

FlyWire

FireFly Communication Protocol for the Solar Chimney



This document describes the commands available for the FireFly to communicate with a Solar Chimney and how to change the settings by using additional factory, test and custom commands. See the FlyWire communication protocol document for additional information.

The following topics will be addressed in this document:

1. Principle of operation
2. Standard/factory/test commands
3. Custom commands
4. EEPROM map

1. Principle of operation

The Solar Chimney is an Air Temperature (T) and Relative Humidity (RH) sensor that provides accurate readings in the presence of direct sunlight. The Solar Chimney is powered by the FireFly and automatically starts measuring after connecting to the FireFly. The Solar Chimney data is sent in addition to the data from the FireFly's internal sensors, using the FireFly's wireless transmitter.

The design of the Solar Chimney causes the air inside the black section of the chimney to warm up in direct sunlight. As a result, air will flow upwards through the tube and ambient air is drawn in at the bottom. This allows the sensor, located in the bottom section, to accurately measure ambient conditions.

The Solar Chimney contains a microcontroller running the FireFly stack and a T/RH sensor, as described in more detail in the FlyWire protocol. All standard and optional commands are implemented, except for Set Values.

2. Standard/factory/test commands

The following commands have been implemented:

Request Sensor Values:

0x5A | 0x04 | 0x02 | CHK

After receiving this command the Solar Chimney replies with both the Temperature and Relative Humidity values in signed integer format. Both values are multiplied by 100 to allow a 2 decimal fractional value to be transmitted as a signed integer. The internal sensor has a Cyclic Redundancy Check (CRC) that is calculated for both temperature and relative humidity. If the CRC is invalid, the Solar Chimney will report a value of -100.00.

The Slave will respond with:

STF | 0x08 | 0x06 | MSBT | LSBT | MSBH | LSBH | CHK

MSB is the most significant byte and LSB is the least significant byte. xSBT is the temperature and xSBH the humidity.

For example, the Solar Chimney can give the following reply:

STF | 0x08 | 0x06 | 0x0A | 0x98 | 0x19 | 0xD5 | CHK

This can be decoded as follows:

Temperature: 0x0A98 = 2712 : 27.12 °C

Humidity: 0x19D5 = 6613 : 66.13 %RH

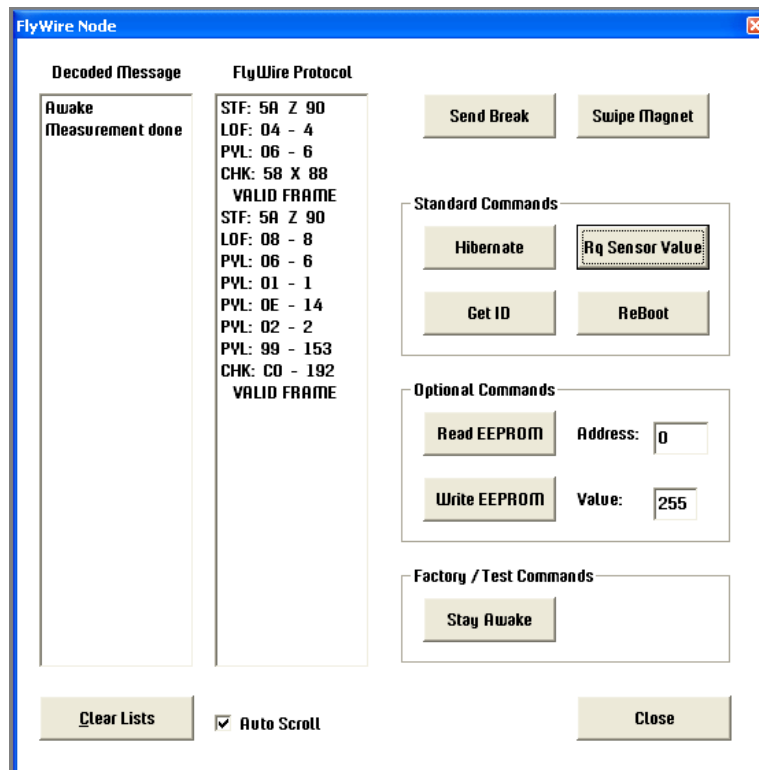


Figure 1: Solar Chimney reply to Get Sensor Values command.

Stay Awake:

0x5A | 0x04 | 0xE0 | CHK

This command will override the 1 second auto sleep feature of the Solar Chimney. After issuing this command the Solar Chimney will stay awake until a power cycle occurs or a Reboot or a Hibernate command is issued.

The Solar Chimney will reply with an ACK:

STF | LOF | NAK | CHK

In *Figure 1*, the Stay Awake command has been issued to prevent the Solar Chimney from going to sleep. This allows the user to press the Get ID and Rq Sensor Value buttons without having to send a break condition to wake up the device after a 1 second delay.

3. Custom commands

Besides formatted temperature and relative humidity data, the Solar Chimney can return the raw sensor values. For this, a custom command has been implemented compliant with the FlyWire protocol.

Get Raw Value:

0x5A | 0x04 | 0xF1 | CHK

This command returns the raw values as an unsigned integer

The Slave will respond with:

STF | 0x08 | 0x06 | MSBT | LSBT | MSBH | LSBH | CHK

MSB is the most significant byte and LSB is the least significant byte. xSBT is the temperature and xSBH the humidity.

SRH and ST denote the raw sensor output for humidity and temperature, respectively.

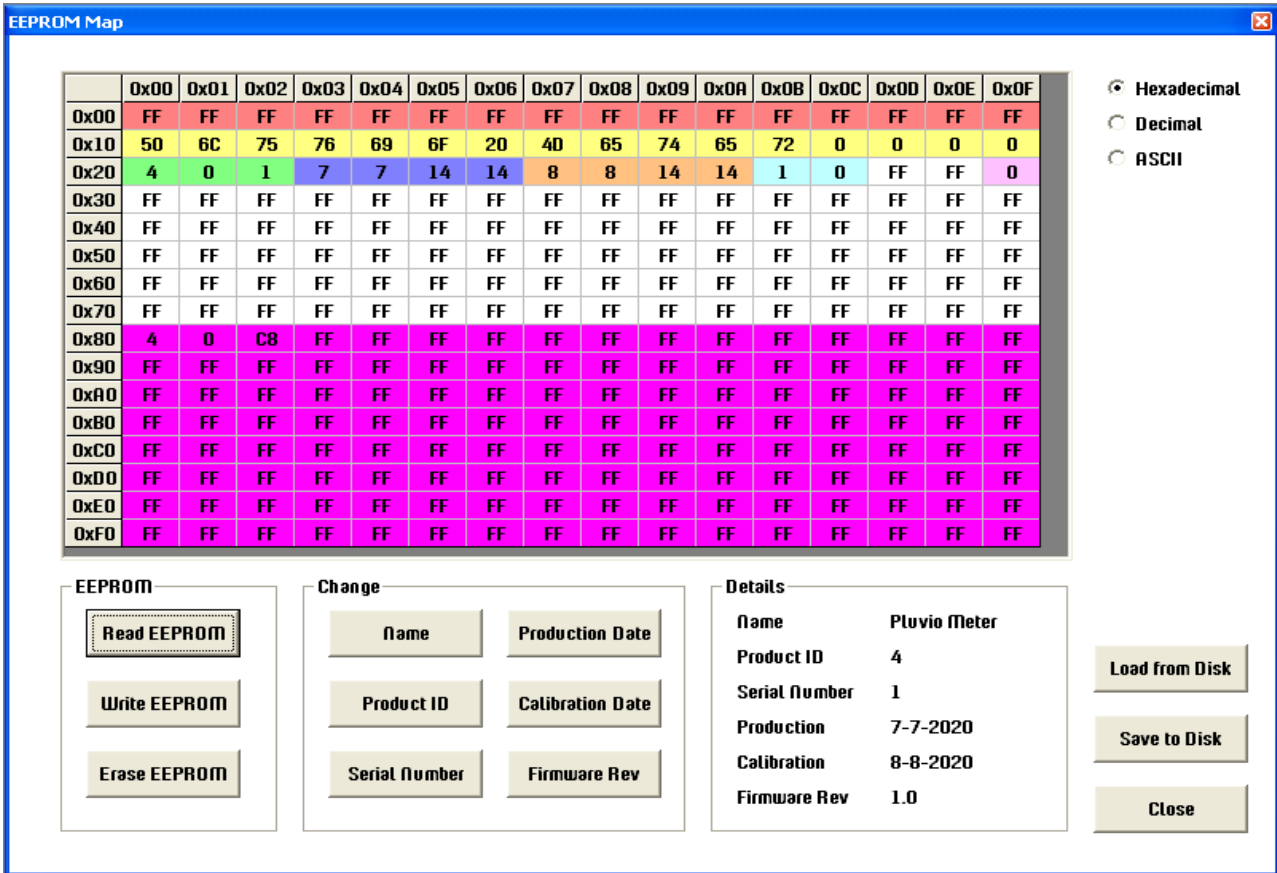
The temperature and relative humidity can be calculated from SRH and T by using the following equations:

$$RH[\%] = 100 \cdot \frac{SRH}{2^{16} - 1}$$

$$T[{}^{\circ}C] = -45 + \frac{175 \cdot ST}{2^{16} - 1}$$

IMPORTANT NOTE: These formulas only apply when SRH and ST are represented as decimal values!

4. EEPROM map



The screenshot shows the EEPROM Map application window. It features a grid of memory addresses from 0x00 to 0xF0. The data at 0x10-0x1F is 'Solar Chimney', at 0x20-0x21 is '00', at 0x22-0x23 is '01', at 0x24-0x25 is '0707', at 0x26-0x27 is '1414', at 0x28-0x29 is '0808', at 0x2A-0x2B is '1414', at 0x2C-0x2D is '0100', and at 0x2E-0x2F is 'FF00'. Below the grid are three panels: 'EEPROM' with 'Read EEPROM', 'Write EEPROM', and 'Erase EEPROM' buttons; 'Change' with 'Name', 'Production Date', 'Product ID', 'Calibration Date', 'Serial Number', and 'Firmware Rev' buttons; and 'Details' showing 'Name: Pluvio Meter', 'Product ID: 4', 'Serial Number: 1', 'Production: 7-7-2020', 'Calibration: 8-8-2020', and 'Firmware Rev: 1.0'. On the right, there are radio buttons for 'Hexadecimal', 'Decimal', and 'ASCII', and buttons for 'Load from Disk', 'Save to Disk', and 'Close'.

Figure 2: Example EEPROM memory snapshot.

- 0x00 – 0x0F Reserved
- 0x10 – 0x1F These locations hold the name of the device in ASCII. Unused locations at the end should be padded with 0x00. In the example above the EEPROM holds the name Solar Chimney.
- 0x20 – 0x22 Product ID and Serial Number. The SN consists of two bytes forming an unsigned integer. High byte at 0x21, low byte at 0x22. The product ID is 2 for the Solar Chimney. (see list of supported devices in the FlyWire protocol document). The Serial Number in the example is 0x0001 (1 in decimal)
- 0x23 – 0x26 Production date in DD/MM/YY/YY format. The year is split in two bytes. E.g. 2020 is stored as 20, 20 or 0x14, 0x14 in hex format. In the example both production date is set to July 7th 2020.
- 0x27 – 0x2A Calibration date in DD/MM/YY/YY format. In the example the calibration date is August 8th, 2020. Format is similar to the production date and set to 8 august 2020.
- 0x2B – 0x2C Firmware version. Major value is stored at 0x2B, minor value at 0x2C. In the example the firmware version is 1.0.

- 0x2F Location 0x2F is used for debugging. If its value is non-zero, the on-board LED will be lit as long as the Solar Chimney is active, and switch off in hibernation. When set to zero, the LED will always be off to preserve power.
- 0x80 – 0xFF This area is reserved for calibration data. It is not used in the Solar Chimney.