USB HID Transport

When connected via USB, the Touch Sensor Module communicates in Full Speed (12 Mbit/s) in two modes: Raw HID mode (also called HID Pipe) and HID Touch Digitizer mode. HID Touch Digitizer mode is initiated automatically as soon as the sensor module is plugged in. In order to use Raw HID mode, the module's operation mode must be changed. For more information, refer to Initializing Sensor Modules.

HID Touch Digitizer Mode

The Touch Sensor Module acts as a HID Input device and communicates directly with the OS, and is completely plug and play.

> **Ubuntu 17.10 - 18.04**
>
> The sensor module is not recognized as a touch screen in the Ubuntu versions 17.10 - 18.04. This has been fixed and works fine in Ubuntu 18.10.

Raw HID Mode / HID Pipe

This mode uses two HID Feature Reports to communicate with the host.

- Send data to the sensor module by writing to Feature Report 1.
- Read data from the sensor module by reading from Feature Report 2.

Refer to zForce Message Specification for examples of requests, responses and notifications.

USB Communication in Different Operating Systems

Depending on the system and programming language you are using to write and read from a feature report, the implementation differs. For example, in Windows, this is abstracted and the hid.dll offers a function to get and set feature reports, while in for example a UNIX based OS, you might have to implement your own function to get and set a feature report.

The **communication** heading below describes how to implement your own get and set feature report functions, using a control transfer.

> **USB Permission**
>
> Depending on operating system you might need explicit permission for your program to have access to the HID device.

How to Implement Custom Functions for Raw HID Communication

In order to communicate with the sensor module the data flow type called *control transfer* should be used. The control transfer usually takes the following parameters:

- Request Type (*int*)
- Request (*int*)
- Value (*int*)
- Index (*int*)
- Data (*byte array*)
- Length (*int*)
- Timeout (*int*)

Writing to Feature Report 1

When writing to the sensor module, a full 257 bytes need to be sent no matter how long the actual message is. Take a look at the code snippet below, to see how this could be done.

```
uint8_t operationMode[] = { 0x01, 0x17, 0xEE, 0x15, 0x40, 0x02, 0x02, 0x00,
                                                    0x67, 0x0F, 0x80, 0x01, 0xFF, 0x81, 0x01, 0x00,
                                                    0x82, 0x01, 0x00, 0x83, 0x01, 0x00, 0x84, 0x01, 0x00 };
// The first two bytes are the header. First byte is feature report, second byte is length of the following
data.
uint8_t data[257];
memcpy(data, operationMode, sizeof(operationMode));

int requestType = 0x00 | (0x01 << 5) | 0x01; // USB_HOST_TO_DEVICE | USB_TYPE_CLASS | USB_RECIPIENT_INTERFACE
int request = 0x09; // SET_CONFIGURATION = 0x09
int value = 0x0301; // 0x03 for feature report, 0x01 for feature report 1
int index = 0x0000;
int length = sizeof(data);
int timeout = 0;

 connection.controlTransfer(
            requestType,
            request,
            value,
            index, data, length, timeout);
```

Reading from Feature Report 2

When reading from feature report 2, the message is always 258 bytes long.

```
uint8_t data[258];

int requestType = 0x80 | (0x01 << 5) | 0x01; // USB_DEVICE_TO_HOST | USB_TYPE_CLASS | USB_RECIPIENT_INTERFACE
int request = 0x01; // CLEAR_FEATURE = 0x01
int value = 0x0302; // 0x03 for feature report, 0x02 for feature report 2
int index = 0x0000;
int length = sizeof(data);
int timeout = 0;

connection.controlTransfer(
            requestType,
            request,
            value,
            index, data, length, timeout);
```

HID Report Descriptor

The HID Report Descriptor is subject to change. The descriptor below is from firmware version 1.47.

Item	Data
Usage Page (Digitizer)	05 0D
Usage (Touch Screen)	09 04
Collection (Application)	A1 01
Report ID (4)	85 04
Usage (Contact Count Maximum)	09 55
Logical Minimum (0)	15 00
Logical Maximum (-1)	25 FF
Report Size (8)	75 08
Report Count (1)	95 01
Feature (Data,Var,Abs,NWrp,Lin,Pref,NNul,NVol,Bit)	B1 02

Report ID (3)	85 03
Usage (Contact Count)	09 54
Input (Data,Var,Abs,NWrp,Lin,Pref,NNul,Bit)	81 02
Usage (Scan Time)	09 56
Logical Maximum (65535)	27 FF FF 00 00
Report Size (16)	75 10
Unit Exponent (-4)	55 0C
Unit (SI Lin: Time (s))	66 01 10
Input (Data,Var,Abs,NWrp,Lin,Pref,NNul,Bit)	81 02
Usage (Finger)	09 22
Collection (Logical)	A1 02
Usage (Tip Switch)	09 42
Logical Maximum (1)	25 01
Report Size (1)	75 01
Report Count (1)	95 01
Input (Data,Var,Abs,NWrp,Lin,Pref,NNul,Bit)	81 02
Usage (Contact Identifier)	09 51
Logical Maximum (127)	25 7F
Report Size (7)	75 07
Report Count (1)	95 01
Input (Data,Var,Abs,NWrp,Lin,Pref,NNul,Bit)	81 02
Usage Page (Generic Desktop)	05 01
Usage (X)	09 30
Logical Maximum (65535)	27 FF FF 00 00
Report Size (16)	75 10
Report Count (1)	95 01
Input (Data,Var,Abs,NWrp,Lin,Pref,NNul,Bit)	81 02
Usage (Y)	09 31
Input (Data,Var,Abs,NWrp,Lin,Pref,NNul,Bit)	81 02
Usage Page (Digitizer)	05 0D
Unit Exponent (-2)	55 0E
Unit (SI Lin: Length (cm))	65 11
Usage (Width)	09 48
Usage (Height)	09 49
Report Count (2)	95 02
Input (Data,Var,Abs,NWrp,Lin,Pref,NNul,Bit)	81 02
End Collection	C0
Usage (Finger)	09 22
Collection (Logical)	A1 02
Usage (Tip Switch)	09 42

Logical Maximum (1)	25 01
Report Size (1)	75 01
Report Count (1)	95 01
Input (Data,Var,Abs,NWrp,Lin,Pref,NNul,Bit)	81 02
Usage (Contact Identifier)	09 51
Logical Maximum (127)	25 7F
Report Size (7)	75 07
Report Count (1)	95 01
Input (Data,Var,Abs,NWrp,Lin,Pref,NNul,Bit)	81 02
Usage Page (Generic Desktop)	05 01
Usage (X)	09 30
Logical Maximum (65535)	27 FF FF 00 00
Report Size (16)	75 10
Report Count (1)	95 01
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End Collection	C0
Usage (Finger)	09 22
Collection (Logical)	A1 02
Usage (Tip Switch)	09 42
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Report Count (1)	95 01
Input (Data,Var,Abs,NWrp,Lin,Pref,NNul,Bit)	81 02
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Usage Page (Generic Desktop)	05 01
Usage (X)	09 30
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Report Size (16)	75 10
Report Count (1)	95 01
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Usage (Y)	09 31
Input (Data,Var,Abs,NWrp,Lin,Pref,NNul,Bit)	81 02
Usage Page (Digitizer)	05 0D
Unit Exponent (-2)	55 0E
Unit (SI Lin: Length (cm))	65 11
Usage (Width)	09 48
Usage (Height)	09 49
Report Count (2)	95 02
Input (Data,Var,Abs,NWrp,Lin,Pref,NNul,Bit)	81 02
End Collection	C0
Usage (Finger)	09 22
Collection (Logical)	A1 02
Usage (Tip Switch)	09 42
Logical Maximum (1)	25 01
Report Size (1)	75 01
Report Count (1)	95 01
Input (Data,Var,Abs,NWrp,Lin,Pref,NNul,Bit)	81 02
Usage (Contact Identifier)	09 51
Logical Maximum (127)	25 7F
Report Size (7)	75 07
Report Count (1)	95 01

Input (Data,Var,Abs,NWrp,Lin,Pref,NNul,Bit)	81 02
Usage Page (Generic Desktop)	05 01
Usage (X)	09 30
Logical Maximum (65535)	27 FF FF 00 00
Report Size (16)	75 10
Report Count (1)	95 01
Input (Data,Var,Abs,NWrp,Lin,Pref,NNul,Bit)	81 02
Usage (Y)	09 31
Input (Data,Var,Abs,NWrp,Lin,Pref,NNul,Bit)	81 02
Usage Page (Digitizer)	05 0D
Unit Exponent (-2)	55 0E
Unit (SI Lin: Length (cm))	65 11
Usage (Width)	09 48
Usage (Height)	09 49
Report Count (2)	95 02
Input (Data,Var,Abs,NWrp,Lin,Pref,NNul,Bit)	81 02
End Collection	C0
End Collection	C0
Usage Page (Vendor-Defined 1)	06 00 FF
Usage (Vendor-Defined 1)	09 01
Collection (Application)	A1 01
Report ID (1)	85 01
Usage (Vendor-Defined 1)	09 01
Report Size (8)	75 08
Report Count (1)	95 01
Logical Minimum (0)	15 00
Logical Maximum (-1)	25 FF
Feature (Data,Var,Abs,NWrp,Lin,Pref,NNul,NVol,Bit)	B1 02
Usage (Vendor-Defined 2)	09 02
Report Count (255)	95 FF
Feature (Data,Var,Abs,NWrp,Lin,Pref,NNul,Vol,Buf)	B2 82 01
Report ID (2)	85 02
Usage (Vendor-Defined 1)	09 01
Report Count (1)	95 01
Feature (Data,Var,Abs,NWrp,Lin,Pref,NNul,NVol,Bit)	B1 02
Usage (Vendor-Defined 2)	09 02
Report Count (255)	95 FF
Feature (Data,Var,Abs,NWrp,Lin,Pref,NNul,Vol,Buf)	B2 82 01
Usage (Vendor-Defined 3)	09 03
Report Size (1)	75 01

Logical Maximum (1)	25 01
Report Count (1)	95 01
Input (Data,Var,Abs,NWrp,Lin,Pref,NNul,Bit)	81 02
Report Size (7)	75 07
Input (Cnst,Ary,Abs)	81 01
Report Size (8)	75 08
Report ID (128)	85 80
Usage (Vendor-Defined 1)	09 01
Feature (Cnst,Var,Abs,NWrp,Lin,Pref,NNul,NVol,Bit)	B1 03
Report ID (130)	85 82
Usage (Vendor-Defined 1)	09 01
Feature (Cnst,Var,Abs,NWrp,Lin,Pref,NNul,NVol,Bit)	B1 03
End Collection	C0

Parsed reports by Report ID

Input Report 2		
Bit offset	**Bit count**	**Description**
0	1	Internal use
1	7	(Not used)
Input Report 3		
Bit offset	**Bit count**	**Description**
0	8	Contact count
8	16	Scan Time
24	1	Tip Switch
25	7	Contact identifier
32	16	X
48	16	Y
64	16	Width
80	16	Height
96	1	Tip Switch
97	7	Contact identifier
104	16	X
120	16	Y
136	16	Width
152	16	Height
168	1	Tip Switch
169	7	Contact identifier
176	16	X
192	16	Y
208	16	Width

224	16	Height
240	1	Tip Switch
241	7	Contact identifier
248	16	X
264	16	Y
280	16	Width
296	16	Height
312	1	Tip Switch
313	7	Contact identifier
320	16	X
336	16	Y
352	16	Width
368	16	Height
384	1	Tip Switch
385	7	Contact identifier
392	16	X
408	16	Y
424	16	Width
440	16	Height
Feature Report 1 - Write		
Bit offset	**Bit count**	**Description**
0	8	Payload size (bytes)
8	2040	Payload
Feature Report 2 - Read		
Bit offset	**Bit count**	**Description**
0	8	Payload size (bytes)
8	2040	Payload
Feature Report 4		
Bit offset	**Bit count**	**Description**
0	8	Contact count maximum
Feature Report 128		
Bit offset	**Bit count**	**Description**
0	8	Internal use
Feature Report 130		
Bit offset	**Bit count**	**Description**
0	8	Internal use

Read More about the Communication Protocol

- Serialization Protocol Quick Start
- USB HID Transport
- I2C Transport
- zForce Message Specification
- Understanding the zForce ASN.1 Serialization Protocol

Read More

- Introduction
- Getting started with Touch Sensor Module Evaluation
- Getting Started with Software Integration
- Mechanical Integration
- Electrical Integration
- Software Integration
- Implementation Examples
- Specifications
- Legal Notice