
User's Manual

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1. Overview

This *ATMEL Wireless and Microcontrollers* ISP software allows to program all our FLASH C51/C251 parts. It runs under Windows 9x, Windows 2000 and Windows NT as well. Linux and Solaris compliant versions will be released later on.

Communicating with the target device may be done through a RS232 link, a CAN or even an USB or an I2C link, depending on the communication media supported by the target device.

This software is named **FLIP**, which stands for: **FLexible In-system Programmer**.

2. Main features

- Intel MCS-86 Hexadecimal Object, Code 88 file format supported for data file loading and saving
- Optional address offset for loading
- Buffer control:
data byte modification, address range fill-in, goto a specified address, data byte sequence search
- Target device control:
Blank check, Program, Read, Verify, Erase, Special bytes edition capability
- Permanently displayed and updated information about the buffer options and the target device status
- Customizable flow for quick repeating programming
- Command window allowing control through a command file (Tcl language)
- Commands recording for automatic reconfiguration and commands replay.
- Progress bar, tooltips and on-line help

3. Software installation and setup

3.1. Windows installation

- Copy the *Flip_<version>.zip* file to an empty temporary directory.
- Perform the zip file extraction so that it builds a *Flip_<version>* directory.
- Open the *Flip_<version>* directory and run the *Setup* file.
- Follow the installation program instructions.

Starting from the release 1.3.0, FLIP supports two CAN hardware interfaces : the IXXAT CANdy interface and the VECTOR CANpari one. These interfaces must be connected to the PC parallel port. The installation procedures of these interfaces are described in the IXXAT and the VECTOR manuals.

Install the parallel / CAN interface software, connect the interface to the parallel port, reboot the PC, then run FLIP.

3.2. Linux installation

Not available, yet.

3.3. Solaris installation

Not available, yet.

4. Getting started

This chapter guides you through a short tour of FLIP to help you getting started with this ISP software.

Once the FLIP main window appears, you can see three areas from the left to the right: the *Operations Flow* area, the *Buffer Information* area and the *Device parameters* one.

Just below these three frames stands a command and history window which use will be discussed in Section “The history and command window”, page 10.

A *message log* window, a *progress bar* area and a *communication information report* are available at the bottom of the main window.

1. Connect your target hardware to the host platform serial port, CAN port or USB one.

At the time this document is written, some of these features are unavailable, but FLIP will be extended to support these communication media. Connect your target hardware to a power supply and reset it. We assume that the device to be programmed contains a FLIP compliant bootloader program.

2. Select a device from the device list.

From the top menu bar, select the **Device** item. In the *Device* pull-down menu, click the **Select** item. The *Device Selection* dialog box pops up. Select a device from the devices list box and click **OK**.

As soon as the device is selected, the *Device parameters* area is updated to let you see the selected device special bytes. The *Buffer information* area is updated as well with device dependent information.

3. Select a communication medium.

From the top menu bar, select the **Settings** item. In the *Settings* pull-down menu, click the **Communication** item. In the *Communication* cascading menu, select a communication medium.

The medium setup dialog box pops up. Adjust the communication parameters, and click **Connect**.

FLIP starts a synchronization sequence with the target device bootloader software. After the synchronization sequence completion, FLIP reads the target device special bytes and updates the main window frame on the right.

4. Select a HEX data file.

From the top menu bar, select the **File** item. In the *File* pull-down menu, click the **Load** item.

Select a HEX file from the file browser. FLIP parses the HEX file and fills in the edition buffer.

5. Open the buffer edition window.

From the top menu bar, select the **Buffer** item. In the *Buffer* pull-down menu, click the **Edit** item.

The *Edit Buffer* window pops up. You may now perform many operations onto the buffer contents.

For details about the possible buffer editing capabilities, see the Section “Editing the buffer and setting options”, page 6.

6. Open the buffer options window.

You may open the buffer options window from the FLIP main window, or from the *Edit Buffer* dialog box.

From the main window menu bar, select the **Buffer** item. In the *Buffer* pull-down menu, click the **Options** item.

The *Buffer Options* dialog box pops up. The main buffer options are: the buffer size, the initial contents, the address programming range and the loading offset. For details about these options, see the Section “Editing the buffer and setting options”, page 6.

7. Program the target device.

From the top menu bar, select the **Device** item. In the *Device* pull-down menu, click the **Program** item.

This concludes our short tour of the FLIP demo. For detailed descriptions of the possible operations, please read the following chapters.

5. Selecting a device

From the top menu bar, select the **Device** item. In the *Device* pull-down menu, click the **Select** item. The *Device Selection* dialog box pops up. Select a device from the devices list box and click **OK**.

As soon as the device is selected, the *Device parameters* area is updated to let you see the selected device special bytes. The *Buffer information* area is updated as well with device dependent information.

The device selection may be done by pressing the **F2** function key.

Each device supports a particular set of communication media.

You may use FLIP as an HEX file editor only; in that case, you do not have to select a device from the device list.

6. Selecting a communication medium

From the top menu bar, select the **Settings** item. In the *Settings* pull-down menu, click the **Communication** item. In the *Communication* cascading menu, select a communication medium. The medium setup dialog box pops up.

The communication medium selection may be done by pressing the **F3** function key.

6.1. RS232

Adjust the communication parameters, and click **Connect**.

FLIP starts a synchronization sequence with the target device bootloader software. After the synchronization sequence completion, FLIP reads the target device special bytes and updates the *Device parameters* area.

Important note:

The RS232 synchronization sequence will probably pass, even at high baudrates. Nevertheless, you must take care to the baudrate selection: if the target hardware oscillator frequency is too low, the bootloader cannot achieve characters reception/transmission and FLASH programming properly. In such cases, you have to decrease the baudrate.

FLIP will warn you through a message box if such a situation occurs. The following table shows the valid Osc. freq./Baudrate pairs which allow a successful RS232 transmission.

Freq. / Baudrate	2400	4800	9600	19200	38400	57600	115200
11.0592 MHz	✓	✓	✓	✓	✓		✓
12.0000 MHz	✓	✓	✓	✓	✓		
14.7456 MHz	✓	✓	✓	✓	✓	✓	✓
16.0000 MHz	✓	✓	✓	✓	✓		
22.1184 MHz	✓	✓	✓	✓	✓	✓	✓
24.0000 MHz	✓	✓	✓	✓	✓	✓	

6.2. CAN

- Select the proper CAN interface from the pulldown CAN menu. FLIP supports several CAN interfaces: three of them must be connected to the PC parallel port, one of them has been developed by Atmel-wm and must be connected to the PC RS232 port; the last one is an USB to CAN interface.

The *Controller Area Network Setup* dialog box shows up.

- Adjust the communication parameters port and baud rate.
- Click the **Init** button; this initializes the CAN hardware interface connected to the PC.

- Check the node number and the *CRIS* parameters values; change them if necessary. For the *CRIS* parameter to be taken into account, you must hit the **RETURN** key after typing the new *CRIS* value; this updates the IDs values displayed in the dialog box.

Click the **Node Connect** button. FLIP reads the target device special bytes and updates the *Device parameters* area.

7. Device special bytes

7.1. General options

The device special bytes are displayed in the main window *Device parameters* area. Some of them are read-only. You may read the special bytes at any time, *if allowed by the security level*, by clicking the **Read** button.

Changing the special bytes values is straight forward: set a new value in the proper entry field and click the **Set** button. FLIP will write the special bytes new values *and will read back the special bytes values from the device*. This guaranties that the displayed values are the device ones, not only values to be programmed.

FLIP takes care about the current security level and disables the *Read* and the *Set* buttons when necessary.

7.2. CAN options

For devices supporting the CAN protocol, FLIP provides a **CAN** button at the bottom of the *Device parameters* area. Clicking the **CAN** button makes the *CAN Node Configuration* dialog visible. It lets you read and modify a CAN node parameters.

The parameters that may be changed are :

- node number
- CRIS (CAN Relocatable Identifier Segment)
- BTC1 / BTC2 / BTC3 (Byte Timing Configuration)

To change a value, simply type the new value in the proper entry and click the **Set** button.

After any CAN node configuration modification, you must reset the target device in order to force the new configuration to be taken into account.

8. Editing the buffer and setting options

FLIP allows many operations on the buffer. This chapter describes each of them.

8.1. The Edit Buffer window

From the top menu bar, select the **Buffer** item. In the *Buffer* pull-down menu, click the **Edit** item.

The entries are not case sensitive. Nor X, neither *0X* prefix is necessary when you type addresses or data values.

- File > Load ...

Loads a HEX file into the buffer. Use the file browser to select a file.

- File > Save as ...

Allows saving the buffer contents to a file.

The range of addresses which will be saved is recalled in the main window *Buffer Information* area, with the *Range* label. You may modify the range values through the *Buffer Options* dialog box. In the *Address Programming Range* field, select the **User Defined Address Range** option and set the **Min** and **Max** addresses, then click **OK** or **Apply**. The main window *Buffer Information* area should reflect your changes.

- Edit > Modify ...

Opens a dialog box which lets you modify the buffer contents. Type an address and a data value in hexadecimal format.

After modification, the buffer window is scrolled and a yellow tag highlights the modified address. You may perform buffer modifications by merely double-clicking a data byte within the buffer window.

Click the **Apply** button to perform changes without closing the *Modify Buffer* dialog box. Click the **OK** button or hit the **Return** key to perform changes and close the dialog box.

- **Edit > Goto ...**
Opens a dialog box which lets you specify an address you want to scroll to.
- **Edit > Fill ...**
Lets you enter a start address, an end address, and a value you want to be used to fill the defined address range. Click the **Fill** button to fill the address range. Use the **Check** button when you want to check an address range contents.
- **Edit > Reset ...**
Use this command to reset the buffer to the default blank value. The default blank value is displayed in the main window *Buffer Information* area. You can change it by using the *Buffer Options* window.
- **Device > Read**
Use this command to read the target device FLASH memory. The *Edit Buffer* window is updated afterwards.
- **Device > Program**
Use this command to program the target device FLASH memory.
The device programming address range is displayed in the main window *Buffer Information* area and is labeled *Range*. You can change it by using the *Buffer Options* window.
- **Device > Verify**
This command lets you compare the target device memory contents with the buffer one. The comparison is done between (and including) boundary addresses. The address range is displayed in the main window *Buffer Information*. You can change it by using the *Buffer Options* window.
FLIP displays the first fail address, if any.
- **Options ...**
This command opens the *Buffer Options* dialog box.

8.2. The Buffer options window

From the top menu bar, select the **Buffer** item. In the *Buffer* pull-down menu, click the **Options** item. The entries are not case sensitive. Nor X, neither OX prefix is necessary when you type addresses or data values.

- **Buffer Size**
After a device selection, this option is set to device dependent state by default; this means that the buffer size is set to the target device memory one (in Kbytes).
You may override this option setup and define a different buffer size value.
- **Initial Buffer Contents**
After a device selection, this option is set to device dependent state by default; this means that the buffer default reset value is set to the target device memory blank value.
You may override this option setup and define a different buffer reset value.
- **Reset Buffer Before Loading**
Set this option to *yes* only if you want the buffer to be reset to the blank value before reading the HEX file. The default *No* value is useful when you intend to load several HEX files into the buffer.
- **Address Programming Range**
This option lets you define the address range which will be used to program the target device. It can be set to the following values:
 - **Address Range From Last Buffer Load**
This is the default setup. The address programming range is set to the address range of the last HEX file loaded into the buffer.
 - **Whole Buffer**
The whole buffer address range will be used to program the target device.

- **User Defined Address Range**

Select this option if you want to define a particular range of address to program the target device.

- **Loading Address Offset**

This field lets you enter an offset value to be added to the HEX file addresses before loading the buffer.

8.3. The Buffer Checksum

The buffer checksum value is displayed in the main window *Buffer Information* area.

The checksum is calculated on the address range displayed in the *Buffer Information* area; the address boundaries are included in the address range. As described in the above paragraph, the user has control over the address programming range.

The checksum value is updated each time the buffer is modified within the address programming range by operations like: reset, modify, fill, HEX file loading and device reading.

9. Executing operations on the target device

From the top menu bar, select the **Device** item. In the *Device* pull-down menu, select an operation.

- **Device > Select ...**

Use this command to select a device from a list.

- **Device > Erase ...**

This command pops up a dialog box for you to enter the erasing options. Some devices do not allow erasing per block; FLIP takes care about this by making the corresponding selections impossible.

- **Device > Blank Check ...**

This command lets you compare the target device contents to the blank value. The current blank value is displayed in the *Buffer Information* area of the main window. The verification is done between (and including) two boundary addresses which you can adjust through the *Blank Check* dialog box *Start Address* and *End Address* fields. Click the **Check** button to perform the operation. The pass/fail status is displayed in the *Blank Check* dialog box. If an error occurs the fail address is reported in the *Blank Check* dialog box.

Use the dialog box **Reset** button to clear any previous check status message.

- **Device > Read ...**

This command lets you read the target device contents between two boundary addresses. You can specify these boundaries through the dialog box *Start address* and *End address* fields.

- **Device > Program**

This command launches the target device programming. The device programming address range is displayed in the main window *Buffer Information* area and is labeled *Range*. You can change it by using the *Buffer Options* window.

- **Device > Verify**

This command lets you compare the target device contents to the buffer one. The verification is done on the address range displayed in the main window *Buffer Information* area and is labeled *Range*. You can change it by using the *Buffer Options* window.

10. Operations flow

The operations flow is displayed on the left part of the FLIP main window. It lets you select a number of operations to be performed sequentially. You launch the flow sequence by clicking the **Run** button.

When an operation completes, the corresponding check box color changes from white to green (for pass status) or red (for fail status).

If one of the operations fails, the operations flow stops.

Some operations in the flow require that you perform a setup, first :

- Erase - Setup the erase options through *Device > Erase ...*
- Blank Check - Setup the Blank Check options through *Device > Blank Check ...*
- Program - Setup the address programming range through *Buffer > Options ...*
- Verify - Setup the address verifying range through *Buffer > Options ...*

Use the **Clear** button to clear all checkboxes in the flow.

11. The history and command window

Starting with the FLIP version 1.2.0, the history and command window can be displayed through the Settings > Command Window pulldown menu.

This window keeps the history of all actions performed on the target device or on HEX files, but it can do much more than this! Type **pwd** at the prompt and you will get the current FLIP working directory. Type **expr 2 + 5** and you will get the result of this addition.

FLIP has been written in Tcl and C; everything you type in the command window is interpreted by a Tcl interpreter. Type anything stupid in the command window (no example is provided here, you should be able to find your own) and you will get an *invalid command name "stupid"* message.

The command window gives you access to the Tcl commands and you can rely on the Tcl power to write flexible scripts which you can then execute in the command window. Since some of the FLIP functions are made available to the Tcl command window, you can call these functions in you Tcl script. An example of use of this capability follows.

Imagine that the Erase function which performs the target device erase operation is called `erase_f`. This function returns 1 if erase passes and 0 if it fails. You want to perform the erase operation once, check if it passes or fails and execute it again if it has failed. Your Tcl script would be something like :

```
if { [ erase_f ] != 1 } {  
    erase_f  
}
```

Do not type this example in the command window because it cannot work. At the time this document is written, this scripting capability is not fully implemented and cannot be used to write production scripts, but it is used by the FLIP developpers for tests and software validation purposes. Future versions of FLIP will make this capability available to the end user and all the usable functions will be documented.

12. Recording and replaying commands

FLIP lets you build, load and play a configuration file so that you can quickly configure a large number of devices or repeat a given sequence onto the same device.

You may build a configuration file by launching FLIP, executing commands and saving these commands into a configuration file. You may also write this configuration file by hand.

12.1. Building the configuration file from FLIP

Launch FLIP and perform the following operations :

- Select a device
- Set the communication parameters and connect to the target device
- Load a HEX file from disk
- Program the device
- Build the configuration file by executing the *File > Save Configuration As...* pulldown menu command.

Even if you do not explicitly save a configuration file, it is built and saved anyway when you exit FLIP. In that case, it will be named flip.cfg by default and will be written in the directory in which the flip.exe file is located if you have write privileges to this directory.

Open the configuration file with a text editor to look at what FLIP has produced; you should see something like :

```
selectDevice T89C51RC2
set port COM1
set baud 57600
initProtocol RS232Standard
connectRS232 Standard
parseHexFile "D:/Labo/dev/app/Flip_dev/bin/2kisp.hex"
setupProgramDevice
runOperations
```

12.2. Loading and running the configuration file

Use the *File > Load Configuration...* pulldown menu command to load and execute a configuration file.

You can then rerun the configuration file without loading it by simply pressing the **F5** function key.

12.3. Building a configuration file using a text editor

The configuration file is mainly made of calls to Tcl procedures defined in FLIP. Tcl being case sensitive, you must take care to the syntax.

- Selecting a device
Syntax : `selectDevice <device_name>`
Example : `selectDevice T89C51RC2`
- Selecting a communication port
Syntax : `set port <port_name>`
Example : `set port COM1`
- Selecting a baudrate
Syntax : `set baud <baudrate>`
Example : `set baud 57600`

- Connecting to the device
The connection is made of two steps: you first specify a protocol and then connect to the device.
Syntax :
initProtocol <medium-protocol_name>
connectRS232 <protocol_name>
Example :
initProtocol RS232Standard
connectRS232 Standard
- Loading a HEX file
Syntax : parseHexFile "<hex_file_pathname>"
Example 1 : parseHexFile "D:/Labo/dev/app/Flip Dev/bin/2kisp.hex"
The double quotes may be omitted if the file pathname does not contain any space.
Example 2 : parseHexFile D:/Labo/dev/app/FlipDev/bin/2kisp.hex
- Erasing the device
Some devices only support a full chip erase operation; some others support full chip and per block erasing operations.
 - Full chip erase :
Syntax : setupFullEraseDevice
 - Block erase :
Syntax : setupEraseBlock<i>
Example : setupEraseBlock0
If you intend to erase several blocks, simply write several block erase lines with different block numbers.
- Blank checking the device
Checking that a device is blank requires that you enter three lines :
Syntax :
setupBlankCheckDevice
set blankCheckAddr(start) <start_addr>
set blankCheckAddr(end) <end_addr>
Example :
setupBlankCheckDevice
set blankCheckAddr(start) 0000
set blankCheckAddr(end) 7FFF
- Programming the device
Syntax : setupProgramDevice
- Verifying the device
Syntax : setupVerifyDevice
- Setting the Software Boot Vector value
Syntax : setupSBV <value>
Example : setupSBV FC
- Setting the Boot Status Byte value
Syntax : setupBSB <value>
Example : setupBSB FE

- Setting the device security level
Syntax : setupSecurityLevel <security_level>
Example : setupSecurityLevel 1
- Programming the Oscillator fuse
Syntax : setupOscFuse <value>
Example : setupOscFuse 1 (*)
- Programming the BLJB fuse
Syntax : setupBljbFuse <value>
Example : setupBljbFuse 1 (*)
- Programming the X2 fuse
Syntax : setupX2Fuse <value>
Example : setupX2Fuse 1 (*)

The above commands do not actually perform the described operations, they only setup them. In order to execute the described operations, you must add a runOperations command to the configuration file.

You may comment out a line of the configuration file by inserting a "#" character at the beginning of the line.

12.4. Configuration file example

Putting all this together, we can build a full configuration file :

```
# ----- Configuration file example -----  
#  
# Device selection and communication setup  
selectDevice T89C51RC2  
set port COM1  
set baud 57600  
initProtocol RS232Standard  
connectRS232 Standard  
#  
parseHexFile "D:/Labo/dev/app/Flip_dev/bin/2kisp.hex"  
# Erase 3 blocks  
setupEraseBlock0  
setupEraseBlock1  
setupEraseBlock2  
# Blank checking requires 3 lines  
setupBlankCheckDevice  
set blankCheckAddr(start) 0010  
set blankCheckAddr(end) 07FF  
# Program the device with the above loaded HEX file  
setupProgramDevice  
# Verify proper device programming  
setupVerifyDevice  
# Program the special bytes  
setupSBV FB  
setupBSB 81  
setupOscFuse 1  
setupBljbFuse 0  
setupX2Fuse 1  
setupSecurityLevel 1  
# Without the following line, nothing would be done!  
runOperations
```

(*) Please read the device data sheet to determine if the "on" value is 1 or 0.

13. Troubleshooting

It may happen that FLIP prompts you with warning or error messages; this chapter lists these messages and explains where they come from.

13.1. Global messages

- **Time Out Error**

Check the communication medium connections and the target hardware power supply.

If everything is alright, reset the target hardware and select a smaller baud rate from the FLIP communication medium dialog box. For maximum performance purpose, FLIP and its software companion (the bootloader) do not perform any data flow control (no XON/XOFF). Therefore, at high baud rates, it may happen that the bootloader has no time enough to perform data management and does not answer properly to the FLIP commands or the answer comes too late.

- **Software Security Bit set. Cannot access device data.**

The major part of the target device is protected against writing operations when the device is set to the security level 1 and protected against reading operations when the device is set to the security level 2. The above message means that the operation performed by FLIP is not legal.

13.2. CAN messages

- **CAN interface error**

The PC parallel port to CAN hardware interface did not execute the FLIP command properly.

- **Unexpected CAN response data length**

The length of the CAN message sent by the bootloader is unexpected.

- **The bootloader did not understand the FLIP command**

The CAN protocol stack specification mentions that while sending programming frames to the device, the bootloader may answer with a data byte of 0x00 if it got all data from FLIP, 0x02 if it expects more data from FLIP and 0x01 if the bootloader failed to execute the write command.

- **Got an error message ID from the bootloader but the CAN message data value is not correct.**

The bootloader has detected an error condition and signals it by an error message which is itself corrupted.

- **Got an error message ID from the bootloader but the CAN message data length is not correct.**

The bootloader has detected an error condition and signals it by an error message which length is not correct.

- **The CAN message ID is not correct.**

The bootloader answer contains an incorrect identifier.

- **Invalid bootloader answer on blank check**

During the device blank check operation, the bootloader has sent an incorrect answer to FLIP.

13.3. RS232 messages

- **The board reply is not correct**

Probably a framing error detected by the microcontroller UART.

- **The RS232 port could not be opened**

The selected serial port does not exist or has not been closed properly. Quit FLIP and start it again.

- **Check sum error**

The bootloader has received from FLIP a frame which checksum is not correct.

