Application Note

AN_561

Using Linux I2C Tools with HID FT260

Version 1.0

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This document shows how to use the new HID-FT260 library in the latest Linux kernel. This library was designed to easily implement I2C communication with the FT260 IC.

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1 Introduction

This document illustrates how to use the HID-FT260 driver built into the latest Linux kernels to configure the FTDI FT260 in I2C mode.

1.1 Overview

Until recently, implementing USB to I2C with the FT260 in Linux required detailed knowledge of FT260 opcodes and familiarity with complex HID IOCTL commands. With the addition of the HID-FT260 driver into the latest Linux kernels, this process can now be handled by a simple command line interface.

1.2 Scope

This document shows the user how to use the HID-FT260 driver in Linux to implement a USB to I2C Master bridge using Linux I2C tools. Other FT260 features such as UART and GPIO are not covered in this document. Refer to AN_394 User Guide for FT260 for details on how to control the FT260 IC with raw HID class commands for UART and GPIO control.

2 Hardware and Software Requirements

2.1 Linux OS for HID-FT260

For HID-FT260 driver support, ensure the Linux installation is running kernel version **5.15** or later.

Ubuntu release 22.04 LTS was used for the examples in this document. To verify your kernel version, use the following command:

uname -r <enter>

2.2 Linux Software Required

Download the Linux I2C utilities to run the examples in this document. Once installed, you can use Linux man pages for more details about the I2C commands.

Use the following command in Terminal window:

sudo apt install i2c-tools <enter>

2.3 FTDI Hardware Required

UMFT260EV1A development module as shown in Figure 2.1.

Figure 2.1 UMFT260EV1A

2.4 Miscellaneous Hardware

- Microchip 24AA02 2K I2C Serial EEPROM
- 10K 1/4-watt resistors for I2C pullups
- Breadboard

3 Hardware Setup

3.1 UMFT260EV1 and 24AA02 EEPROM Breadboard

Figure 3.1 shows the simple connections between the UMFT260EV1 & 24AA02 EEPROM.

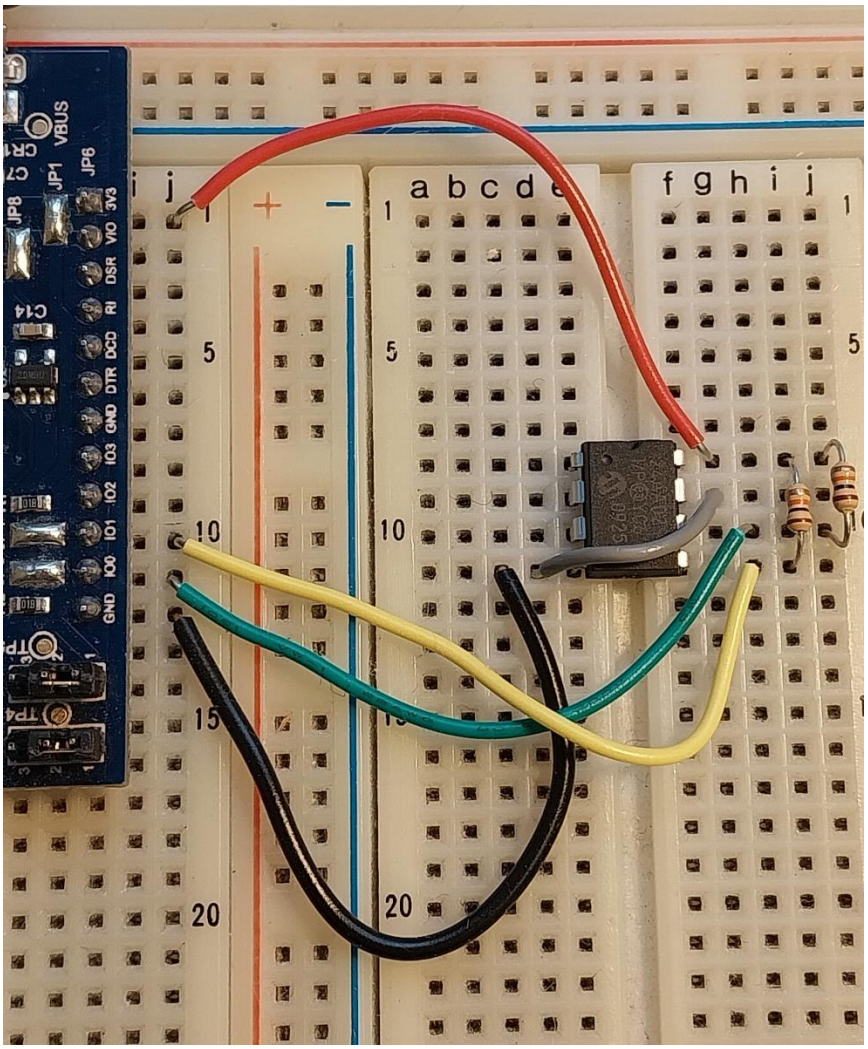

Figure 3.1 UMFT260EV1 + EEPROM Breadboard

3.2 UMFT260EV1 and 24AA02/24LC02 EEPROM Schematic

Figure 3.2 shows the schematic diagram of the picture shown in the previous section.

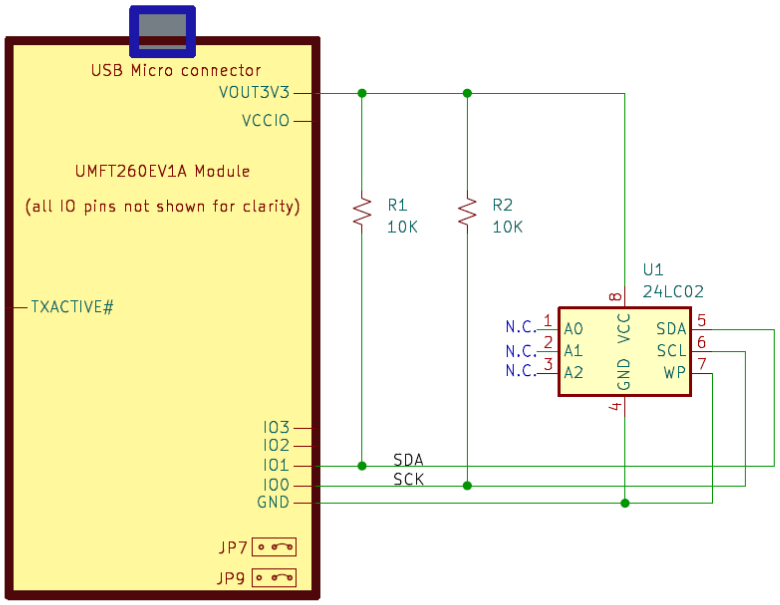

Figure 3.2 FT260 + I2C Serial EEPROM Circuit Schematic

4 Linux I2C Utilities and HID-FT260

4.1 Basic Commands

The basic Linux I2C commands covered in this document are:

- i2cdetect
- i2cdump
- i2cset
- i2cget
- i2ctransfer

These commands will be used with the UMFT260EV + 24AA02 EEPROM hardware setup described in Section 3 Hardware Setup.

All commands are used with a Linux terminal window.

4.1.1 i2cdetect

The first task is to show all the I2C devices present on the bus and identify the FT260 device.

With the UMFT260 setup and plugged in, open a Linux terminal window. The -l (lower case 'L') argument will list all I2C controllers on the Linux PC.

Enter the following command as shown in Figure 4.1.

```
sudo i2cdetect -l  <ret>
```

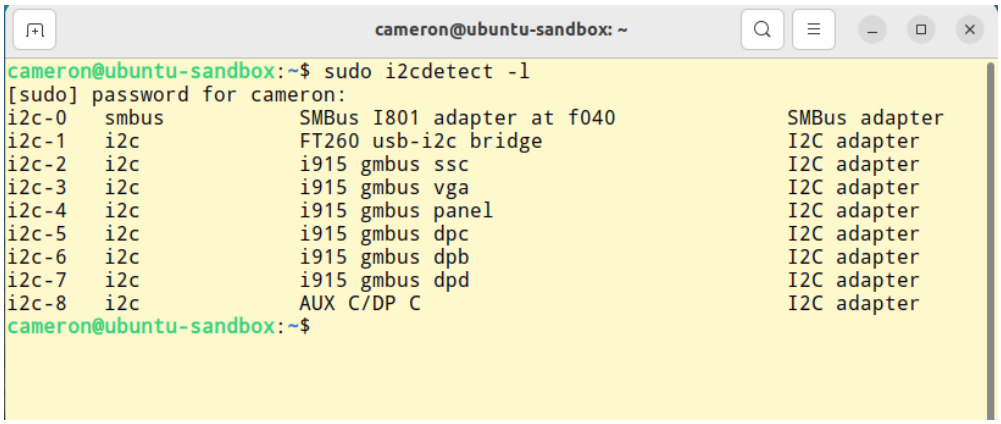

Figure 4.1 i2cdetect -l command

The results of this command indicate the bus name of the FT260 is **i2c-1.**

All Linux I2C command examples will refer to this as bus 1.

Note: You can implement the I2C commands without the "sudo" (super user) prefix by going to the /dev directory and changing the permissions of the i2c-* device assigned to the FT260 as shown in the previous screenshot.

```
cd /dev <ret>
sudo chmod 777 i2c-*  <ret>
```

This will allow you to run the Linux I2C commands as a normal user.

To find the I2C Slave address of I2C slaves connected to the FT260 you can use the i2cdetect command with the -y option to show all the I2C slave addresses connected to the FT260 i2c bus, i2c-1 as shown in Figure 4.2.

```
i2cdetect -y 1 <ret>
```

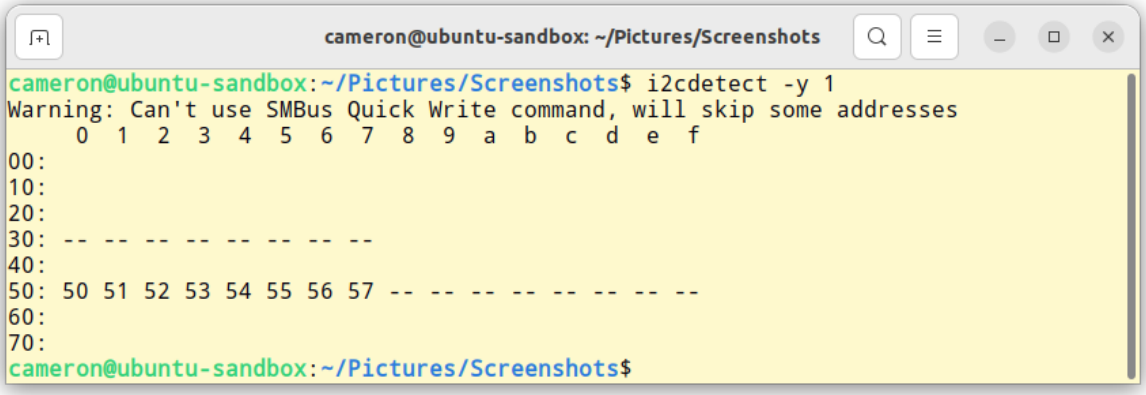

Figure 4.2 i2cdetect -y 1 command

For the command demonstrations in this app note, I2C slave address 0x51 will be used.

4.1.2 i2cdump

This command is used to dump all the data from any attached I2C slave device. The following command will show the contents of the empty 24AA02 serial EEPROM at slave address 0x51. The entire 256 x 8-bit address space will be listed as shown in Figure 4.3.

```
i2cdump -y 1 0x51 <ret>
```

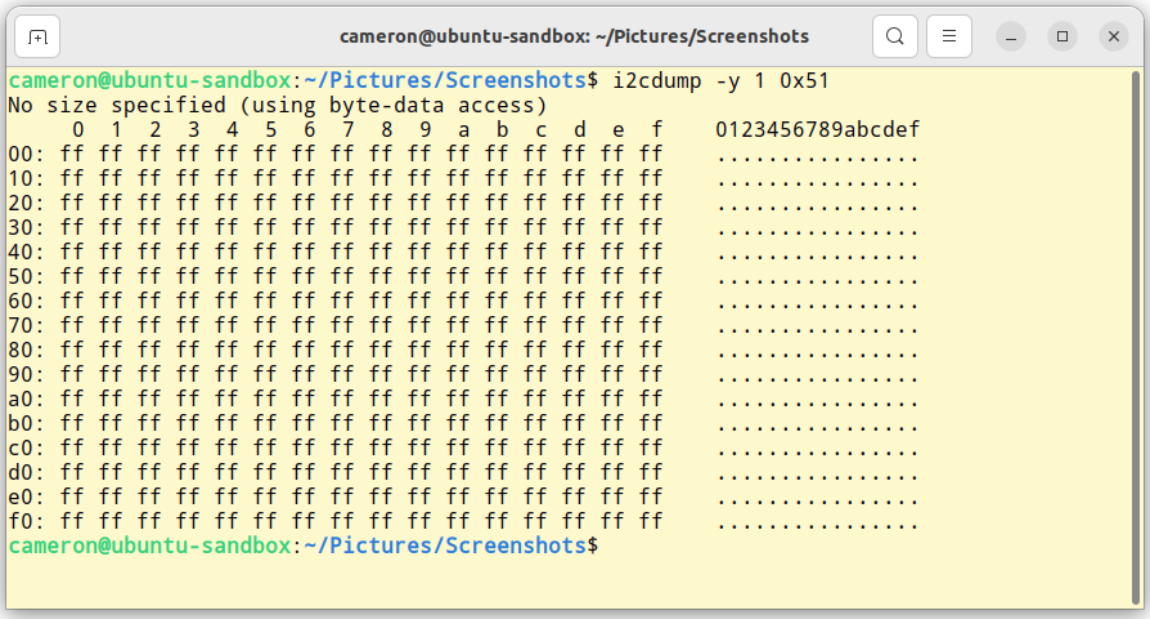

Figure 4.3 i2cdump command

4.1.3 i2cset/i2cget

This command is used to assign data to a given address on the I2C Slave device. The bus number of the FTDI device must be specified and the target address / data.

In this example, we write hex 0x46 to address 0x00 in the EEPROM and read the result from address 0x00 as shown in Figure 4.4.

```
i2cset -y 1 0x51 0x00 0x46 <ret>
i2cget -y 1 0x51 0x00 <ret>
```

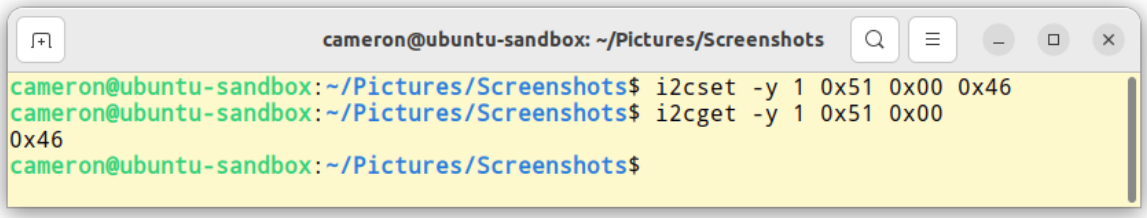

Figure 4.4 i2set/i2cget commands

4.1.4 i2ctransfer

You can transfer up to 8 bytes of data to the I2C slave using this command. The following command shows how to write 8 bytes of data starting at address offset 0.

```
i2ctransfer -y 1 w9@0x51 0 0x46 0x54 0x20 0x32 0x36 0x30 0x20 0x4c 0x69 <ret>
```

Note: The w9 argument specifies the address offset (1 byte) plus the total number of bytes to write (8) making this value.

Another 8 bytes of data can be sent by specifying an address offset of 9:

```
i2ctransfer -y 1 w9@0x51 9 0x6e 0x75 0x78 0x20 0x44 0x65 0x6d 0x6f <ret>
```

Confirm by sending the i2ctranfer command in read mode.

Note: This will read all the data written to the EEPROM including the data sent by the two i2ctransfer commands.

```
i2ctransfer -y 1 w1@0x51 0 r 16 <ret>
0x46 0x54 0x32 0x30 0x20 0x4c 0x69 0x6e 0x75 0x78 0x30 0x44 0x65 0x6f
```

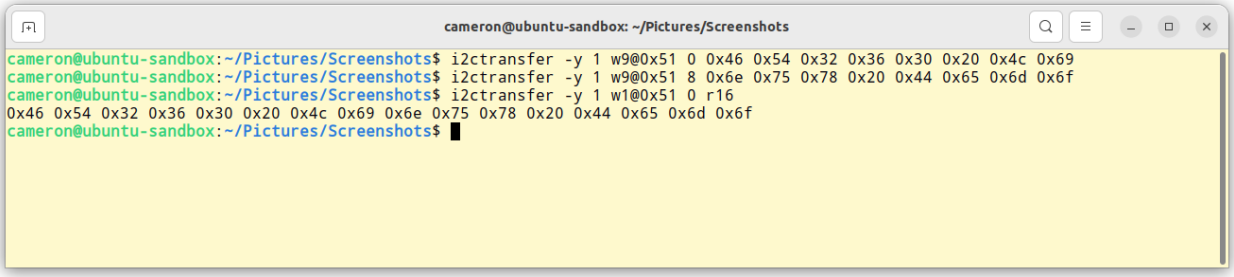

Figure 4.5 i2ctransfer commands

The i2cdump command can be used to show the contents of the first 16 addresses of the EEPROM memory as follows:

```
i2cdump -y -r 0x00-0xF 1 0x51 <ret>
```

This will show the the ASCII characters that were written to the I2C EEPROM in the previous exercises as shown in Figure 4.6.

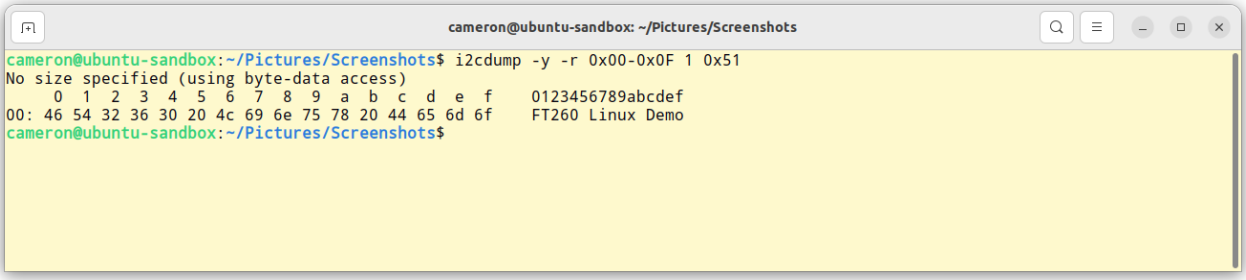

Figure 4.6 i2cdump command showing ASCII characters

5 Conclusion

In this document, a simple way of sending I2C data using our FT260 IC has been demonstrated for Linux using the new HID-FT260 kernel driver and the built-in Linux I2C commands.

With this utility and driver, there is no need to develop code using formal high-level programming and API calls.

The I2C utility commands can be included in a Linux batch file or C program using the system API command.

This new driver is a powerful tool for engineers who need to develop USB to I2C applications in a timely manner.

6 Contact Information

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Distributor and Sales Representatives

Please visit the Sales Network page of the FTDI Web site for the contact details of our distributor(s) and sales representative(s) in your country.

Appendix A – References

Document References

FT260 HID-class USB to UART/I2C Bridge IC Datasheet, FTDI Ltd.

UMFT260EV1A FT260 DIP Development Module, FTDI Ltd.

24AA02/24LC02B/24FC02 2K I²C Serial EEPROM, Microchip Inc.

HID-FT260 Source Code, GitHub

I2C Utilities in Linux, Sushil Rathore

Linux man pages are available for the I2C utility commands used in this document.

(man i2cget <ret>)

AN_394 User Guide for FT260

FT260Q IC Product Page

FT260S IC Product Page

Acronyms and Abbreviations

Terms	Description
ASCII	American Standard Code for Information Interchange
EEPROM	Electrically Erasable Programmable Read-Only Memory
GPIO	General Purpose Input/Output
I²C	Inter-Integrated Circuit Interface
IC	Integrated circuit
IOCTL	Input/output control
HID	Human Interface Device
HID-FT260	A Linux kernel level driver for the FT260, developed by Michael Zaidman of Xsight Labs.
UART	Universal Asynchronous Receiver/Transmitter
USB	Universal Serial Bus

Appendix B – List of Tables and Figures

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Appendix C – Revision History

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