uTrust 2700 F Contact Desktop Reader-Reference Manual

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Abstract

This document contains in-depth information about the hardware and software features of the uTrust 2700 F contact smart card reader.

Audience

This document is intended for system integrators and software developers.

Revision History

Rev.	Date	Description
1.0	2014-06-0	First published external version
1.1	2017-07-06	Minor modifications and company name change

Contact Information

For additional information, please visit http://www.identiv.com/

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2. Introduction to the manual

2.1. Objective of the manual

This manual provides an overview of the hardware and software features of the uTrust 2700 F smart card reader.

This manual describes in details interfaces and supported commands available for developers using uTrust 2700 F in their applications.

2.2. Target audience

This document describes the technical implementation of uTrust 2700 F.

The manual targets software developers. It assumes knowledge about ISO/IEC 7816 and commonly used engineering terms.

2.3. Product version corresponding to the manual

Item	Version
Hardware	1.0
Firmware	2.01

2.4. Definition of various terms and acronyms

Term	Expansion
APDU	Application Protocol Data Unit
ATR	Answer to Reset, defined in ISO/IEC 7816
Byte	Group of 8 bits
CCID	Chip Card Interface Device
CID	Card Identifier
LED	Light emitting diode
NA	Not applicable
NAD	Node Address
Nibble	Group of 4 bits. 1 digit of the hexadecimal representation of a byte. *Example:* 0xA3 is represented in binary as (10100011)b. The least significant nibble is 0x3 or (0011)b and the most significant nibble is 0xA or (1010)b
PC/SC	Personal Computer/Smart Card: software interface to communicate between a PC and a smart card
PID	Product ID
RFU	Reserved for future use
USB	Universal Serial Bus
VID	Vendor ID

(xyz)b	Binary notation of a number x, y, z ∈{0,1}
0xYY	The byte value YY is represented in hexadecimal

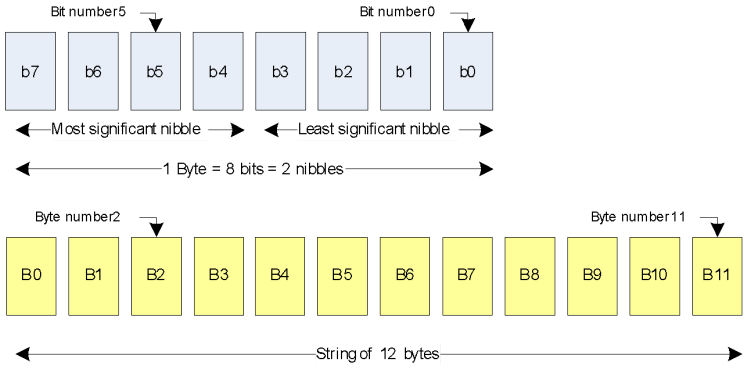
2.5. References

Doc ref in the manual	Description	Issuer
ISO/IEC 7816-3	Identification cards — Integrated circuit cards — Part 3: Cards with contacts — Electrical interface and transmission protocols	ISO / IEC
ISO/IEC 7816-4	Identification cards - Integrated circuit(s) cards with contacts Part 4: Interindustry commands for interchange ISO/IEC 7816-4: 2005 (E)	ISO / IEC
PC/SC	Interoperability Specification for ICCs and Personal Computer Systems v2.01	PC/SC Workgroup
CCID	Specification for Integrated Circuit(s) Cards Interface Devices 1.1	USB-IF
USB	Universal Serial Bus Specification 2.0	USB-IF

2.6. Conventions for bits and bytes

Bits are represented by a lower case ‘b’ followed by an ordering digit which indicates its position.

Bytes are represented by an upper case ‘B’ followed by one or more ordering digits which indicate its position.



Example:

163 decimal number is represented

- in hexadecimal as 0xA3
- in binary as (10100011)b

The least significant nibble of 0xA3 is

- 0x3 in hexadecimal

- (0011)b in binary

The most significant nibble of =xA3 is

- 0xA in hexadecimal
- (1010)b in binary

3. General information about uTrust 2700 F

3.1. uTrust 2700 F key benefits

With its combination of a modern slim design and its state of the art feature set, uTrust 2700 F is the perfect desktop reader choice for environments where smart card support is required. Such environments may be corporates or authorities where use applications like network log-in, Windows authentication & Single Sign-On are implemented.

As for all Identiv products, uTrust 2700 F is designed to offer best in class interoperability.

3.2. uTrust 2700 F key features

- ISO/IEC 7816 compliant smart card reader
- PC/SC v2.0 compliant
- Secure in-field SmartOS™ firmware upgrade
- Unique reader serial number which enables that uTrust 2700 F can be plugged into any USB slot on a PC without having to re-install the driver. Additionally, the application S/W running on the host can check for exact readers
- 249 bytes of non-volatile user memory

3.3. uTrust 2700 F ordering information

Item	Part number	
uTrust 2700 F	905399-1	
Standing Base Kit	905418	

3.4. uTrust 2700 F customization options

Upon request and based on a minimum order quantity, Identiv can customize:

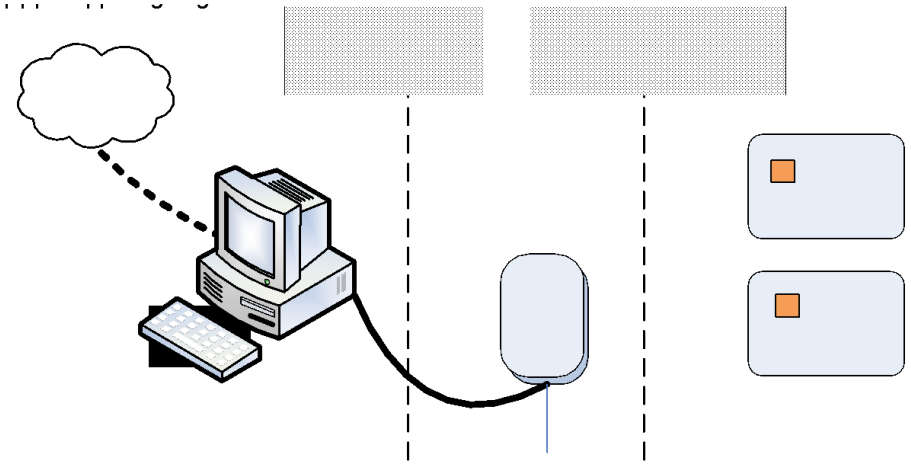
- The color of the casing
- The logo
- The product label
- The USB strings

*Terms and conditions apply, please contact your local Identiv representative.

3.5. Applications

3.5.1. General

uTrust 2700 F is a transparent reader designed to interface a personal computer host supporting PC/SC interface with smart cards according to ISO/IEC 7816 as well as synchronous memory cards like CAC and PKI cards, banking cards and health insurance cards.



uTrust 2700 F itself handles the communication protocol but not the application related to the credential. The application-specific logic has to be implemented by software developers on the host.

3.5.2. Applications provided by Identiv

Identiv provides a few applications for development and evaluation purposes that can function with uTrust 2700 F. There are some tools provided; here is one of them:

- Smart card commander version 1.3 provides capabilities to identify most commonly used cards in the field and display the content of them as well as scripting functionality which can be very useful for developers to develop and debug their applications.

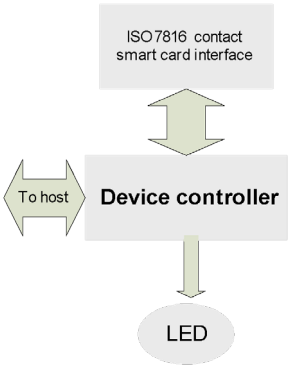
Identiv does not provide PKI or CAC applications.

4. uTrust 2700 F characteristics

4.1. uTrust 2700 F high level architecture

4.1.1. Block diagram

The link between uTrust 2700 F and the host to which it is connected is the USB interface providing both the power and the communication channel.



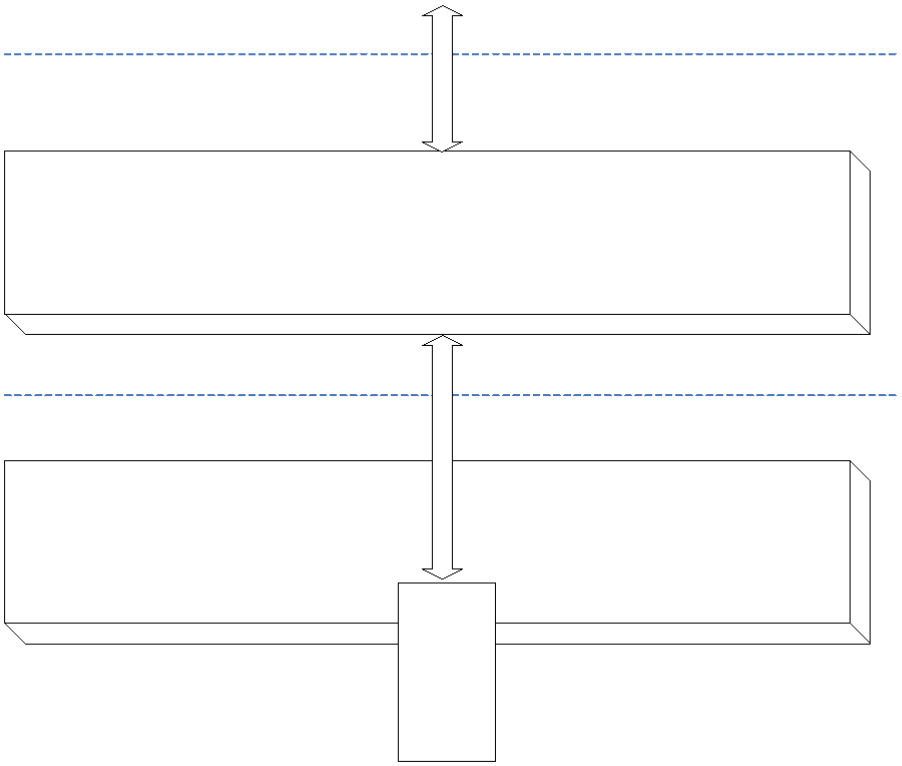
The uTrust 2700 F device controller has several interfaces available. In the uTrust 2700 F implementation 2 peripherals are connected to the device controller:

- LED for reader status indication
- A smart card interface

The µController contains the firmware developed by Identiv to handle all the ISO/IEC 7816 contact protocol and the PC/SC communication protocol with the host.

4.1.2. Software architecture

Applications can interface with the driver directly through the PC/SC interface.



The uTrust 2700 F leverages a PC/SC CCID driver that is freely available for all supported operating systems (Windows, macOS X and Linux).

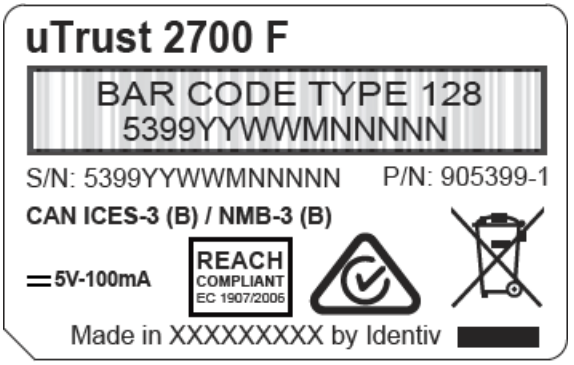
With the diverse Linux derivatives, there may be distribution specific drivers that should get installed using the install mechanism of the used distribution.

If there is none, the driver may always be downloaded from the webpage of the maintainer, Ludovic Rousseau, https://alioth.debian.org/frs/?group_id=30105.

Additionally, Identiv provides a proprietary driver for all the supported OSs.

4.2. Quick reference data

4.2.1. uTrust 2700 F dimensions

Item	Characteristic	Value
uTrust 2700 F	Weight	66g 204g with Standing Base Kit
	External dimensions	70x60x16 mm 70x63x62 mm with Standing Base Kit
	Cable length	1.5 meter long with USB type A connector
	Default color	white and cool grey
	Default label	

Drawing with dimensions of the uTrust 2700 F can be found in annex.

4.2.2. LED behavior

uTrust 2700 F is equipped with a green LED. Its behavior is described in the table below.

uTrust 2700 F states	LED Indication
Reader powered, card out	OFF
Reader powered, card in but not powered	OFF
Card powered	ON
Card access	LED1 (yellow/green) blinking (500ms ON/500ms OFF)
error condition	LED2 (red) blinking (100ms ON/100ms OFF

4.2.3. Other data

4.2.3.1.1. General

Parameter	Value/Description
Clock of the device controller	48 MHz
API	PC/SC 2.0
Operating temperature range	0º to 50ºC
Operating humidity range	Up to 95%RH non-condensing
Certifications	USB CE UL FCC VCCI WEEE RoHS2 REACH WHQL EMV-L1 Listed in GSA APL

4.2.3.1.2. USB

Parameter	Value/Description
DC characteristics	Low bus powered (uTrust 2700 F draws power from USB bus) Voltage: 5V Max. Current: 10mA + current consumed by an inserted card Suspend current: 500uA
USB specification	USB 2.0 FS device
USB Speed	Full Speed Device (12Mbit/s)
Device Class	CCID
PID	0x5710
VID	0x04E6

4.2.3.1.3. Card interface

Parameter	Value/Description
Smart card operating frequency	up to 12MHz
Maximum supported card baud-rate	600Kbps
Cards supported	Class A, B and C asynchronous smart cards (T=0, T=1) Synchronous smart cards (2wire, 3wire, I^2C)
ISO/IEC 7816 compliant	Yes
EMV 4.2 compliant	Yes
CT-API compliant	Yes
Number of slots	Single smart card slot
Ejection mechanism	Manual

5. Software modules

5.1. Installation

On Operating Systems with a PC/SC CCID driver preinstalled, no installation is necessary.

Where there's no PC/SC CCID driver preinstalled (Linux systems) the driver has to be installed using distribution specific measures or installed using the available source packages.

5.2. Utilities

The following utilities are available:

- A tool for testing the resource manager
- A tool called *PCSCDiag* capable of providing basic information about the reader and a card through PC/SC stack

  Operating systems supported by the tools:
  - Windows Server 2012
  - Windows 7, Windows 8.1, Windows 10

5.3. Driver

5.3.1. uTrust 2700 F listing

uTrust 2700 F is listed by PC/SC applications as

- *Identiv uTrust 2700 F Smart Card Reader*

Identiv 2700 F uses the PC/SC CCID class driver readily available for all the supported operating systems.

Starting with Windows Vista, the OS does have the driver preinstalled, so no additional driver installation is necessary.

macOS X systems do have the PC/SC CCID driver preinstalled.

On Linux systems, the distribution specific installation mechanism should be used.

5.3.2. Supported operating systems

- Windows Server 2012 (32 & 64 bit)
- Windows 7, 8.1, 10 (32 and 64 bit)
- macOS 10.13
- Linux 3.x (32 & 64 bit)

5.4. CT-API

A CT-API interface that mostly is used in German banking applications and in conjunction with health insurance cards, is available for the reader.

5.5. MCard-API

With this proprietary Identiv API, it is possible to access a vast majority of synchronous memory cards.

Cards supported are:

- SLE4404
- SLE4428
- SLE4432
- SLE4436
- SLE6636
- SLE4442
- SLE5532
- SLE5536
- SLE5542
- AT24C01ASC
- AT24C02SC
- AT24C04SC
- AT24C08SC
- AT24C16SC
- AT24C32SC
- AT24C64SC
- AT24C128SC
- AT24C256SC
- AT24C512SC
- AT88SC153
- AT88SC1608
- ST14C02

5.6. Firmware

5.6.1. CCID transport protocol

uTrust 2700 F implements a transport protocol that is compliant with USB Device Class: *Smart Card CCID Specification for Integrated Circuit(s) Cards Interface Devices Revision 1.10*.

This paragraph describes the CCID specification features that are implemented.

5.6.2. CCID class requests supported

- Abort

5.6.3. CCID messages supported

The following CCID messages are supported for the contact interface when received through bulk-out endpoint.

- PC_to_RDR_IccPowerOn
- PC_to_RDR_IccPowerOff
- PC_to_RDR_GetSlotStatus
- PC_to_RDR_XfrBlock
- PC_to_RDR_GetParameters

- PC_to_RDR_SetParameters
- PC_to_RDR_Escape
- PC_to_RDR_Abort
- PC_to_RDR_NotifySlotChange
- PC_to_RDR_ResetParameters
- PC_to_RDR_T0APDU
- PC_to_RDR_SetDatarateAndClockFrequency

5.6.4. CCID Error Codes

Extensive error codes are reported on many conditions during all CCID responses. Most of the error messages are reported by the CCID appropriately. Some of the main error codes for the contact interface are:

- HW_ERROR
- XFR_PARITY_ERROR
- ICC_PROTOCOL_NOT_SUPPORTED
- BAD_ATR_TS
- BAD_ATR_TCK
- ICC_MUTE
- CMD_ABORTED
- Command not supported

The following sub-sections discuss when and why these error codes are returned:

5.6.4.1.1. HW_ERROR

This error code is returned when a hardware short circuit condition is detected, during application of power to the card or if any other internal hardware error is detected.

5.6.4.1.2. XFR_PARITY_ERROR

This error code is returned when a parity error condition is detected. This error will be reported in the response to a PC_to_RDR_XfrBlock message.

5.6.4.1.3. ICC_PROTOCOL_NOT_SUPPORTED

This error code is returned if the card is signaling to use a protocol other than T=0 or T=1 in its ATR.

5.6.4.1.4. BAD_ATR_TS

This error code is returned if the initial character of the ATR contains invalid data.

5.6.4.1.5. BAD_ATR_TCK

This error code is returned if the check character of the ATR contains is invalid.

5.6.4.1.6. ICC_MUTE

This error code is returned when the card does not respond until the reader time out occurs. This error will be reported in the response to PC_to_RDR_XfrBlock message and PC_to_RDR_IccPowerOn messages.

5.6.4.1.7. CMD_ABORTED

This error code is returned if the command issued has been aborted by the control pipe.

5.6.4.1.8. Command not supported

This error would be returned, if the command would not be supported by the reader.

6. Commands description

6.1. Escape commands for the uTrust 2700 F

6.1.1. Sending Escape commands to uTrust 2700 F

A developer can use the following method to send Escape commands to uTrust 2700 F

- SCardControl method defined in PC/SC API

When using the CCID driver for Windows, in order to be able to send Escape commands to the uTrust 2700 F, this feature has got to be enabled by setting a REG_DWORD value named 'EscapeCommandEnable' in the registry to a value of '1'.

When using the Identiv supplied driver, this will not be necessary.

For Windows XP and Windows Vista, the key to hold the value would be HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Enum\USB\VID_04E6&PID_5710\ Device-Instance-xxxx \Device Parameters

For Windows 7 and Windows 8, that would be HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Enum\USB\VID_04E6&PID_5710\Device-Instance-xxxx \Device Parameters\WUDFUsbccidDriver

Device-Instance-xxxx has got to be equal to the serial number of the reader used, so this modification has got to be made for every physical reader intended to be used on the machine in question. The reader has got to be plugged in at least once for the mentioned key to exist and the driver has got to be restarted for this setting to take effect. (Unplug and re-plug the reader).

To be able to work with synchronous memory cards using our MCard API, the same setting will have to be established.

See appendix B for some sample code sending Escape commands to the reader.

6.1.2. Escape command codes

Escape commands can be used by an application to configure uTrust 2700 F to function in a mode that is not its default configured mode or to get specific information. To put the uTrust 2700 F back into its default mode, it either has to be unplugged and plugged again or the application can send the same Escape command again.

The following Escape commands are supported by uTrust 2700 F

Escape command	Code
READER_SETMODE	0x01
READER_GETMODE	0x02
CONTACT_GET_SET_POWERUPSEQUENCE	0x04
CONTACT_EMV_LOOPBACK	0x05
CONTACT_EMV_SINGLEMODE	0x06

CONTACT_APDU_TRANSFER	0x08
CONTACT_CONTROL_PPS	0x0F
CONTACT_EXCHANGE_RAW	0x10
READER_GETIFDTYPE	0x12
READER_LED_CONTROL	0x19
READER_LED_CONTROL_BY_FW	0xB2
READER_GETINFO_EXTENDED	0X1E
CONTACT_GET_SET_CLK_FREQUENCY	0x1F
CONTACT_GET_SET_ETU	0x80
CONTACT_GET_SET_WAITTIME	0x81
CONTACT_GET_SET_GUARDTIME	0x82
CONTACT_GET_SET_MCARD_TIMEOUT	0x85
CONTACT_CONTROL_ATR_VALIDATION	0x88
READER_GENERIC_ESCAPE	0xFF 0x70 0x04 0xE6 XX

6.1.2.1.1. READER_SETMODE

This Escape command sets the current mode of the reader. Applications may call this function, to set the desired mode. Typically, this call is used to switch between the ISO/IEC 7816, EMV and memory card operations. Upon power on, the reader will reset to the default ISO/IEC 7816 mode.

Input:

The first byte of the input buffer contains the Escape code value and the second one will contain the value for the desired mode of operation. The output buffer field will be NULL.

Byte0	Byte 1
Escape code (0x01)	Mode

Following table gives the value of modes as interpreted by the firmware:

Mode	Value	Remarks
ISO	0x00	ISO/IEC 7816 mode
EMV	0x01	EMV
Synchronous	0x02	memory card mode (Synchronous)

ISO mode uses APDU mode of data transfer and is used for normal operations. This is the default mode of the reader on power up.

EMV mode also uses APDU mode of data transfer and is used for EMV test purposes. This mode has more stringent checks for smart card detection and communication as per EMV4.2 spec.

Synchronous mode is used for communicating only with memory cards.

Any other value sent as mode is invalid.

The output buffer is

Output buffer
NULL

6.1.2.1.2. READER_GETMODE

This Escape command may be used to retrieve the current mode of the reader.

The input buffer is

Byte0
Escape code(0x02)

Output:

Current active reader mode will be returned as a BYTE value.

Following table gives the value of modes as interpreted by reader firmware

Mode	Value	Remarks
ISO	0x00	ISO/IEC 7816 mode
EMV	0x01	EMV
Synchronous	0x02	memory card mode (synchronous)

6.1.2.1.3. CONTACT_GET_SET_POWER_UP_SEQUENCE

This Escape command is used by the application/driver to get/set the following parameters:

- Smart card Power-on sequence
- Delay between successive Activation retries
- Enable/Disable any Voltage Class

As soon as card insertion is detected and power on message is received from the host, the firmware will start activation with the configured voltage sequence. If the activation fails, it will wait for the configured activation delay and then retry with the next enabled voltage class. If power up succeeds at an operating voltage, the firmware will continue card communication at that voltage. If power up fails in all the enabled operating voltages, then the firmware will report an error. The default power-up sequence would be A – B – C.

Input:

The first byte of the input buffer contains the Escape code. The next byte contains the function to be performed. Third byte contains the parameter for the function.

Byte0	Byte1		Byte2
	Value	Description	
Escape code(0x04)	0x00	Starts with Class C voltage. (1.8V – 3V – 5V order)	-
	0x01	Starts with Class A voltage. (5V – 3V – 1.8V order)	-
	0x08	Time delay between resets	Delay value in milliseconds
	0x09	Enable/Disable a Voltage Class	Bit Map of all Voltage Classes [Bit0 – Class A; Bit1 – Class B; Bit2 – Class C] Set bit to enable the Voltage class Clear bit to disable the Voltage class
	0xFE	Retrieves all the above values	-
	0xFF	Retrieves the current Power up sequence	-

Output:

For retrieving all settings (0xFE), the output will be the following:

Byte0		Byte 1	Byte2
Value	Description		
0x00	Starts with Class C voltage. (1.8V – 3V – 5V order)	Time delay between resets in milliseconds	Bit Map of all Voltage Classes [Bit0 – Class A; Bit1 – Class B; Bit2 – Class C]
0x01	Starts with Class A voltage. (5V – 3V – 1.8V order)		

For retrieving current power up sequence (0xFF), the output will be:

Byte0	
Value	Description
0x00	Starts with Class C voltage. (1.8V – 3V – 5V order)
0x01	Starts with Class A voltage. (5V – 3V – 1.8V order)

Example: retrieve all the current settings:

```
DataIn = 04 FE
DataOut: 01 0A 07 (3 bytes)
```

00: Starting with Class A
0A: 10ms delay between resets
07: Class A, B, and C enabled

6.1.2.1.4. CONTACT_EMV_LOOPBACK

This Escape command lets the host force the firmware to perform an EMV Loop-back application.

The input buffer is

Byte0
Escape code(0x05)

The output buffer is

Output buffer
NULL

6.1.2.1.5. CONTACT_EMV_SINGLEMODE

This Escape command lets the host perform a one-shot EMV Loop-back application as specified in the EMV Level 1 Testing Requirements document.

The input buffer is

Byte0
Escape code(0x06)

The output buffer is

Output buffer
NULL

6.1.2.1.6. CONTACT_APDU_TRANSFER

This Escape command exchanges a short APDU with the smart card. The user has to ensure that a card is inserted and powered before issuing this Escape command.
This Escape command mostly is used by the MCard API to access synchronous memory cards.

Input:

The input buffer contains the Escape code value followed by the short APDU to be sent to the card.

Byte0	Byte1 onwards
Escape code(0x08)	Short APDU to be sent to card

The output buffer contains the response APDU.

Output buffer
Response APDU

6.1.2.1.7. CONTACT_CONTROL_PPS

This Escape command enables or disables the PPS done by the firmware/device for smart cards. This setting will take effect from the next card connect and remains effective till it is changed again or the next Reader power on. Default mode is PPS enabled.

Input:

The first byte of input buffer contains the Escape code and the following byte, if 1 disables the PPS and if 0 enables the PPS.

Byte0	Byte1
Escape code(0x0F)	PPS control byte (1-DISABLES PPS, 0-ENABLES PPS)

The output buffer is

Output buffer
NULL

6.1.2.1.8. CONTACT_EXCHANGE_RAW

This Escape command can be used to perform raw exchange of data with the card. The user must ensure that a card is inserted and powered on before issuing this Escape command. The Card is deactivated upon any reception error.

Input:

The input buffer for this command will contain the Escape code, low byte of the length of data to be sent, high byte of length of data to be sent, low byte of the length of expected data, high byte of length of expected data and the command.

Byte0	Byte1	Byte2	Byte3	Byte4	Byte 5 onwards
Escape code(0x10)	LSB of send length	MSB of send length	LSB of expected length	MSB of expected length	Raw data to the card

Output:

Output buffer
Response APDU

6.1.2.1.9. READER_GET_IFDTYPE

This Escape command is used to get the current IFD type from the reader.

Input:

The first byte of the input buffer contains the Escape code.

Byte0
Escape code(0x12)

Output:

The reader returns the PID of the firmware which can be used to identify the reader.

PID value		Description
B0	B1	
0x10	0x57	USB PID of Identiv uTrust 2700 F smart card Reader

6.1.2.2. READER_LED_CONTROL

This Escape command may be used to toggle the LED state. LED control by firmware should be disabled using the Escape command READER_LED_CONTROL_BY_FW to see proper LED change while using this IOCTL else the LED state will be overwritten by the FW LED behavior.

Input:

The first byte of the input buffer contains the Escape code, followed by LED number and then the desired LED state.

Byte0	Byte 1	Byte2
Escape code(0x19)	LED number (0-RED, 1-GREEN)	LED state (0-OFF, 1-ON)

Output:

Output buffer
NULL

6.1.2.2.1. READER_LED_CONTROL_BY_FW

This command is used to enable/disable LED control by firmware. Default setting is: LED is controlled by firmware.

Input:

The first byte of the input buffer contains the Escape code. The second byte specifies if LED control by the firmware should be disabled or enabled. The output buffer is NULL.

Byte0	Byte1	
	Value	Description
Escape code(0xB2)	0	Enable LED Control by firmware
	1	Disable LED Control by firmware
Get State	FF	0 -- LED control by firmware enabled 1 -- LED control by firmware disabled

Output:

No response is returned for set state. For Get State 1 byte response is received.

Output buffer
NULL or current state

6.1.2.2.2. READER_RD_WR_USER_AREA

This Escape command is used to access the user data area in the reader. The user area is located in the non-volatile memory of the reader and hence data will be retained even after power cycle.

Note:

Frequent writes should be avoided (The non-volatile memory supports only 100K writing cycles). A maximum of 249 bytes can be read and written. The sector can be read and written only as a whole.

If complete data (249 bytes) is not given during write operation then random data will be padded to the given data and then written. If you want to modify only part of the data, read the entire 249 bytes, modify the data you want to change and then write it back to the reader.

Input:
The first byte of the input buffer contains the escape code. The second byte specifies if user area is to be read or written as described below.

Byte0	Byte1		Byte2 to Byte251
	Value	Description	
Escape code(0xF0)	1	Read 249 bytes of user data	None
	2	Write 249 bytes of user data	Data to be written

Output:

Operation	Data (Byte0-BYTE248)
Read	249 bytes of user data
Write	No bytes returned

6.1.2.2.3. READER_GET_INFO_EXTENDED

This Escape command may be used to retrieve extended information about the reader and supported features.

Input:

The first byte of the input buffer contains the Escape code.

Byte0
Escape code(0x1E)

Output:
The firmware returns data as per structure SCARD_READER_GETINFO_PARAMS_EX mentioned below. This Escape command is used to get the firmware version, reader capabilities, and Unicode serial number of the reader.

Field Size in Bytes	Field Name	Field Description	Default value
1	byMajorVersion	Major Version in BCD	Based on current firmware version
1	byMinorVersion	Minor Version in BCD	
1	bySupportedModes	Total no of supported modes in the reader	0x03 (ISO, EMV and MCard modes)

2	wSupportedProtocols	Protocols supported by the Reader Bit 0 – T0 Bit 1 – T1	0x0300 (LSB first)
2	winputDevice	IO_DEV_NONE 0x00 IO_DEV_KEYPAD 0x01 IO_DEV_BIOMETRIC 0x02	0x0000(LSB first)
1	byPersonality	Reader Personality (Not used)	0x00
1	byMaxSlots	Maximum number of slots	0x01 (Single slot device)
1	bySerialNoLength	Serial number length	0x1C
28	abySerialNumber [28]	Unicode serial number	Reader serial number(MSB first)

```
DataIn = 1E

DataOut: 01 00 03 03 00 00 00 00 01 1C 35 00 33 00 36 00
         39 00 31 00 33 00 30 00 31 00 32 00 30 00 30 00
         30 00 36 00 32 00 (38 bytes)
```

6.1.2.2.4. CONTACT_GET_SET_CLK_FREQUENCY

In case when an application wants to get or set the smart card clock frequency, this Escape command is used to instruct the reader to change the clock or to get the current Clock divisor used. Once set, the change in frequency will take effect immediately. Default divisor value is 10, that is 4.8MHz.

Input:

The first byte of the input buffer will contain the Escape code; the next byte will contain the clock divisor value to set clock frequency or 0xFF to get clock frequency.

Byte0	Byte1	
	Value	Description
Escape code(0x1F)	Clock divisor	The value to be Set in the smart card CLK divisor register
	0xFF	Get current Clock divisor value

Output:

Set clock frequency: None

Get clock frequency: One byte value indicating the current Clock divisor.

Output buffer
NULL or current divisor

Clock Divisor values:

DIVISOR VALUE	SCCLK Frequency
0x04	4 MHz
0x03	4.8 MHz
0x02	6 MHz
0x01	8 MHz
0x00	12 MHz

```
DataIn = 1F FF
DataOut: 03 (1 byte)
```

6.1.2.2.5. CONTACT_GET_SET_ETU

This Escape command is be used by the HOST to get/set the current ETU for smart cards. Once set, the new ETU value will take effect immediately.

Input:
The input buffer contains the Escape followed by an 8 bit GET/SET identifier. For SET ETU, a DWORD specifying the value to be set is following.

Byte0	Byte1		Byte2	Byte3	Byte4	Byte5
	Value	Description	Wait time			
Escape code(0x80)	0x01	SET ETU	BIT31-BIT24	BIT23-BIT16	BIT15-BIT8	BIT7-BIT0
	0x00	GET ETU	-	-	-	-

Output:
For both Set and Get ETU, the output will be the following.

Byte0	Byte1	Byte2	Byte3
ETU value			
BIT31-BIT24	BIT23-BIT16	BIT15-BIT8	BIT7-BIT0

```
DataIn = 80 00
DataOut: 00 00 01 40 (4 bytes)
```

6.1.2.3. CONTACT_GET_SET_WAITTIME

This Escape command is used to get/set the Character/Block Waiting Time for smart cards. The wait time is specified in terms of ETU. Once set, the new Wait time will take effect from the next card communication.

Input:

The input buffer contains the Escape code followed by an 8 bit GET/SET identifier, an 8 bit Wait time identifier and a 32 bit Wait time value. BWT must be specified in units of 1.25ms and CWT in units of ETU.

Byte0	Byte1		Byte2		Byte3	Byte4	Byte5	Byte6
	Value	Description	Value	Description	Wait time in ETU			
Escape code(0x81)	0x01	SET Wait time	0x00	CWT	BIT31-BIT24	BIT23-BIT16	BIT15-BIT8	BIT7-BIT0
			0x01	BWT				
	0x00	GET Wait time	0x00	CWT	-	-	-	-
			0x01	BWT				

Output:

For both Get/Set Wait time, the output will be the following.

Byte0	Byte1	Byte2	Byte3
Wait time in ETU			
BIT31-BIT24	BIT23-BIT16	BIT15-BIT8	BIT7-BIT0

```
DataIn = 81 00 01
DataOut: 00 00 03 5D (4 bytes)
```

6.1.2.4. CONTACT_GET_SET_GUARDTIME

This Escape command is used to get/set the Character/Block Guard Time of the reader. The guard time is specified in terms of ETU. Once set, the new Guard time will take effect immediately.

Input:

The input buffer contains the Escape code followed by an 8 bit GET/SET identifier, an 8 bit guard time identifier and a 32 bit guard time value in ETU.

Byte0	Byte1		Byte2		Byte3	Byte4	Byte5	Byte6
	Value	Description	Value	Description	Guard time in ETU			
Escape code(0x82)	0x01	SET Guard time	0x00	CGT	BIT31-BIT24	BIT23-BIT16	BIT15-BIT8	BIT7-BIT0
			0x01	BGT				
	0x00	GET Guard time	0x00	CGT	-	-	-	-
			0x01	BGT				

Output:

For Get/Set guard time, the output will be the Character/Block Guard Time value.

Byte0	Byte1	Byte2	Byte3
Character Guard time in ETU			
BIT31-BIT24	BIT23-BIT16	BIT15-BIT8	BIT7-BIT0

```
DataIn = 82 00 01
DataOut: 00 00 00 18 (4 bytes)
```

6.1.2.5. CONTACT_GET_SET_MCARD_TIMEOUT

This Escape command is used to get or set the delay which is applied after a Write operation to memory cards. The delay is specified in milliseconds.

Input:
The first byte of the input buffer will contain the Escape code; the next byte will contain the memory card write delay in seconds.

Byte0	Byte1	
	Value	Description
Escape code(0x85)	0x01	Delay in milliseconds for memory card Write
	Any value other than 1	Read the current applied delay for memory card Write

Output:

Write delay: No response byte

Read delay value: A byte value specifying the current delay applied during memory card Write in milliseconds

Byte0
Delay in ms

```
DataIn = 85 00
DataOut: 00 (1 byte)
```

6.1.2.6. CONTACT_CONTROL_ATR_VALIDATION

This Escape command is used to enable or disable the ATR validation by the firmware in ISO/IEC 7816 mode.

In case the card would emit an ATR that is not ISO/IEC 7816 compliant, the card reader may fail to power up the card. In these cases, disabling ATR validation will let you work with the card regardless of ISO conformity of the ATR.

By default, ATR validation is enabled.

Input:

The first byte of the input buffer will contain the Escape code; the next byte will contain the control byte.

Byte0	Byte1	
	Value	Description
Escape code(0x88)	0x00	Enable ATR validation
	0x01	Disable ATR validation

Output:

Output buffer
NULL

6.1.2.7. CONTACT_READ_INSERTION_COUNTER

This Escape command is supported through the READER_GENERIC_ESCAPE command and retrieves the number of times a contact smart card has been inserted into the reader.

Input:

The first five bytes of the input buffer follow APDU structure as per [PCSC3-AMD1]. The 6thbyte is the Escape code 0x00 to identify the command.

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte5	Le
0xFF	0x70	0x04	0xE6	0x01	0x00 (Escape code)	4 (Insertion counter is a 4 byte value)

Output:

Byte0	Byte1	Byte2	Byte3	Byte 4	Byte 5
Insertion counter value				SW1	SW2
BIT31-BIT24	BIT23-BIT16	BIT15-BIT8	BIT7-BIT0	0x90	0x00

In case of any error, only SW1 and SW2 set with error status will be returned.

6.1.2.8. READER_GENERIC_ESCAPE

This Escape command is used to invoke newly defined escape functions and send proprietary commands to the reader. It is defined in line with vendor specific generic command defined in [PCSC3-AMD1].

Input:
The first five bytes of the input buffer shall follow APDU structure as per [PCSC3-AMD1]. 6TH byte shall be the command code used to identify the specific command.

Byte 0	Byte 1	Byte 2	Byte 3	Byte4	From Byte5 (up to Lc bytes)		ByteLc+5
					Byte 5	Byte 6 onwards	
0xFF	0x70	0x04	0xE6	Lc (always > 0)	Cmd Opcode	Command parameters or data	Le (optional)

Output:
Depending on the command, the output shall be Le bytes of data + SW1 + SW2 or SW1+ SW2. The escape message shall at least return 2 bytes status word SW1, SW2. In case of success, SW1=0x90 and SW2=0x00 shall be returned. In error scenario, appropriate error status shall be returned (as defined in Error Code section 8.0).

7. Annexes

7.1. A – Status words table

SW1	SW2	Description
0x90	0x00	NO ERROR
0x67	0x00	LENGTH INCORRECT
0x6D	0x00	INVALID INSTRUCTION BYTE

0x6E	0x00	CLASS NOT SUPPORTED
0x6F	0x00	UNKNOWN COMMAND
0x63	0x00	NO INFORMATION GIVEN
0x65	0x81	MEMORY FAILURE
0x68	0x00	CLASS BYTE INCORRECT
0x6A	0x81	FUNCTION NOT SUPPORTED
0x6B	0x00	WRONG PARAMETER P1-P2

7.2. Annex B – Sample code using Escape commands through Escape IOCTL

```
File Name :  uTrust 2700 F Escape.h

#ifndef _uTrust_2700 F_ESCAPE_H_
#define _uTrust_2700 F_ESCAPE_H_

#ifdef __cplusplus
extern "C" {
#endif

# pragma pack (1)
typedef struct
{
   BYTE byMajorVersion;
   BYTE byMinorVersion;
   BYTE bySupportedModes;
   WORD wSupportedProtocols;
   WORD winputDevice;
   BYTE byPersonality;
   BYTE byMaxSlots;
   BYTE bySerialNoLength;
   BYTE abySerialNumber [28];
} ReaderInfoExtended;
# pragma pack ()

#define IOCTL_CCID_ESCAPE                SCARD_CTL_CODE  (0xDAC)

#define READER_SET_MODE                      0x01
#define READER_GET_MODE                      0x02
#define CONTACT_GET_SET_POWERUPSEQUENCE 0x04
#define CONTACT_EMV_LOOPBACK             0x05
#define CONTACT_EMV_SINGLEMODE           0x06
#define CONTACT_APDU_TRANSFER                0x08
#define CONTACT_CONTROL_PPS              0x0F
#define CONTACT_EXCHANGE_RAW             0x10
#define READER_GETIFDTYPE                0x12
#define READER_LED_CONTROL                   0x19
#define READER_LED_CONTROL_BY_FW             0xB2
#define READER_GETINFO_EXTENDED          0x1E
#define CONTACT_GET_SET_CLK_FREQUENCY    0x1F
#define CONTACT_GET_SET_ETU              0x80
#define CONTACT_GET_SET_WAITTIME             0x81
#define CONTACT_GET_SET_GUARDTIME        0x82
#define CONTACT_GET_SET_MCARD_TIMEOUT    0x85
#define CONTACT_CONTROL_ATR_VALIDATION       0x88

#ifdef __cplusplus
}
#endif

#endif


File Name :  uTrust 2700 F Escape.c
```

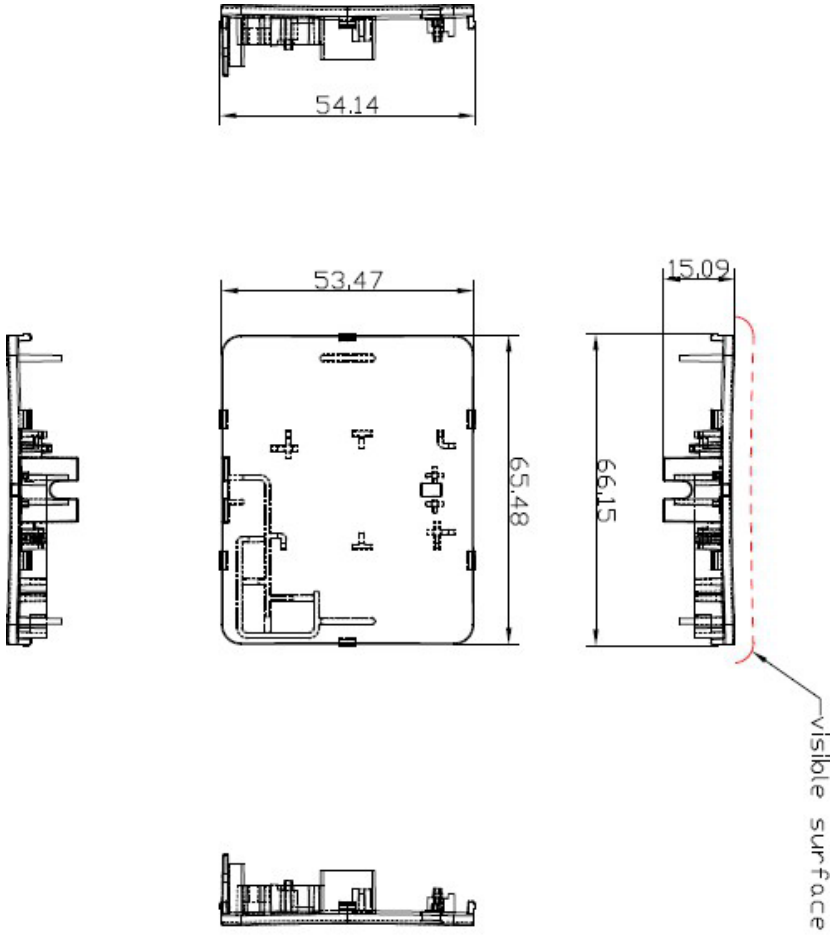
```
#include <windows.h>
#include  <winbase.h>
#include <stdio.h>
#include <conio.h>
#include "winscard.h"
#include  "winerror.h"
#include "uTrust 2700R Escape.h"

VOID main(VOID)



{

   SCARDCONTEXT         ContextHandle;
   SCARDHANDLE          CardHandle;
   ReaderInfoExtended  strReaderInfo;
   BYTE                 InByte, i;
   DWORD                BytesRead,  ActiveProtocol;
   ULONG                ret;
   char                 *ReaderName[] = {"Identiv uTrust 2700 F Smart Card Reader 0",
                                         NULL};

/*****************************************************************************************
**************/

   ContextHandle = -1;

   ret  =  SCardEstablishContext(SCARD_SCOPE_USER,  NULL,  NULL,  &ContextHandle);

   if  (ret  ==  SCARD_S_SUCCESS)
   {
      ret  =  SCardConnect(  ContextHandle,
                             ReaderName[0],
                             SCARD_SHARE_DIRECT,
                             SCARD_PROTOCOL_UNDEFINED,
                             &CardHandle,
                             &ActiveProtocol);

      if  (ret  ==  SCARD_S_SUCCESS)
      {
         InByte  =  0x1E;
         ret  =  SCardControl(  CardHandle,
                                IOCTL_CCID_ESCAPE,
                                &InByte,
                                1,
                                &strReaderInfo,
                                sizeof(strReaderInfo),
                                &BytesRead);
         if  (SCARD_S_SUCCESS  ==  ret)  {
            printf("major version:\t\t%d%d\n", (strReaderInfo.byMajorVersion & 0xF0)>> 4,
(strReaderInfo.byMajorVersion & 0x0F));
            printf("minor version:\t\t%d%d\n", (strReaderInfo.byMinorVersion & 0xF0)>> 4,
(strReaderInfo.byMinorVersion & 0x0F));
            printf("modes:\t\t\t%d\n", strReaderInfo.bySupportedModes);
            printf("protocols:\t\t%04x\n", strReaderInfo.wSupportedProtocols);
            printf("input device:\t\t%04x\n", strReaderInfo.winputDevice);
            printf("personality:\t\t%d\n", strReaderInfo.byPersonality);
            printf("max slots:\t\t%d\n", strReaderInfo.byMaxSlots);
            printf("serial no length:\t%d\n", strReaderInfo.bySerialNoLength);
            printf("serial no:\t\t");
            for (i = 0; i < strReaderInfo.bySerialNoLength; i++)
               printf("%c", strReaderInfo.abySerialNumber[i]);

         } else {
            printf("SCardControl  failed:  %08X\n",  ret);
         }
      }
      else {
```

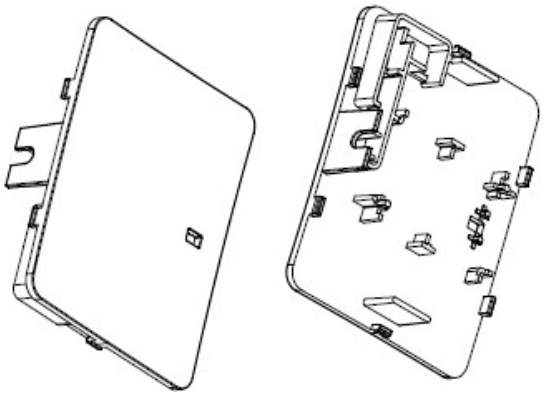
```
        printf("SCardConnect failed: %08X\n", ret);
    }

    ret = SCardReleaseContext(ContextHandle);
}
else
{
    printf("\n SCardEstablishContext failed with %.8lX",ret);
}

printf("\npress any key to close the test tool\n");
```

```
    getch();
}
```

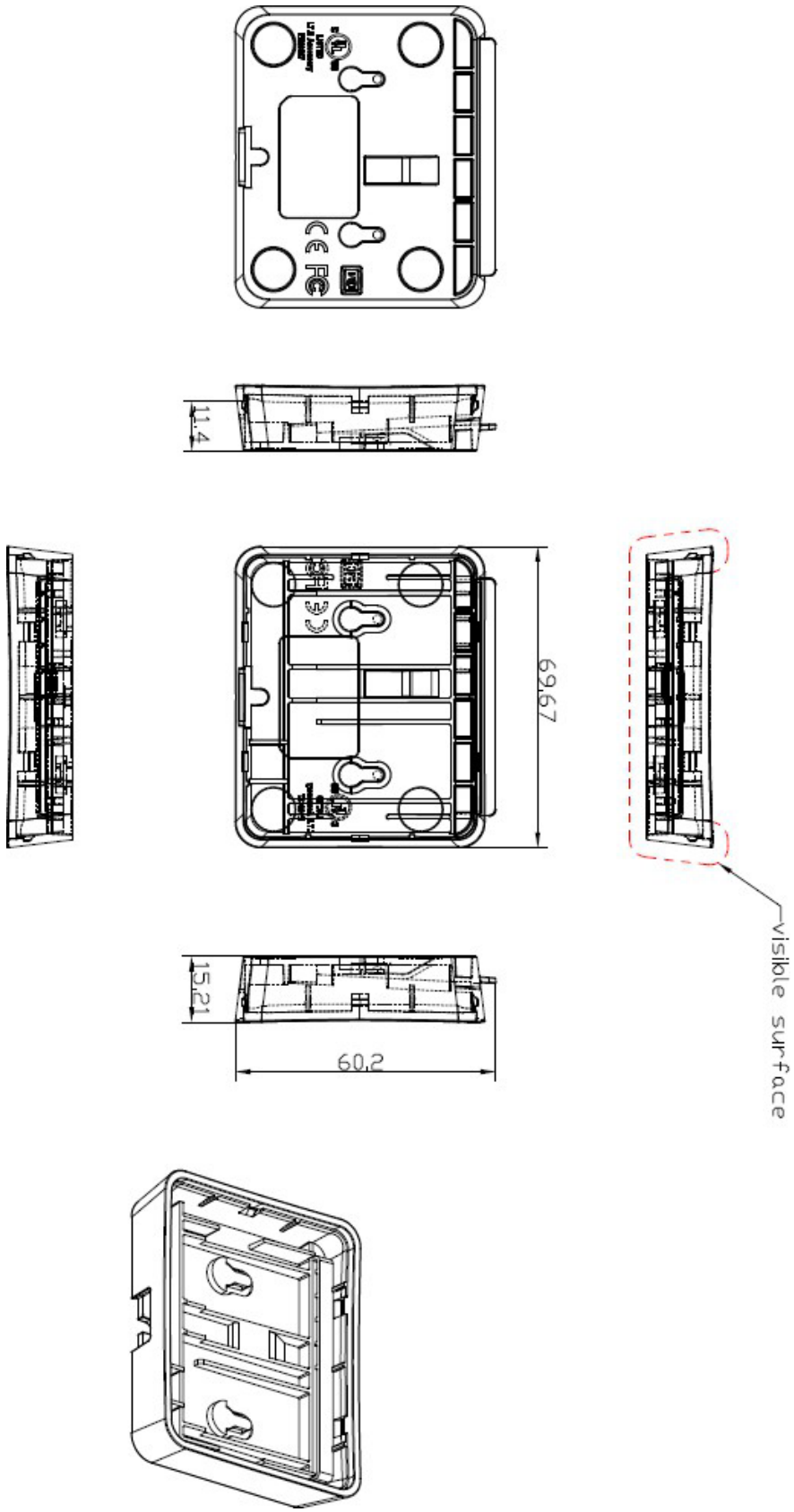
7.3. Annex C – Mechanical drawings

7.3.1. Top Casing

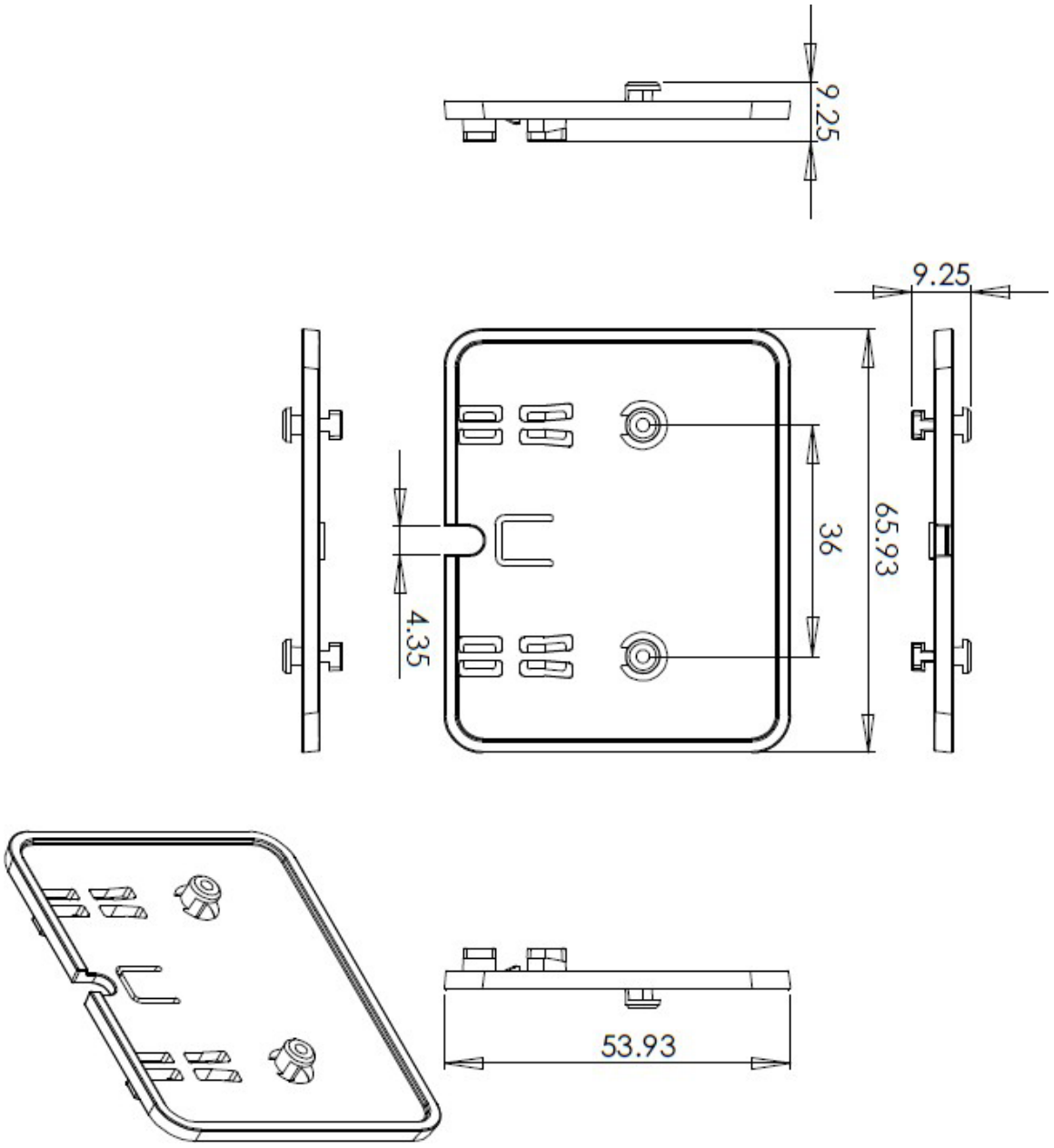




7.3.2. Bottom Casing



7.3.3. Stand plate



7.3.4. Stand socket