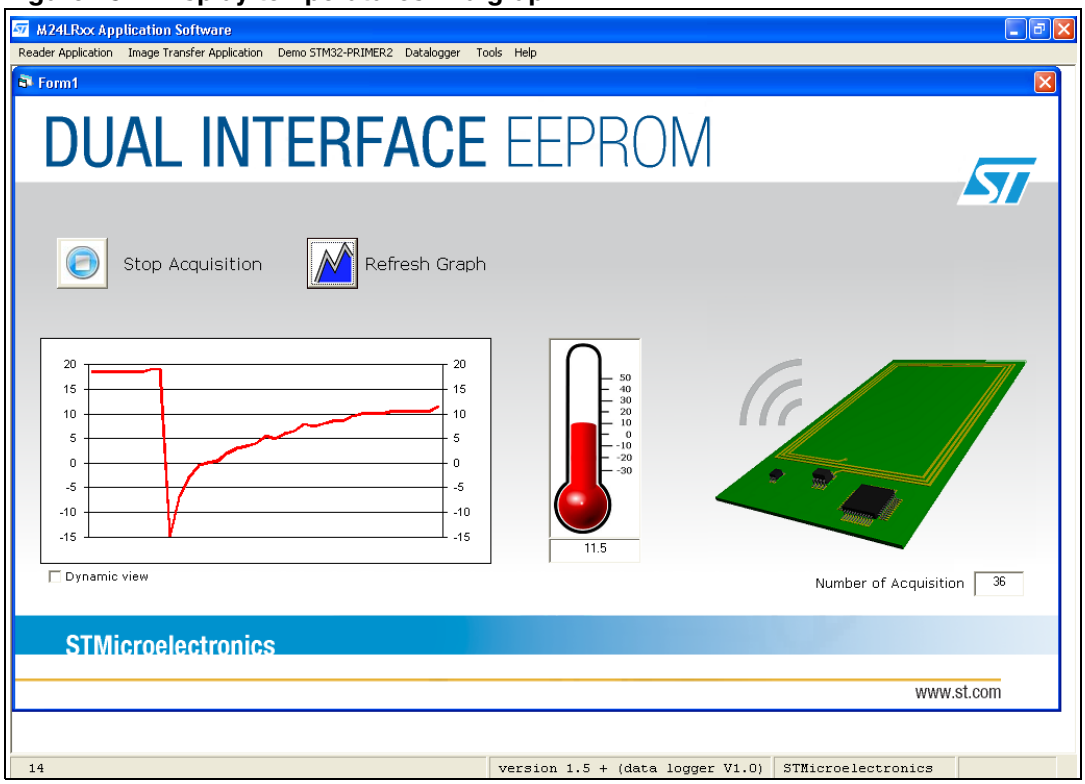
3.4 Tracing a graph

Using the TRACE GRAPH button you can generate a graph of the acquired temperatures saved in the M24LR64-R dual mode EEPROM in the M24LR64-R datalogger.

Note: As soon as you click on the TRACE GRAPH *button, it changes into a REFRESH GRAPH button which allows you to update the graph with the latest acquired temperature values.*

Note: Don't forget that the M24LR64-R datalogger must be in the reader field to communicate with the user interface.

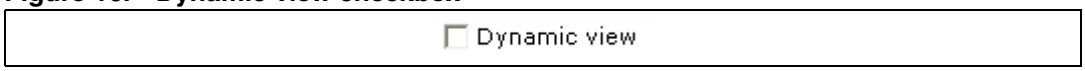
Figure 15. Display temperatures in a graph



Dynamic view option: A checkbox appears under the graph which allows you to make the view dynamic (the graph is updated in real time with latest temperature acquired). See *Figure 16*.

This option is only available when the DELAY RATE is set to 1s (see *Section 4.1: Delay selector on page 18*).

Figure 16. Dynamic view checkbox



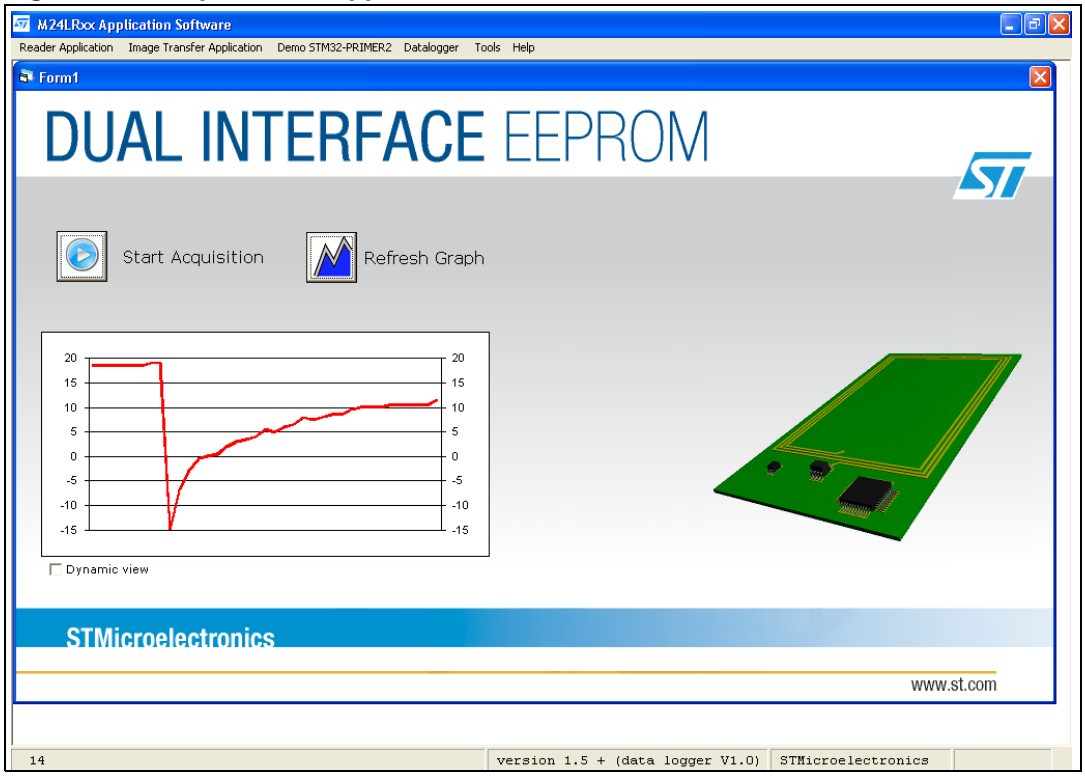
3.5 Stopping acquisition mode

If you click on the STOP button, the M24LR64-R datalogger stops measuring temperatures until the next start condition.

Any previously acquired temperatures are still available after a stop condition, the graph button can be still used to display a graph of the acquired data. See *Figure 16*

Note: As soon as acquisition mode is stopped, the STOP button changes into a START button, which allows you to start a new acquisition at any time. This clears the EEPROM memory and all previously saved temperature values are lost.

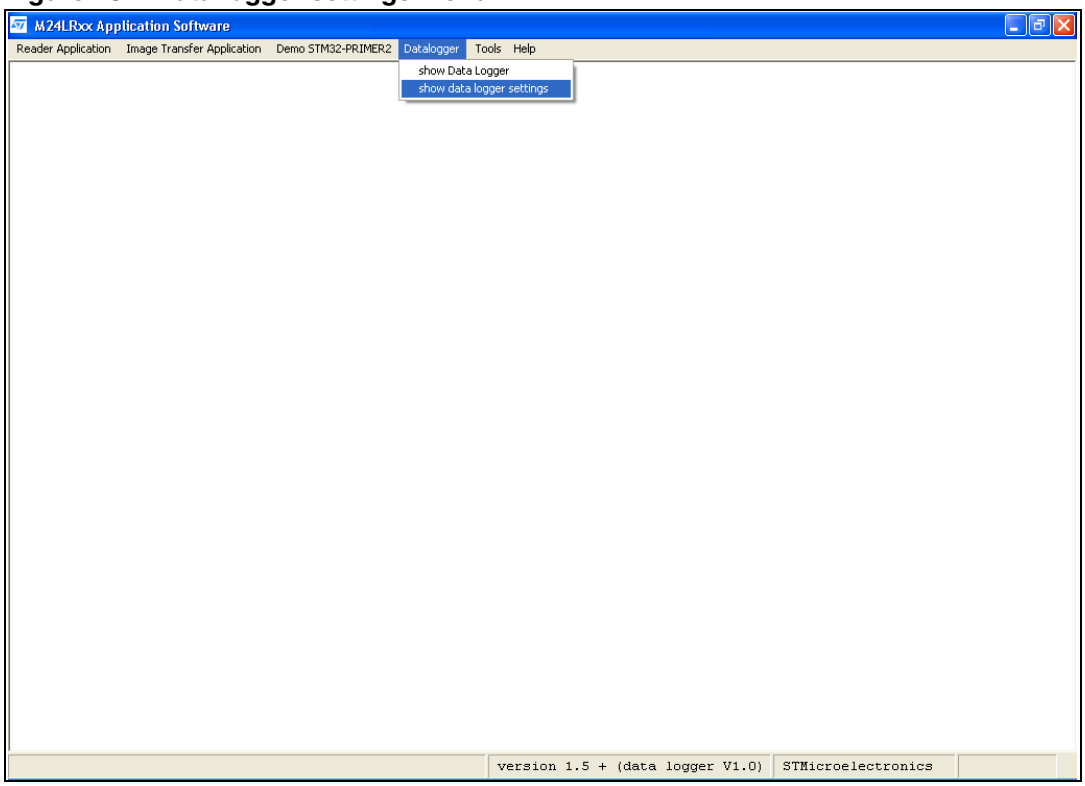
Figure 17. Acquisition stopped



4 Changing the data logger settings

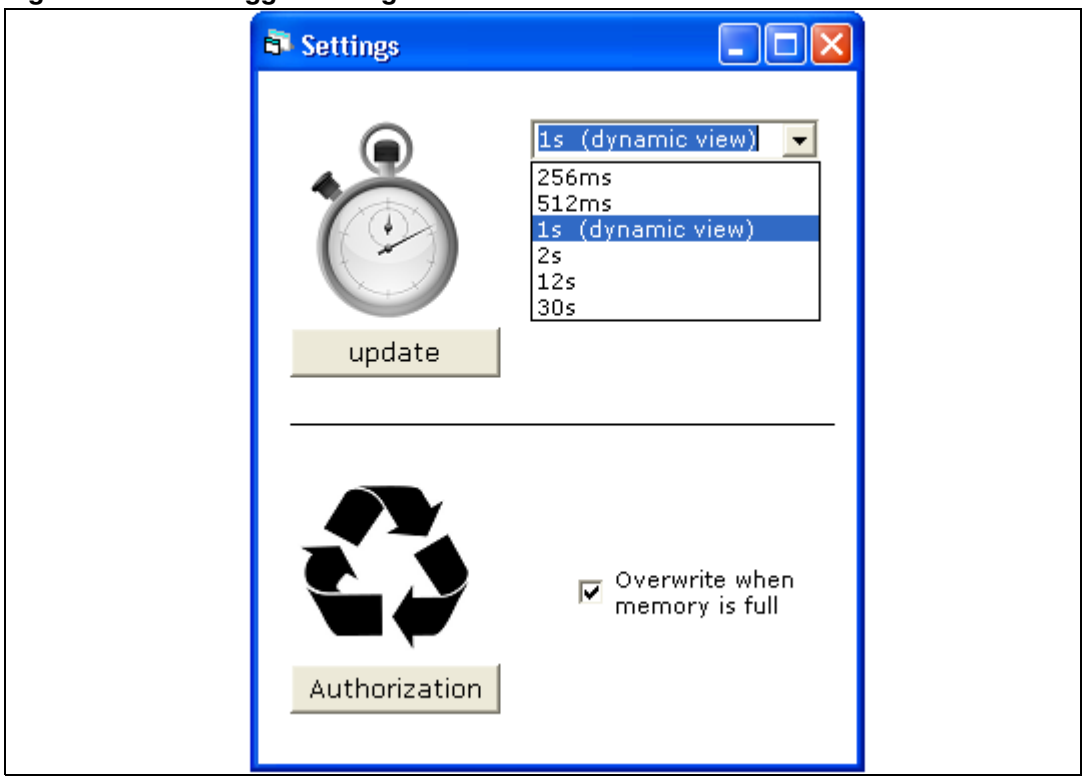
In the "M24LRXX application software" main menu, click on data logger then on data logger settings as shown in *Figure 18*.

Figure 18. Data logger settings menu



A dialog box appears and allows you to change the acquisition rate and the overwrite authorization. See *Figure 19*.

Figure 19. Data logger settings



4.1 Delay selector

The delay selector allows you to choose the delay between two temperature acquisitions. Click on the update button to set the new delay.

Example: If you choose a 512 ms delay the data logger acquires and saves two temperature values every second.

4.2 Overwrite checkbox

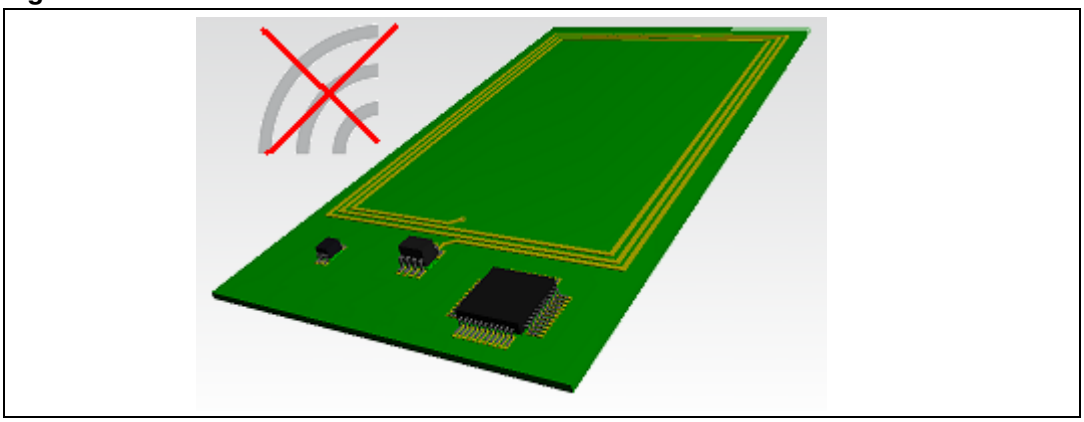
The overwrite checkbox allows you to choose what the data logger does when the memory is full.

- **Check the box to enable overwrite**: After saving the last temperature, the memory is cleared and the cycle restarts from the beginning.
- **Uncheck the box to disable overwrite**: after saving the last temperature, the data logger automatically performs a stop condition and remains in this state until the you send a new start condition.

5 System status pictograms

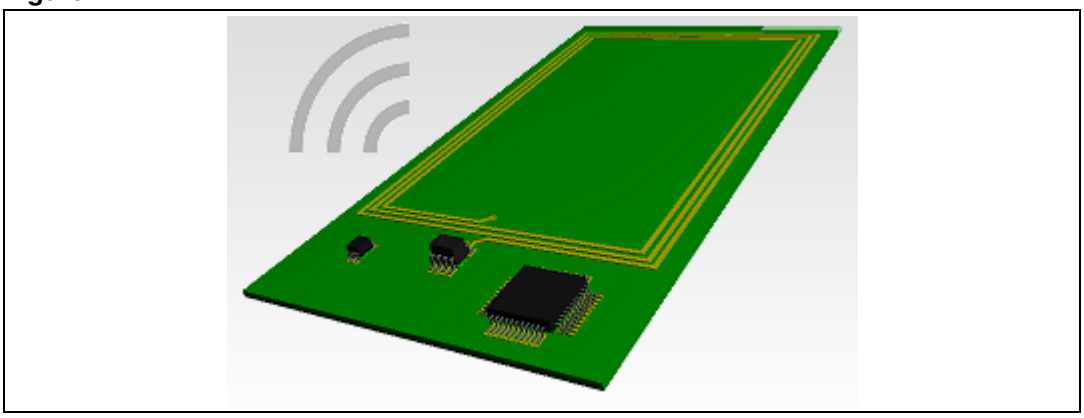
There is no M24LR64-R datalogger in the reader field

Figure 20. No RF



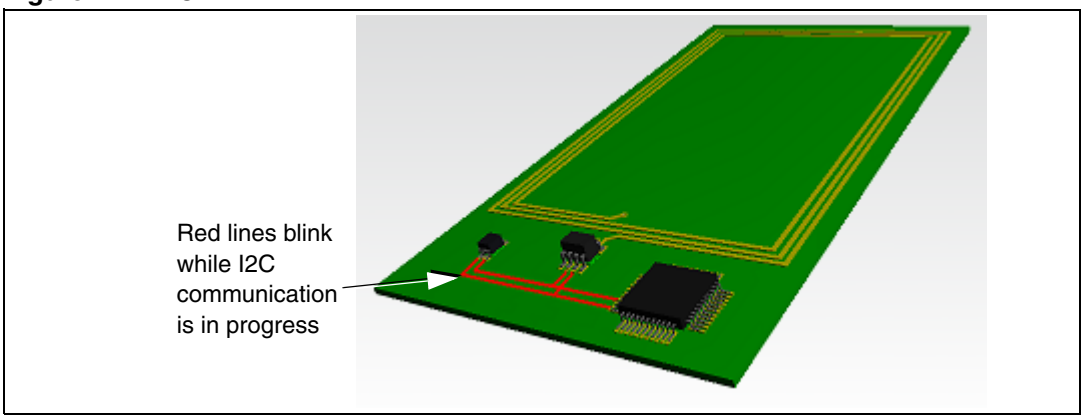
RF communication progressing

Figure 21. RF



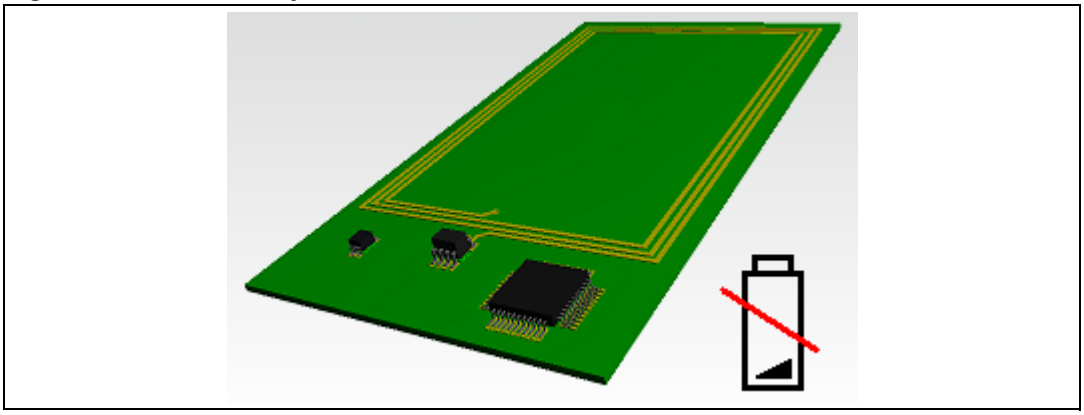
I2C communication progressing

Figure 22. I2C



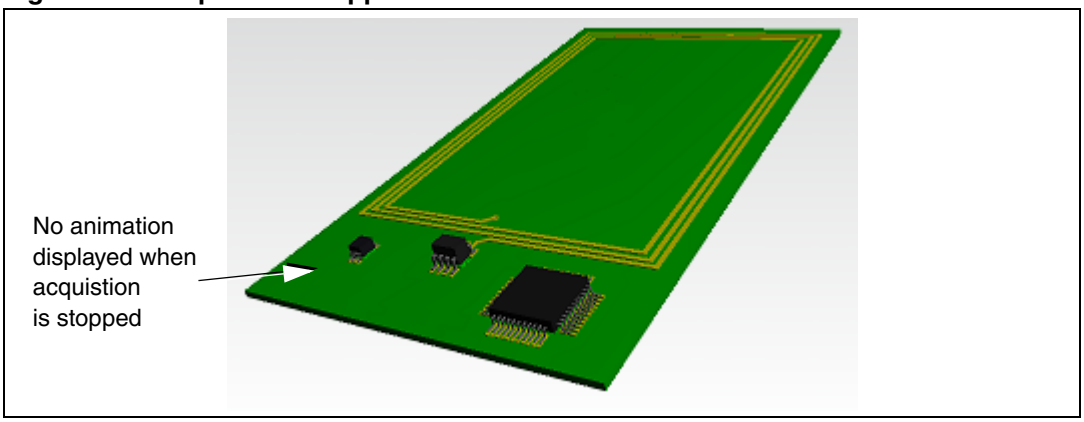
Battery LOW

Figure 23. Low battery



Acquisition stopped

Figure 24. Acquisition stopped



6 Revision history

Table 1. Document revision history

Date	Revision	Changes
26-Mar-2010	1	Initial release.
10-June-2010	2	Corrected publication date in revision history

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