



Future Technology Devices International Ltd

DS_US232R-10(R-100/500)

USB to RS232 Adapter cable

Data Sheet

The USB-RS232 adaptor cables are a family of communication devices from FTDI Ltd. This model, US232R, provides a simple method of adapting legacy serial devices with RS232 interfaces to modern USB ports by incorporating the FTDI FT232RQ bridge chip.

The US232R cable is available in three lengths 10cm (US232R-10), 100cm (US232R-100) and 500cm (US232R-500). Indicator LEDs provide status of Transmit (TX) and Receive (Rx).

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1 Introduction

1.1 Functional Description

The USB-RS232 adaptor cables are a family of communication devices. This model, US232R, provides a simple method of adapting legacy serial devices with RS232 interfaces to modern USB ports.

Each US232R adapter contains a small internal electronic circuit board which utilises the FTDI FT232RQ, mounted inside a rugged plastic enclosure capable of withstanding industrial temperature ranges. The integrated electronics also include RS232 level shifters and TXD/RXD LEDs to provide a visual indication of data traffic through the adapter.



Figure 1-1 Using the USB-RS232 Adaptor Cable

The Cable incorporates a standard USB-A device connector for connection to an upstream host or hub port. RS232-level signals, including modem handshake signals, are available on an industry-standard DE-9P connector. The maximum RS232-level data rate is 1MBaud.

The US232R adapter cable requires USB device drivers, available free from [FTDI](#), which are used to make the US232R appear as a Virtual COM Port (VCP). This allows existing serial communications software, such as HyperTerminal, to exchange data through the US232R to a legacy RS232 peripheral device.

1.2 Typical Applications

- USB to RS232 Converter
- Upgrading Legacy Peripherals to USB
- USB Audio and Low Bandwidth Video data transfer
- PDA to USB data transfer
- USB Smart Card Readers
- USB Instrumentation
- USB Industrial Control
- USB MP3 Player Interface
- USB FLASH Card Reader / Writers
- Set Top Box PC - USB interface
- USB Digital Camera Interface
- USB Hardware Modems
- USB Wireless Modems
- USB Bar Code Readers
- USB Software / Hardware Encryption Dongles

1.3 Driver Support

Royalty free VIRTUAL COM PORT (VCP) and D2XX Direct Drivers are available for the following Operating Systems (OS):

- Windows
- Linux
- Mac
- Android (J2xx / D2xx only)

See the following website link for the full driver support list including OS versions and legacy OS.

<https://ftdichip.com/drivers/>

Virtual COM Port (VCP) drivers cause the USB device to appear as an additional COM port available to the PC. Application software can access the USB device in the same way as it would access a standard COM port.

D2XX Direct Drivers allow direct access to the USB device through a DLL. Application software can access the USB device through a series of DLL function calls. The functions available are listed in the [D2XX Programmer's Guide](#) document which is available from the [Documents](#) section of our website.

Please also refer to the [Installation Guides](#) webpage for details on how to install the drivers.

1.4 Block Diagram

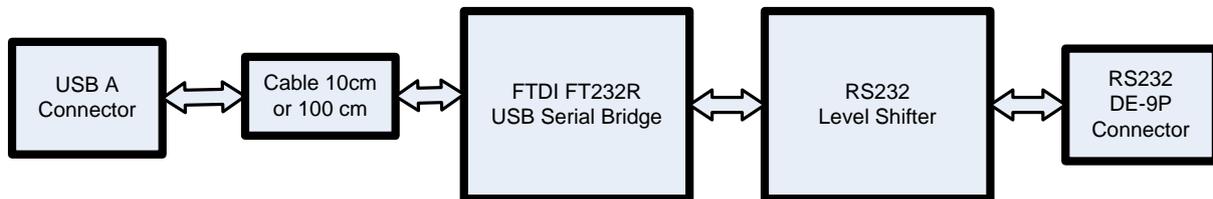


Figure 1-2 Block diagram

1.4.1 Block description

USB A Connector

This connector provides the interface for connection to a USB Host or Hub port

Cable

The US232R cable is available in three lengths 10cm – Part number US232R-10, 100cm - Part number US232R-100 and 500cm - Part number US232R-500.

FTDI FT232RQ

The FTDI FT232RQ provides the USB-to-Serial conversion. Operating system device drivers are required in order to work with the FT232RQ to provide the Virtual COM Port serial functionality.

RS232 Level Shifter

The RS232 level shifter converts the signals provided by the FT232RQ into the voltage levels required by RS232 devices.

DE-9P Connector (Male)

The DE-9P connector is configured in an industry standard (TIA/EIA-574) pin-out to provide connection to RS232 peripherals through standard cables. See section 4.1.2.

1.5 Cable Features

- Adds one RS-232 serial port by connecting to USB
- Special high gloss white finish enclosure design
- Side-lit blue RXD and TXD traffic indicators
- Enhanced RS232 transceiver gives serial port speed of up to 1MBaud.
- Gold plated USB and DB9 connectors for enhanced connection reliability
- Integral 10cm (US232R-10) or 100cm (US232R-100) or 500cm (US232R-500) USB cable with moulded strain relief
- Quality 4-layer PCB design
- Easy plug & play installation and RS-232 device connection
- Works with USB 1.1 & 2.0 Host and Hub ports
- Industry Standard FTDI chip set & device drivers for maximum compatibility
- Microsoft Windows® WHQL-certified, Mac, Linux and Android device drivers
- Installs as a standard Windows COM port
- COM port number can be changed to any available COM port number, including COM1 to COM4, to support HyperTerminal, or any other serial communications software application running in Windows
- FIFO: 128 byte transmit buffer, 256 byte receive buffer
- RS-232 data signals: TxD, RxD, RTS, CTS, DSR, DTR, DCD, RI, GND
- Powered by USB port. No external power adapter required.
- Serial Communication Parameters
 - Parity: None, Even, Odd
 - Data bits: 7, 8
 - Flow control: RTS/CTS , DSR/DTR, X-ON/X-OFF, None
 - Stop bits 1,2
- Operating temperature of -20°C to +80°C

1.6 Performance Figures

Parameter	Performance
USB Interface	12Mbps USB 2.0 Full-Speed
RS232 Interface	Standard Windows baud rates (300bps to 921.6Kbps) Custom baud rates (300bps to 1Mbps) through baud rate aliasing. See FTDI Application Note: Configuring FT232R, FT2232 and FT232BM Baud Rates

Table 1.1 Performance Figures

1.7 Ordering Information

Part Number	Description
US232R-10	USB-RS232 Adapter Cable – 10cm cable length
US232R-100	USB-RS232 Adapter Cable – 100cm cable length
US232R-500	USB-RS232 Adapter Cable – 500cm cable length

Table 1.2 Ordering Information

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2 FT232RQ Key features

This section summarises the key features and enhancements of the FT232RQ IC device which is used on the US232R USB to RS232 converter cable. For further details, consult the [FT232R datasheet](#), which is available from the [FTDI website](#).

2.1 Integrated EEPROM

Previous generations of FTDI's USB UART devices required an external EEPROM if the device were to use USB Vendor ID (VID), Product ID (PID), serial number and product description strings other than the default values in the device itself. This external EEPROM has now been integrated onto the FT232RQ chip meaning that all designs have the option to change the product description strings. A user area of the internal EEPROM is available for storing additional data. The internal EEPROM is programmable in circuit, over USB without any additional voltage requirement.

2.2 Pre-programmed EEPROM

The FT232RQ is supplied with its internal EEPROM pre-programmed with a serial number which is unique to each individual device. This, in most cases, will remove the need to program the device EEPROM.

2.3 Lower Operating and Suspend Current

The device operating supply current has been further reduced to 15mA, and the suspend current has been reduced to around 70µA. This allows greater margin for peripheral designs to meet the USB suspend current limit of 500µA.

2.4 Low USB Bandwidth Consumption

The operation of the USB interface to the FT232RQ has been designed to use as little as possible of the total USB bandwidth available from the USB host controller.

2.5 UART Pin Signal Inversion

The sense of each of the eight UART signals can be individually inverted by setting options in the internal EEPROM. Thus, CTS# (active low) can be changed to CTS (active high), or TXD can be changed to TXD#.

2.6 FTDIChip-ID™

Each FT232RQ is assigned a unique number which is burnt into the device at manufacture. This ID number cannot be reprogrammed by product manufacturers or end-users. This allows the possibility of using FT232RQ based dongles for software licensing. Further to this, a renewable license scheme can be implemented based on the FTDIChip-ID™ number when encrypted with other information. This encrypted number can be stored in the user area of the FT232RQ internal EEPROM, and can be decrypted, then compared with the protected FTDIChip-ID™ to verify that a license is valid. Web based applications can be used to maintain product licensing this way. An application note describing this feature is available separately from the [FTDI website](#).

2.7 Improved EMI Performance

The reduced operating current and improved on-chip VCC decoupling significantly improves the ease of PCB design requirements in order to meet FCC, CE, UKCA and other EMI related specifications.

2.8 Programmable Receive Buffer Timeout

The receive buffer timeout is used to flush remaining data from the receive buffer. This time defaults to 16ms, but is programmable over USB in 1ms increments from 1ms to 255ms, thus allowing the device to be optimised for protocols that require fast response times from short data packets.

2.9 Baud Rates

The FT232RQ supports all standard baud rates and non-standard baud rates from 300 Baud up to 3 Mbaud. Achievable non-standard baud rates are calculated as follows -

$$\text{Baud Rate} = 3000000 / (n + x)$$

where n can be any integer between 2 and 16,384 (= 2^{14}) and x can be a sub-integer of the value 0, 0.125, 0.25, 0.375, 0.5, 0.625, 0.75, or 0.875. When n = 1, x = 0, i.e. baud rate divisors with values between 1 and 2 are not possible.

This gives achievable baud rates in the range 183.1 baud to 3,000,000 baud. When a non-standard baud rate is required simply pass the required baud rate value to the driver as normal, and the FTDI driver will calculate the required divisor, and set the baud rate. See FTDI application note [AN232B-05](#) for more details.

The US232R cable is limited to a maximum of 1 Mbaud because of the line driver within the circuit.

3 Installation

3.1 RS232 Connection Pin Out

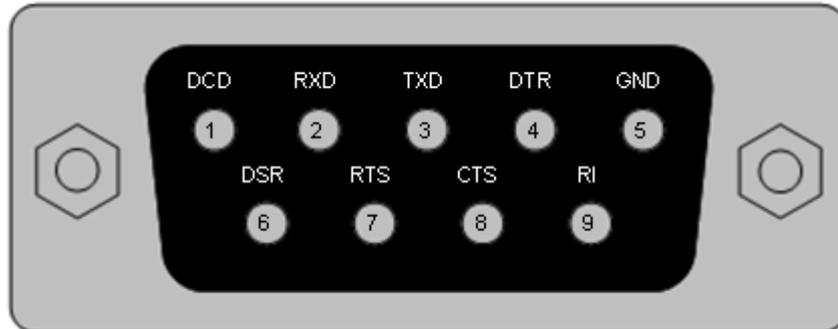


Figure 3-1 RS232 DB9 Pin Out

DB9 Pin No.	Name	Type	Description
1	DCD	Input	Data Carrier Detect control input
2	RXDATA	Input	Receive Asynchronous Data input.
3	TXDATA	Output	Transmit Asynchronous Data output.
4	DTR	Output	Data Terminal Ready control output / Handshake signal
5	GND	Gnd	Device ground supply pin.
6	DSR	Input	Data Set Ready control input / Handshake signal
7	RTS	Output	Request To Send Control Output / Handshake signal
8	CTS	Input	Clear to Send Control input / Handshake signal.
9	RI	Input	Ring Indicator control input. When remote wakeup is enabled in the FT232RQ's internal EEPROM taking RI# low can be used to resume the PC USB host controller from suspend.

Table 3.1 RS232 DB9 Pin Descriptions

3.2 Device Driver Installation

The US232R adaptor drivers are available for download from:

<https://ftdichip.com/>

3.2.1 Microsoft Windows

With the device drivers being Windows Hardware Quality Labs (WHQL) certified, they are also available through download directly from the Microsoft® Windows® Update service. Simply plug the device into the Windows PC and the drivers should load automatically if the PC is connected to the internet. Additional installation instructions can be found on the [Installation Guides](#) page of our website.

3.2.2 Mac OS X, Linux and Android

Device drivers and FTDI installation guides for Mac OS X, Linux and Android are available for download on the FTDI Chip website. Follow the respective FTDI [Installation Guides](#) for the chosen operating system.

4 Connections

4.1 External Connectors

4.1.1 USB

The USB-F-1001 is a downstream USB 2.0 Device. A standard USB Series "A" connector is mounted inside the USB-F-1001 to facilitate connection to an upstream USB Host or Hub.

Pin Number	Pin Type	Description
1	Power	VBUS – USB Power provided from upstream USB Host or Hub
2	Bidirectional	D- = USB data signal, negative polarity
3	Bidirectional	D+ = USB data signal, positive polarity
4	Ground	GND = USB signal ground
Shield	Case Ground	Drain = typically connected to the host PC case

Table 4.1 USB "A" Connector Pin-Out

4.1.2 RS232

The RS232 port is configured as Data Terminal Equipment (DTE), with a 9-contact D-Sub Pin connector. Pin assignments are according to TIA/EIA-574 which formally defines the assignments for a COM port found on many personal computers.

Pin Number	Pin Type	Description
1	Input	DCD = Data Carrier Detect
2	Input	RXD = Receive Data
3	Output	TXD = Transmit Data
4	Output	DTR = Data Terminal Ready
5	Ground	GND = RS232 signal ground
6	Input	DSR = Data Set Ready
7	Output	RTS = Request To Send
8	Input	CTS = Clear To Send
9	Input / Power	RI = Ring Indicator
Shield	Case Ground	Drain = typically connected to the host PC case

Table 4.2 DE-9P RS232 Pin-Out

5 Electrical details

5.1 USB

Parameter	Description	Minimum	Typical	Maximum	Units	Conditions
USB_VCC	Input Power Voltage*	4.25	5.0*	5.25	V	*Present when USB cable is attached and USB Host or Hub powered.
I _{cc}	USB current		30	50	mA	

Table 5.1 USB Electrical Details

5.2 RS232

Parameter	Description	Minimum	Typical	Maximum	Units	Conditions
V _{trans}	Transmitter output voltage swing	± 5			V	RL = 3KΩ
V _{rec}	Receiver input voltage range	±2.4		±25	V	Input resistance = 3KΩ to 7KΩ
	ESD HBM		±15		KV	RS-232 Inputs and Outputs

Table 5.2 RS232 Electrical Details

6 Mechanical Details

6.1 Module Mechanical Dimensions

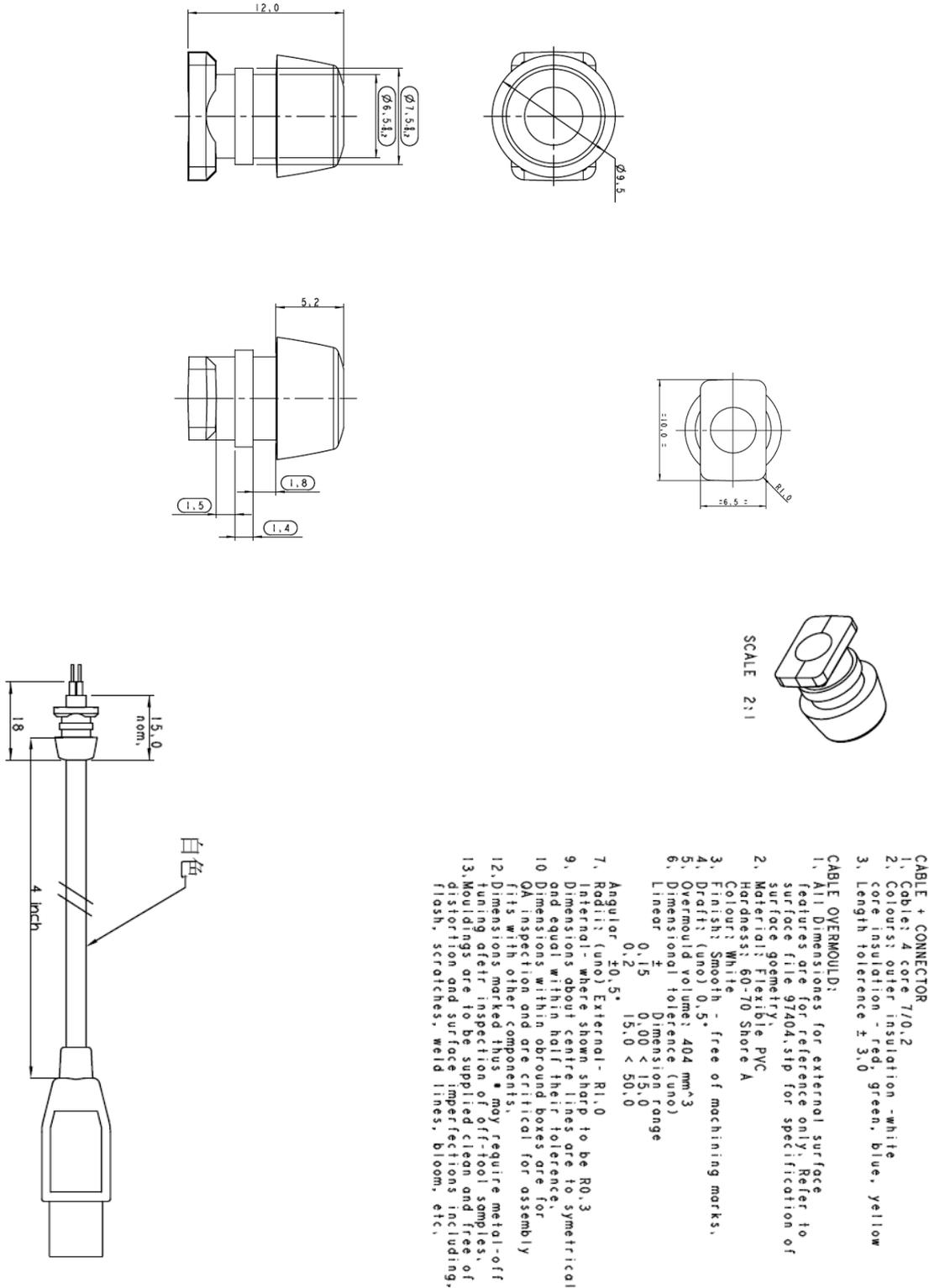


Figure 6-1 Cable Dimensions

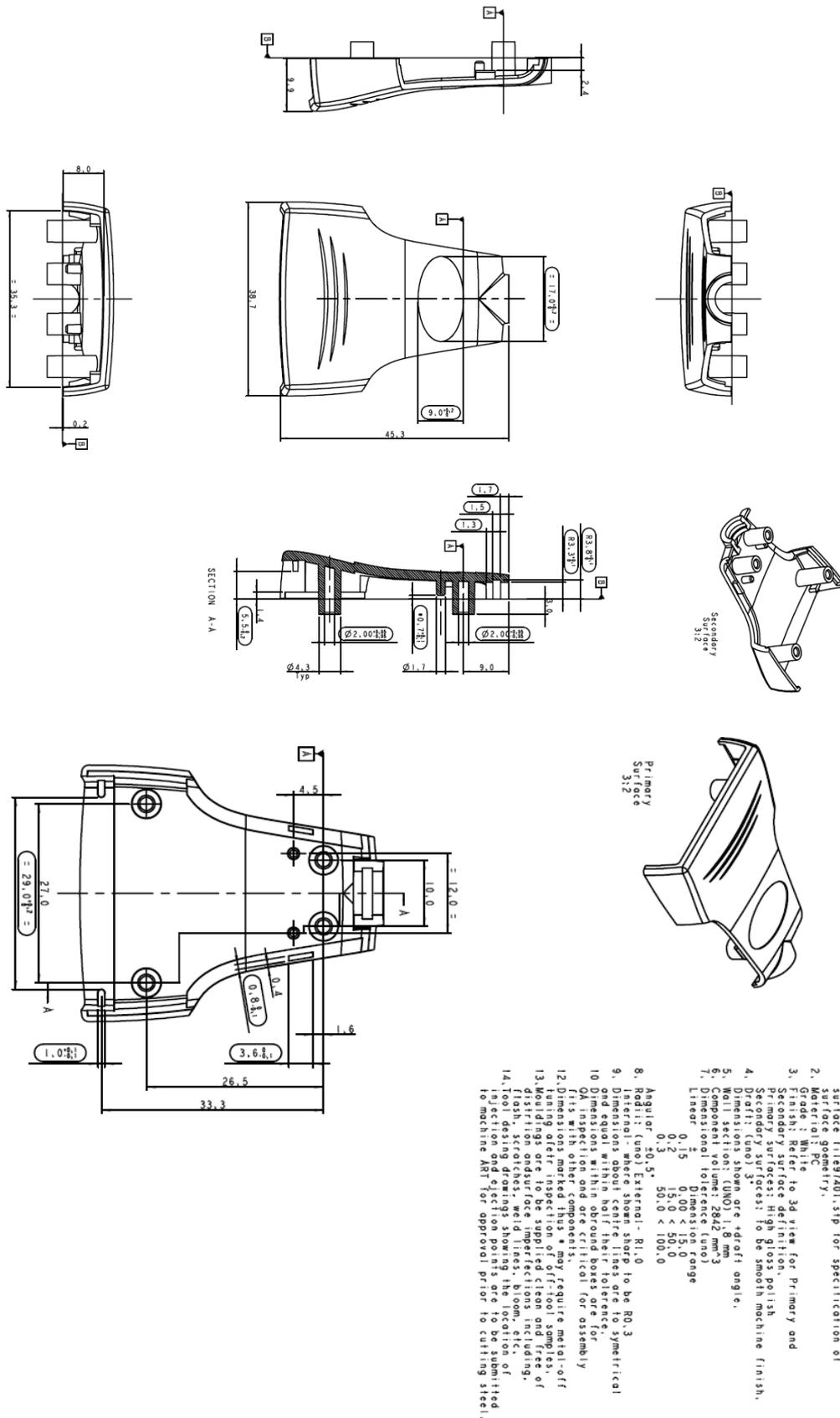


Figure 6-2 Case top Dimensions

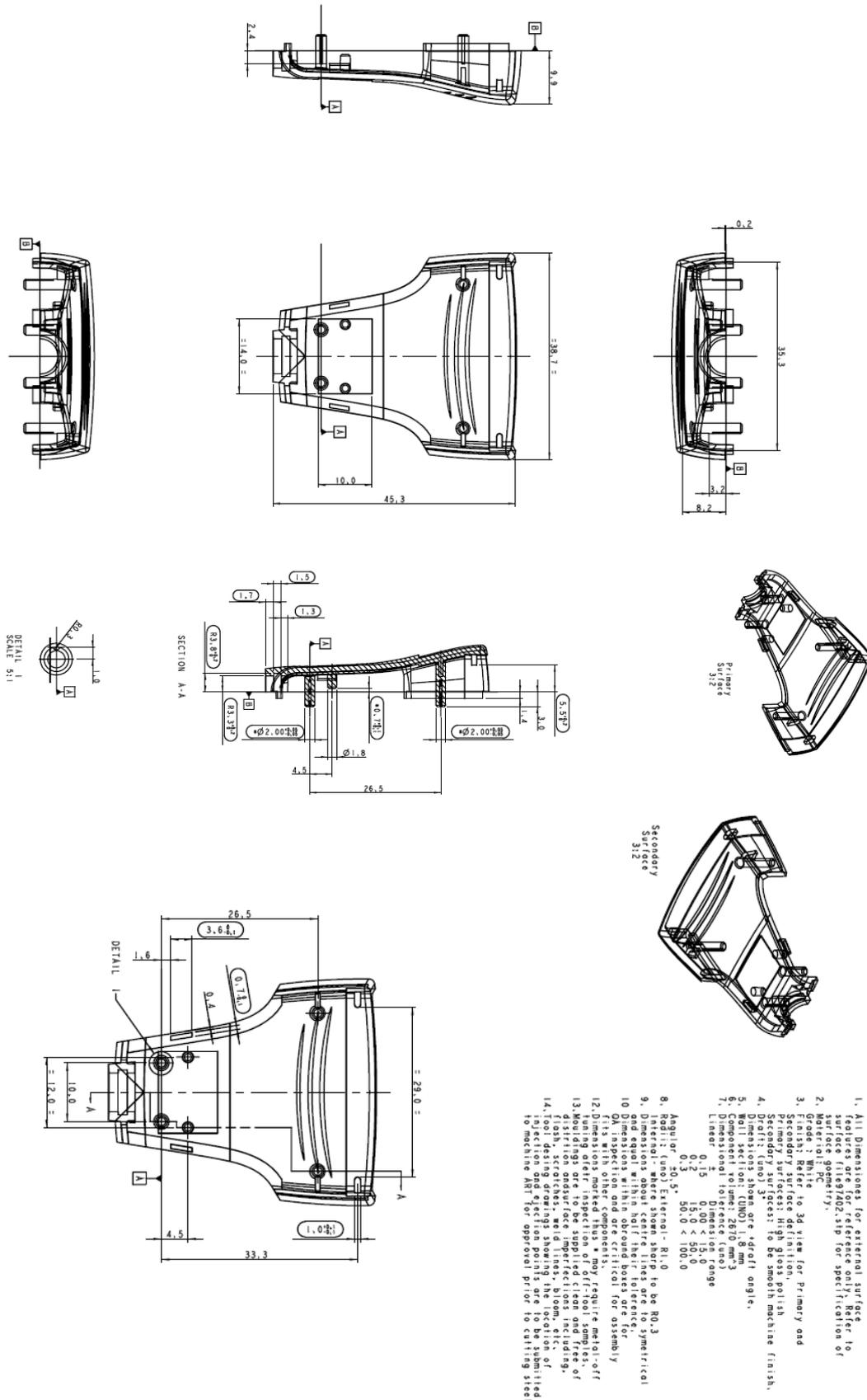
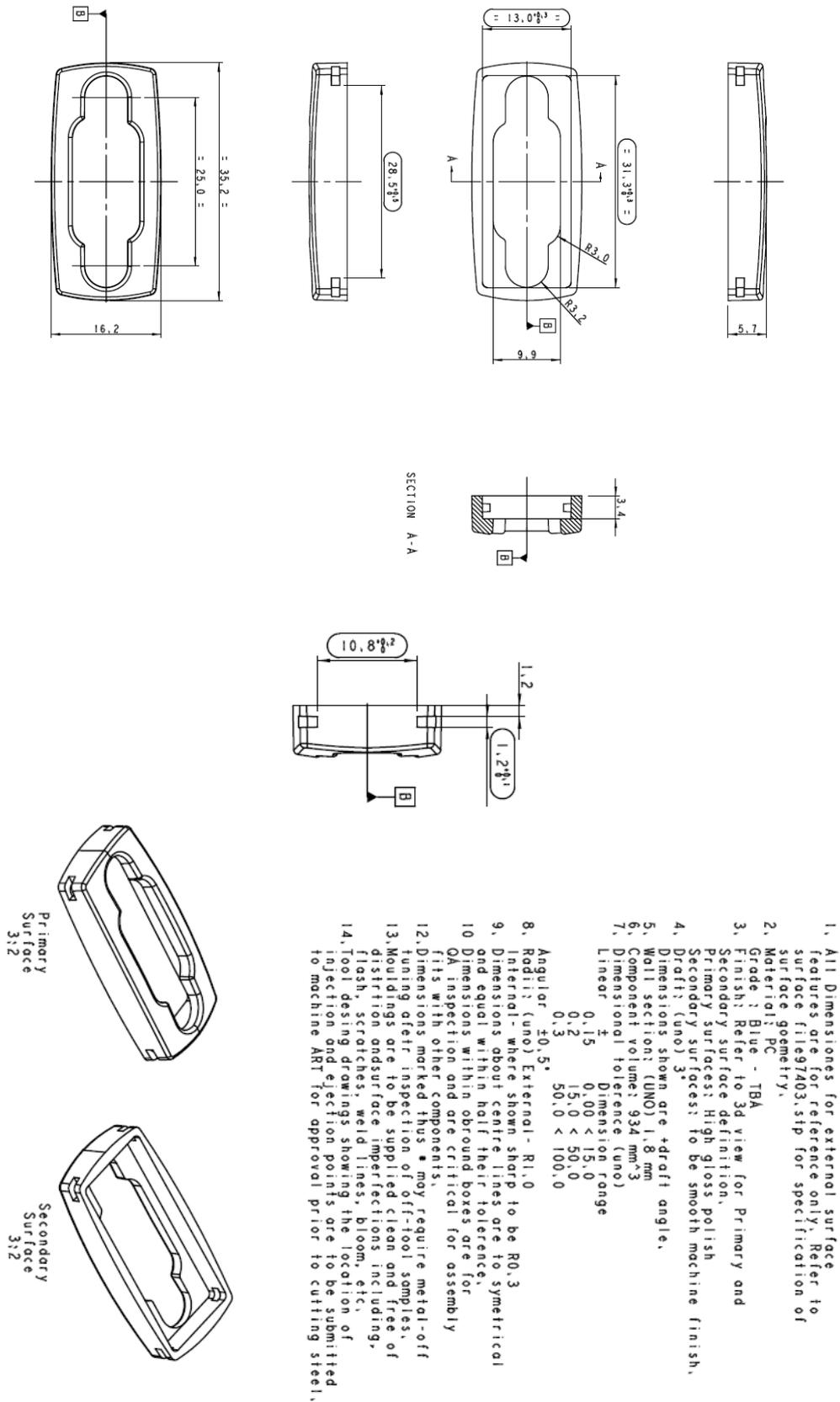


Figure 6-3 Case Base Dimensions


Figure 6-4 Cap Dimensions

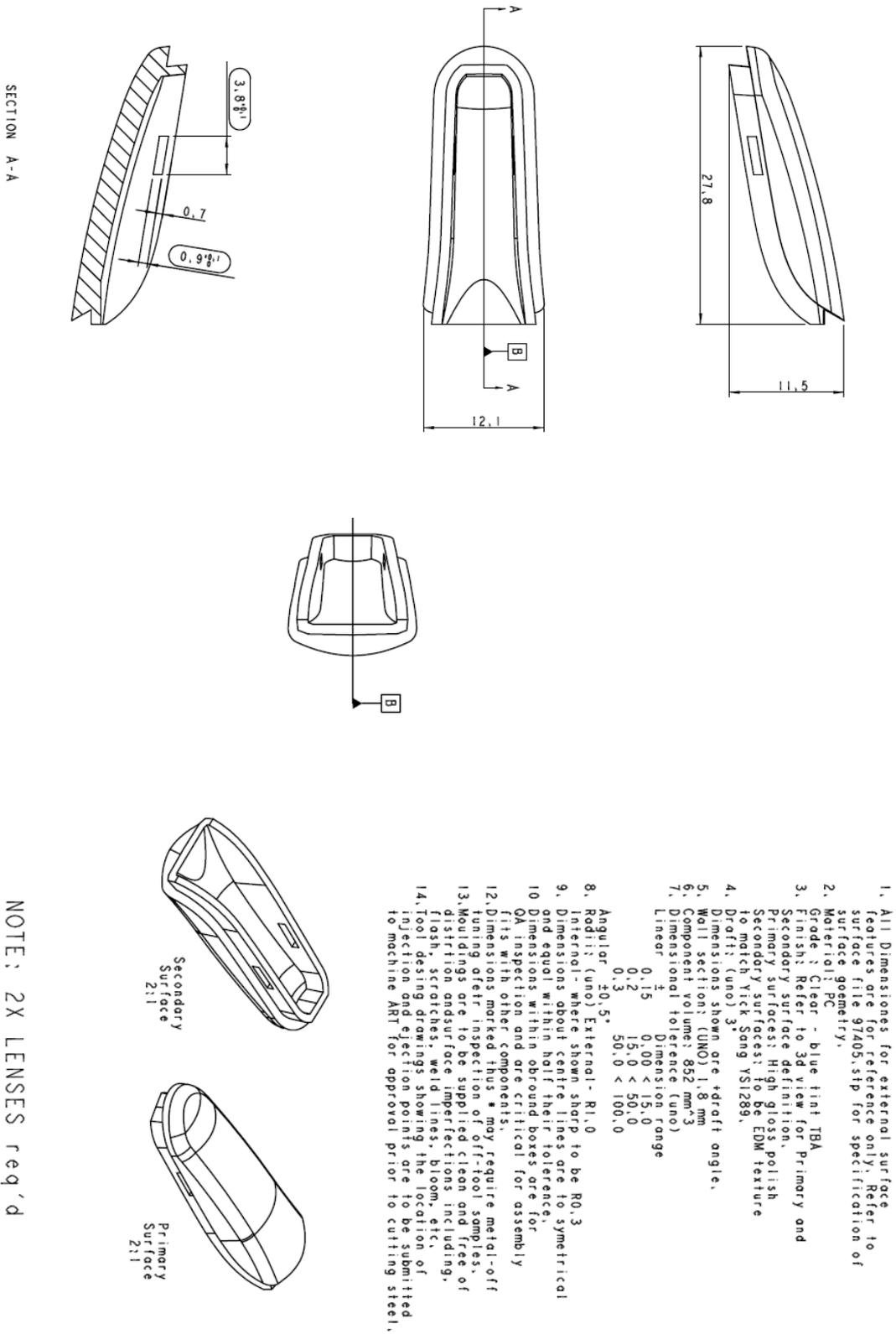


Figure 6-5 Lens Dimensions

NOTE: 2X LENSES req'd

7 Physical Environment Details

7.1 Operating

Parameter	Description	Minimum	Typical	Maximum	Units	Conditions
T	Operating Temperature Range	-20		+80	°C	5% to 95% RH, non condensing

Table 7.1 Operating Temperature

8 Environmental Approvals & Declarations

8.1 EMI Compatibility

FCC, CE and UKCA

The US232R has been tested to be compliant with both FCC Part 15 Subpart B and European EMC Directive.



NOTE: This is a Class B product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.



NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

8.2 Safety

The US232R is defined as Limited Power Supply (LPS) device, with operating voltages under 60VDC.

8.3 Environmental

The US232R is a lead-free device that complies with the following environmental directives: RoHS, WEEE, REACH, PFOS and DecaBDE.

8.4 Reliability

The US232R is designed as a robust USB-Serial adapter for use in many environments. There are no user-serviceable parts. Any failure will require a replacement of the unit.

9 Troubleshooting

9.1 Hardware

Cables are the most common sources of trouble with external devices.

Check the following:

- USB cable is properly inserted
- Computer power is ON
- Computer is not in Sleep or Standby
- If a USB Hub is used, be sure it is set for "Self-Powered" operation
- If a USB Hub is used, be sure all cables are properly inserted

RS232 cables – check the following:

- Output signals (TXD, RTS, DTR) are connected to the respective inputs (RXD, CTS, DSR) in each direction.
- Check for specific handshake requirements of your RS232 peripheral.
- If handshake signals are not used, ensure the application is set to "No Hardware Handshake", or equivalent.
- Test the port with a loop-back connector. Connect TXD to RXD, RTS to CTS and DTR to DSR. Use a simple terminal program (e.g. HyperTerminal) to check that data is transmitted and received.

9.2 Device Driver

Ensure the latest device driver is in use. See <https://ftdichip.com/>

If other devices with FTDI chips are installed in the system, check with all manufacturers of these devices for the latest device drivers.

See the FTDI installation guides for additional details: <https://ftdichip.com/document/installation-guides/>

Common Windows Device Driver Troubles:

- **DEVICE TIMES OUT:** The default settings of the device driver assume typical data transfers of hundred to thousands or more bytes at a given time. Some applications, such as a GPS device, only send data in short packets, often only a few bytes. If this is the case, it may be necessary to adjust the drivers buffer size and/or latency timer to smaller values. These values can be adjusted through the Advanced driver options as noted in Figure 2.13. The buffer size can be reduced to 64 bytes. The latency timer can be set as low as 2ms. A setting of 1ms will cause unnecessary USB traffic and could adversely affect data transmission.
- **ERRATIC MOUSE POINTER:** The device driver defaults to query an attached device to find out whether it is a mouse or modem, consistent with native COM port operation. Some RS232 peripherals constantly send short packets of data, causing the host system to "think" a mouse or modem has been attached. These short packets will interfere with normal mouse operation causing the pointer to jump around the screen. If this happens, disconnect the RS232 device and *uncheck the Serial Enumerator* option, also found on the Advanced driver options screen in Figure 2.13.
- **COM PORT IN USE:** Windows keeps track of all COM port assignments. If multiple FTDI products have been connected to a single system, the COM port number will increase, even if the other devices are not attached. If the higher COM port assignments are not acceptable for the application, known unused COM port numbers should be uninstalled according to the FTDI installation guide: <https://ftdichip.com/document/installation-guides/>.

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Appendix B - Revision History

Document Title: DS_US232R-10(R-100/500) USB to RS232 Adapter cable Datasheet
Document Reference No.: FT_000151
Clearance No.: FTDI #99
Product Page: [Cables](#)
Document Feedback: [Send Feedback](#)

Revision	Changes	Date
Draft	Initial Draft – subject to change	07-07-2009
Version 1.0	Initial Release	04-08-2009
Version 1.1	Added part number US232R-500 and modified disclaimer	13-01-2011
Version 1.11	Edited that the US232R cable is available in three lengths	25-01-2011
Version 1.2	Added UKCA and updated part number to FT232RQ. Updated driver support and links.	17-07-2023