

User's Guide

SerialGhost Module

SerialGhost Module TimeKeeper



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Getting started

Already familiar with *SerialGhost* data loggers?

⇒ Configure your device and start logging in 5 simple steps: section **Quick Start**

New to *SerialGhost* data loggers?

- ⇒ First, configure the serial bus parameters: section **Configuration**
- ⇒ Then learn about recording data: section **Recording data**
- ⇒ Finally, retrieve the recorded data: section **Viewing recorded data**

Questions or problems?

⇒ Go through the **Troubleshooting** section.

Introduction

About the product

The *SerialGhost Module* is a modular RS-232 and serial bus logger with high-capacity internal memory, which may be accessed as a USB flash drive. Bidirectional data flowing through the serial bus will be captured and stored on the internal flash drive in a special file. This data may be retrieved by switching to flash drive mode. The logger will pop up as a removable drive, giving instant access to all captured data. The *SerialGhost Module* does not require any dedicated software or drivers.

The *SerialGhost Module TimeKeeper* has an additional built-in time-stamping module and battery. This enables adding time and date information to the log file. Thanks to the internal battery, the time and date persist even when the device is not powered.

Features

- Logs asynchronous serial transmission (RS-232 compatible)
- Baud rates up to 230400 bps
- Logs 2 streams simultaneously (RX and TX)
- High-capacity internal flash memory, accessible as a USB removable drive
- Powered from a USB port, or external power supply
- No software or drivers required, Windows, Linux, and Mac compatible
- USB flash drive mode
- Modular form-factor with terminal block connectors
- Time and date stamping (*SerialGhost Module TimeKeeper*)
- Built-in battery (*SerialGhost Module TimeKeeper*)

Requirements

- Asynchronous serial bus with RS-232 logic levels
- Operating system with USB Mass-Storage device support
- USB 5V DC or power supply 9V...24V DC

Quick Start

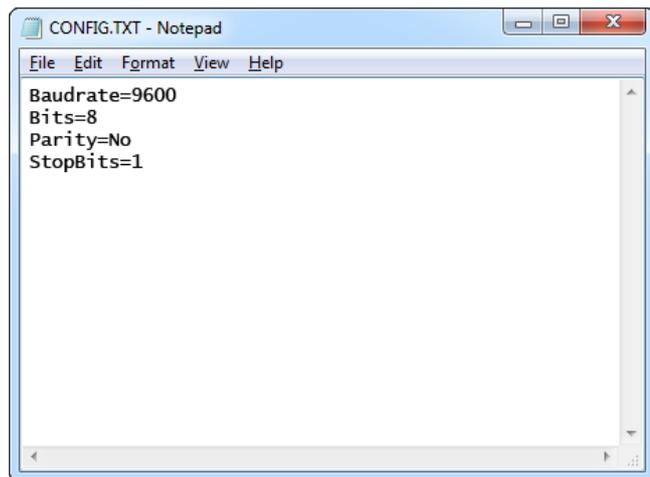
This section contains concise information on basic operation of the *SerialGhost Module* and *SerialGhost Module TimeKeeper*. If you need detailed instructions, please refer to sections [Configuration](#), [Recording data](#), and [Viewing recorded data](#).

Before you start, make sure you have the following information about the serial bus you want to log data from:

- Baud rate (bits per second)
- Number of bits per transfer (usually 8)
- Parity bit configuration (usually not used)
- Number of stop bits per transfer (usually 1)

Step 1. Open a text editor (such as *Notepad*) and create a file named CONFIG.TXT. This file will later be used to configure the device. Use the following template:

```
Baudrate=9600  
Bits=8  
Parity=No  
StopBits=1
```



Replace *Baudrate* with the actual baud rate in bits per second of the serial bus you want to log data from. Replace *Bits* with the number of bits per transfer (5...8). Provide the parity check using one of the following strings: *No*, *Even*, *Odd*, *Space*, or *Mark*. Replace *StopBits* with the number of stop bits per transfer (1, 1.5, or 2).

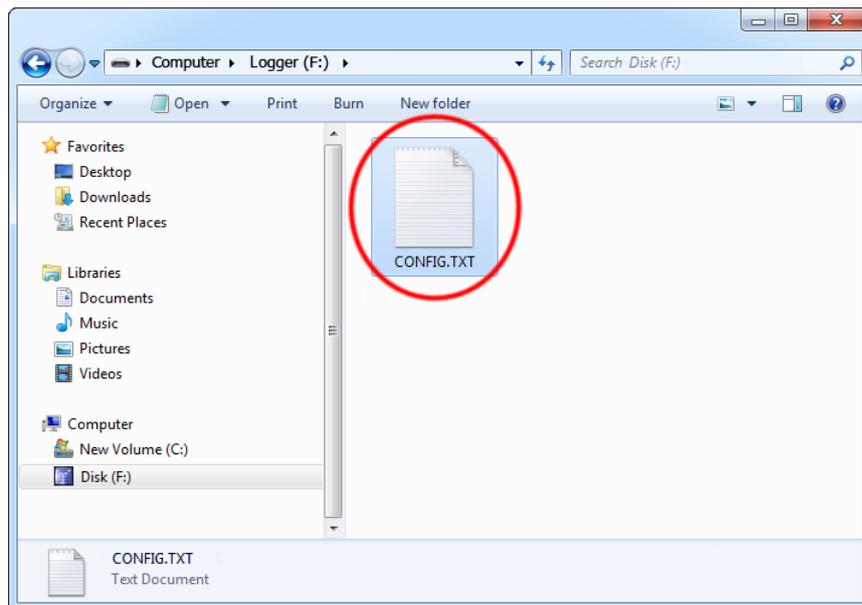
Finally, save the configuration file as CONFIG.TXT.

Step 2. Connect the device to a computer or laptop using the USB connector and then short input MODE to GND for a short moment. This will initiate toggling the mode of operation from record mode to flash drive mode.



After a few seconds, the device will automatically get detected as a mass storage device, and pop up as a removable drive.

Step 3. Copy the configuration file CONFIG.TXT to the logger's flash drive.



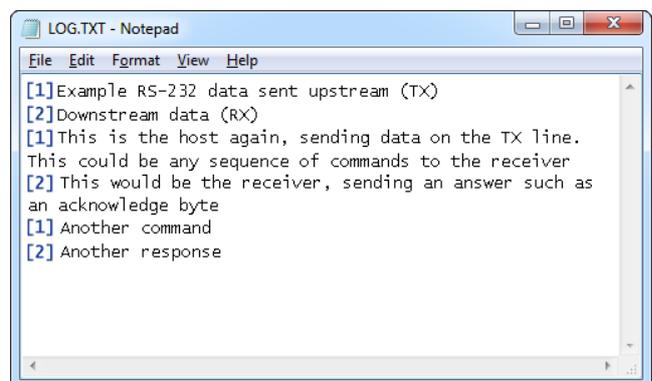
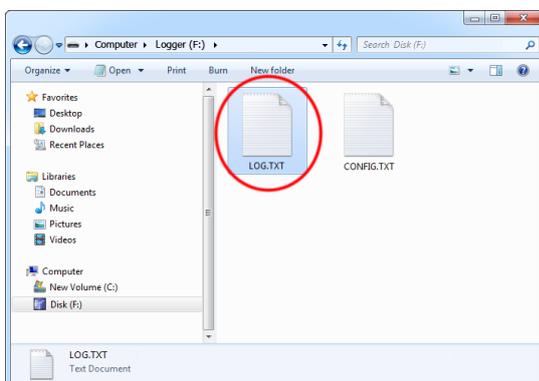
Then, safely remove the device, and short input MODE to GND for a short moment to exit flash drive mode.

Step 4. To start logging, connect the logger in-line on a serial bus. Connect either one, or two sources of serial data with RS-232 logic levels to inputs RX1 and RX2.



The device may be powered from a standard USB port with +5V DC. Alternatively, an external +9...+24V DC (min. 200 mA) power supply may be used to power the device. It is important to connect the ground of the monitored bus to the *SerialGhost's* ground connector GND.

Step 5. To retrieve the logged data, enable flash drive mode by shorting input MODE to GND for a short moment, just like in step 2. A removable drive will pop-up, containing the file LOG.TXT with recorded data.



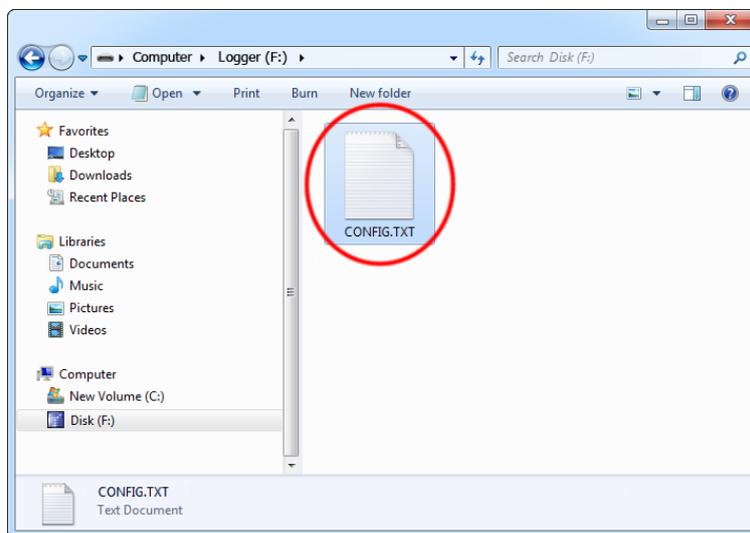
The upstream data (TX) and downstream data (RX) will be differentiated by the channel headers interleaved in the log file.

Configuration

The *SerialGhost Module* and *SerialGhost Module TimeKeeper* may be configured through the file CONFIG.TXT, placed in the flash drive root folder. Use any text editor to prepare such a configuration file, containing the following text:

```
Baudrate=9600
Bits=8
Parity=No
StopBits=1
```

Copy this file to the root folder in flash drive mode. The new configuration will be loaded on next power-up.



The following list presents the most common configuration options. All variable and value strings are case insensitive.

Baudrate sets the baud rate in bits per second of the monitored serial bus. Range is 300 bps to 230400 bps. Default value is 9600.

Bits sets the number of bits per transfer of the monitored serial bus. Possible values are 5, 6, 7, 8. Default value is 8.

Parity sets the parity bit type of the monitored serial bus. Possible values are *No*, *Even*, *Odd*, *Space*, *Mark*. Default value is *No*.

StopBits sets the number of stop bits per transfer of the monitored serial bus. Possible values are 1, 1.5, 2. Default is 1.

DualPort sets whether both input ports use different serial bus configurations. Possible values are *No* (both ports use common configuration defined by *Baudrate*, *Bits*, *Parity*, *StopBits*) and *Yes* (first port uses configuration defined by *Baudrate*, *Bits*, *Parity*, *StopBits*,

while second port uses configuration defined by *Baudrate2*, *Bits2*, *Parity2*, *StopBits2*). Default is *No*.

Baudrate2 sets the baud rate in bits per second of the monitored serial bus for the second port (used only when *DualPort* is set to *Yes*). Range is 300 bps to 230400 bps. Default value is 9600.

Bits2 sets the number of bits per transfer of the monitored serial bus for the second port (used only when *DualPort* is set to *Yes*). Possible values are 5, 6, 7, 8. Default value is 8.

Parity2 sets the parity bit type of the monitored serial bus for the second port (used only when *DualPort* is set to *Yes*). Possible values are *No*, *Even*, *Odd*, *Space*, *Mark*. Default value is *No*.

StopBits2 sets the number of stop bits per transfer of the monitored serial bus for the second port (used only when *DualPort* is set to *Yes*). Possible values are 1, 1.5, 2. Default is 1.

DisableLogging allows to disable data logging. Allowed values are *Yes* (logging disabled) and *No* (logging enabled). Default value is *No*.

LogMode sets the logging mode. Possible values are *Bin* (data is logged as binary data), *Hex* (data is logged as hexadecimal numbers), *Dec* (data is logged as decimal numbers). Default value is *Bin*.

Separator sets the separator character between data values in logging mode *Dec/Hex*. Possible values are *None*, *Space*, *Comma*, *Tab*, *Newline*. Default is *Space*.

Separator2 sets the separator character used when a header is inserted into the stream (upon active stream change and before a time-stamp). Possible values are *None*, *Space*, *Comma*, *Tab*, *NewLine*. Default is *NewLine*.

EnablePort configures which input ports are enabled and which serial streams are to be logged. Possible values are *Both* (both input ports are enabled), *Port0* (only the first input port is enabled), *Port1* (only the second input port is enabled). Default is *Both*.

Header defines a string value for the main device header, which is included in each header inserted into the log file. No default value.

HeaderInterval sets an inactivity interval in seconds, after which a header is inserted into the log file. A header will be inserted only if there has been no bus activity for a period exceeding the *HeaderInterval* value, or if the active serial stream has changed. Default value is 5.0.

ChannelHeaders enables/disables the channel headers defined by *Channel0Header* and *Channel1Header* to be included in the log file. Allowed values are *Yes* (channel headers enabled) and *No* (channel headers disabled). Default value is *Yes*.

Channel0Header defines a string value for the header for the first input port, which is included in each header inserted into the log file. Default value is 0.

Channel1Header defines a string value for the header for the second input port, which is included in each header inserted into the log file. Default value is *1*.

TimeStamping configures the built-in time- and date-stamping module (*SerialGhost TimeKeeper* only). Allowed values are *Yes* (timestamping enabled) and *No* (timestamping disabled). Default is *Yes*.

TimeFormat configures how time-stamps are formatted in the data log (*SerialGhost TimeKeeper* only). Allowed values are *24* (24h format) and *AM* or *PM* (both values will select the 12h format). Default is *24*.

UsbMode configures mode of USB operation. Allowed values are *Flash* (the device switches between capture and USB flash mode) and *Com* (the device operates as a Virtual COM device). Default is *Flash*.

A full list of parameters is available in section [Configuration files](#).

Recording data

Record mode is the default mode of operation for the *SerialGhost Module (SerialGhost Module TimeKeeper)* data logger. In record mode, the device will silently monitor the bidirectional data flow on the serial bus and store the captured data on the internal flash drive in file LOG.TXT.

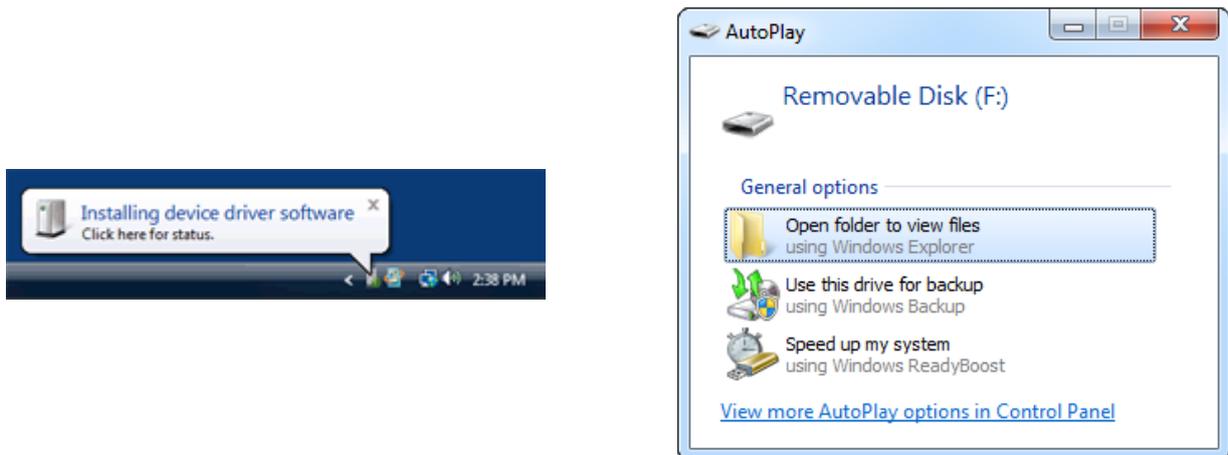
The *SerialGhost Module (SerialGhost Module TimeKeeper)* must first be configured to the appropriate serial bus parameters, such as baud rate. Refer to section **Configuration** for detailed instructions.

Installation of the *SerialGhost Module* in record mode is quick and easy, no software or drivers are required. Connect either one, or two sources of serial data with RS-232 logic levels to inputs RX1 and RX2. The device may be powered from a standard USB port with +5V DC. Alternatively, an external +9...+24V DC (min. 200 mA) power supply may be used to power the device. It is important to connect the ground of the monitored bus to the *SerialGhost's* ground connector GND.

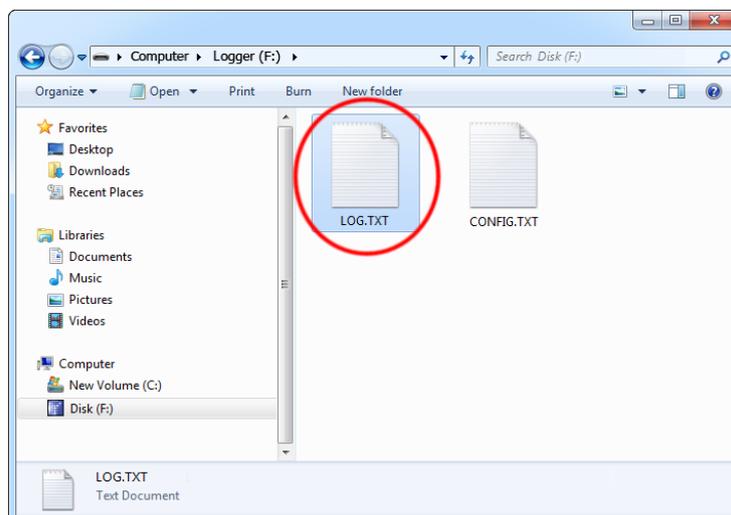


Viewing recorded data

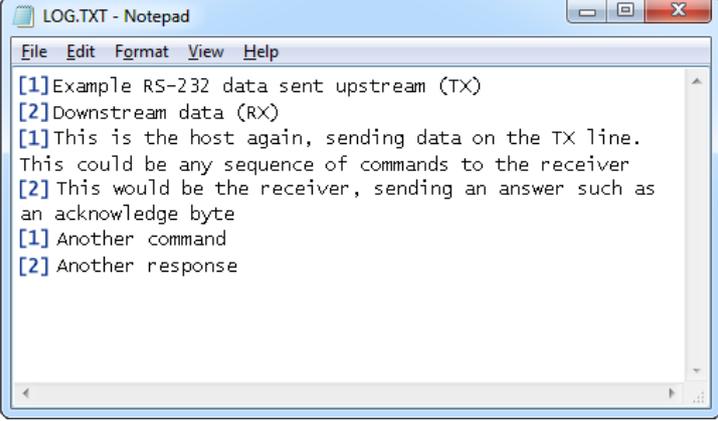
Once serial data has been recorded, it may be retrieved on any computer with a USB port. This is done by switching to flash drive mode. Connect the *SerialGhost Module (SerialGhost Module TimeKeeper)* to any computer with mass storage device support with a USB cable, and short input MODE to GND for a short moment. After a few seconds, the *SerialGhost Module (SerialGhost Module TimeKeeper)* will automatically get detected as a mass storage device, and pop up as a removable drive. The operating system will use the standard built-in mass storage driver (*MS Windows* in the following examples).



Depending on the drive letters available, the device will be visible as a new drive, for example F:. Use the systems file manager to browse this disk (for example *Explorer*).



The removable disk will contain the file LOG.TXT with a text log of all captured data. The data is stored in the same format as appearing on the serial bus, without any encoding. The upstream data (TX) and downstream data (RX) will be differentiated by the channel headers interleaved in the log file. The *SerialGhost Module* will also interleave time-stamps. The file LOG.TXT can be viewed and searched with any text editor, such as *Notepad* or *MS Word*.



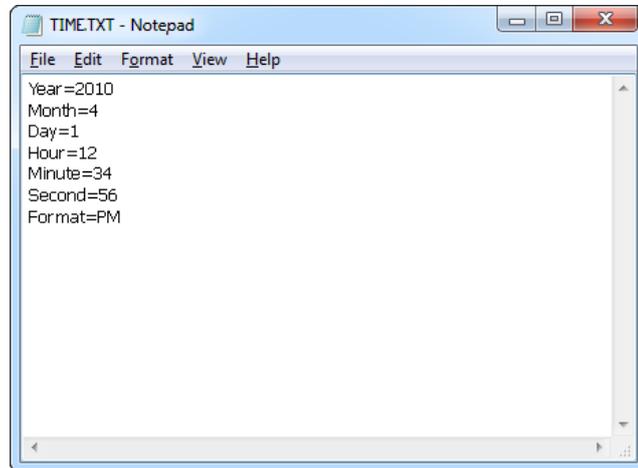
```
LOG.TXT - Notepad
File Edit Format View Help
[1] Example RS-232 data sent upstream (TX)
[2] Downstream data (RX)
[1] This is the host again, sending data on the TX line.
This could be any sequence of commands to the receiver
[2] This would be the receiver, sending an answer such as
an acknowledge byte
[1] Another command
[2] Another response
```

Switching back to record mode can be achieved by a safe software removal of the flash disk. Use the systems standard disk removal procedure. For *MS Windows*, left-click on the *Safe Removal* icon in the system tray and select the appropriate drive. Then short input MODE to GND for a short moment again to return to record mode.

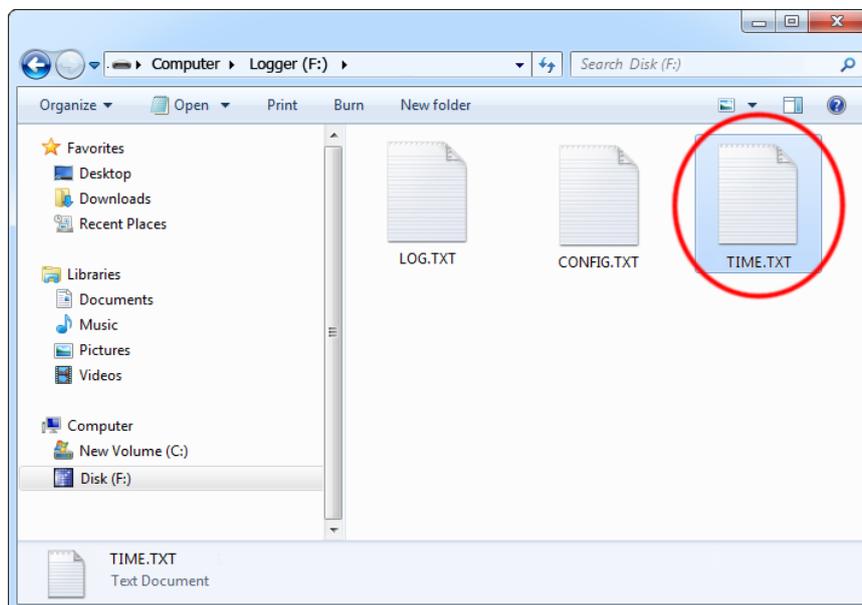
Clock configuration

It is necessary to configure the built-in clock module for getting correct date and time-stamps. To do this, a text file named TIME.TXT should be prepared with the following format:

```
Year=2020  
Month=4  
Day=1  
Hour=12  
Minute=34  
Second=56  
Format=PM
```



The fields should contain the current time and date. The field *Format* allows distinguishing between A.M., P.M., and 24-hour time (use the value *AM*, *PM*, or *24*). After the file has been prepared, switch to flash drive mode and copy the file TIME.TXT to the root folder of the flash disk.



After copying the file, safely remove the flash drive and short input MODE to GND for a short moment to switch back to record mode. The new clock configuration will be loaded during the next power-up.

The clock configuration file must be named TIME.TXT and must be placed in the root folder. Variable and value strings are case insensitive, however they must match the options listed below.

- *Year* sets the clock year value. Valid range is from 2000 to 2099.
- *Month* sets the clock month value. Valid range is from 1 (January) to 12 (December).
- *Day* sets the clock day value. Valid range is from 1 to 31. If the specified day exceeds the maximum number of days in the specified month, the next valid day value will be chosen.
- *Hour* sets the clock hour value. Valid range is from 1 to 12 for 12-hour time (A.M./P.M.), and 0 to 23 for 24-hour time.
- *Minute* sets the clock minute value. Valid range is from 0 to 59.
- *Second* sets the clock second value. Valid range is from 0 to 59.
- *Format* sets the time format. Valid values are *AM*, *PM*, and *24*. If *AM* is chosen, the 12-hour format is selected and the specified hour is treated as before noon. If *PM* is chosen, the 12-hour format is selected and the specified hour is treated as afternoon. If *24* is chosen, the 24-hour format is selected and the specified hour is treated as 24-hour format.

Sample TIME.TXT for 12-hour time:

```
Year=2020
Month=10
Day=25
Hour=5
Minute=51
Second=43
Format=PM
```

Sample TIME.TXT for 24-hour time:

```
Year=2020
Month=10
Day=25
Hour=17
Minute=51
Second=43
Format=24
```

A full list of parameters is available in section [Configuration files](#).

Configuration files

The *SerialGhost Module (SerialGhost Module TimeKeeper)* is configured via two text files placed on the internal flash drive:

- CONFIG.TXT (configures serial bus parameters)
- TIME.TXT (configures the internal clock for time-stamping)

These files should contain configuration parameters, placed in successive lines in the following format:

```
Parameter1=Value  
Parameter2=Value  
Parameter3=Value
```

...

These configuration files must be placed in the device internal memory using flash drive mode.

CONFIG.TXT

The file CONFIG.TXT is responsible for configuring the main operation of the device.

| Parameter | Values | Example | Description |
|-----------|--|-----------------|--|
| Baudrate | Baud rate in bps (default 9600) | Baudrate=115200 | Serial bus baud rate in bits per second (300...230400). |
| Bits | 5 6 7 8 (default) | Bits=7 | Number of bits per transfer on the monitored serial bus. |
| Parity | No (default) Even Odd Space Mark | Parity=Even | Type of parity bit on the monitored serial bus. |
| StopBits | 1 (default) 1.5 2 | Parity=1 | Number of stop bits per transfer on the monitored serial bus. |
| DualPort | Yes No (default) | DualPort=Yes | Sets whether both input ports use different serial bus configurations. Both ports can use a common configuration defined by Baudrate, Bits, Parity, StopBits or different configurations when dual port mode is enabled. In this case the first port uses the configuration defined by Baudrate, Bits, Parity, StopBits, while the second port uses the configuration defined by Baudrate2, Bits2, Parity2, StopBits2. |
| | | | |
| | | | |

| | | | |
|-----------------------|--|-----------------------------------|---|
| Baudrate2 | Baud rate in bps (default 9600) | Baudrate2=9600 | Serial bus baud rate in bits per second (300...230400) for the second port when dual port mode is enabled. |
| Bits2 | 5 6 7 8 (default) | Bits2=8 | Number of bits per transfer on the monitored serial bus for the second port when dual port mode is enabled. |
| Parity2 | No (default) Even Odd Space Mark | Parity2=Mark | Type of parity bit on the monitored serial bus for the second port when dual port mode is enabled. |
| StopBits2 | 1 (default) 1.5 2 | Parity2=2 | Number of stop bits per transfer on the monitored serial bus for the second port when dual port mode is enabled. |
| DisableLogging | Yes No (default) | DisableLogging=Yes | Sets whether to disable data logging completely. |
| LogMode | Bin (default) Hex Dec | LogMode=Hex | Set the data format in log file. |
| Separator | None Space (default) Comma Tab Newline | Separator=Comma | The separator character between data values when LogMode is set to Dec or Hex. |
| Separator2 | None Space Comma Tab Newline (default) | Separator=Newline | The separator character used upon inserting a header. |
| EnablePort | Both (default) Port0 Port1 | EnablePort=Port0 | Configures which input ports are enabled and which serial streams are to be logged. |
| Header | String (no default value) | Header=MyDevice01 | Defines a string value for the main device header, which is included in each header inserted into the log file. |
| HeaderInterval | Interval in seconds (default 5.0) | HeaderInterval=1.5 | Sets an inactivity interval in seconds, after which a header is inserted into the log file. A header will be inserted only if there has been no bus activity for a period exceeding the HeaderInterval value, or if the active serial stream has changed. |
| ChannelHeaders | Yes (default) No | ChannelHeaders=No | Enables/disables the channel headers defined by Channel0Header and Channel1Header to be included in the log file. |
| Channel0Header | String (default "0") | Channel0Header =GPS-downstream | Defines a string value for the header for the first input port, which is included in each header inserted into the log file. |
| Channel1Header | String (default "1") | Channel1Header =GPS-upstream | Defines a string value for the header for the second input port, which is included in each header inserted into the log file. |
| TimeStamping | Yes (default) | TimeStamping=Yes | Sets whether to disable time-stamping |

| | | | |
|-------------------|--------------------------|---------------|--|
| | No | | completely (TimeKeeper version only). |
| TimeFormat | 24 (default) AM PM | TimeFormat=AM | Sets the time format in time-stamps. Use 24 for the 24h format, and either AM or PM for the 12h format. |
| UsbMode | Flash (default) Com | UsbMode=Com | Configures mode of USB operation. Allowed values are Flash (the device switches between capture and USB flash mode) and Com (the device operates as a Virtual COM device). |

TIME.TXT

The file TIME.TXT is responsible for configuring the built-in real-time clock.

| Parameter | Values | Example | Description |
|---------------|---|-----------|---|
| Year | Year value (range 2000...2099, default 2010) | Year=2019 | Year setting (range 2000 to 2099). |
| Month | Month value (range 1...12, default 1) | Month=10 | Month setting (1 is January, 12 is December). |
| Day | Day value (range 1...31, default 1) | Day=15 | Day setting (range 1 to 31). |
| Hour | Hour value (range 1...12 or 0...23, default 1) | Hour=6 | Hour setting (range 1 to 12 for A.M./P.M. format and 0 to 23 for 24-hour time). |
| Minute | Minute value (range 0...59, default 0) | Minute=37 | Minute setting (range 0 to 59). |
| Second | Second value (range 0...59, default 0) | Second=49 | Second setting (range 0 to 59). |
| Format | AM PM (default) 24 | Format=24 | Time format setting. If AM is chosen, the 12-hour format is selected and the specified hour is treated as before noon. If PM is chosen, the 12-hour format is selected and the specified hour is treated as afternoon. If 24 is chosen, the 24-hour format is selected and the specified hour is treated as 24-hour format. |

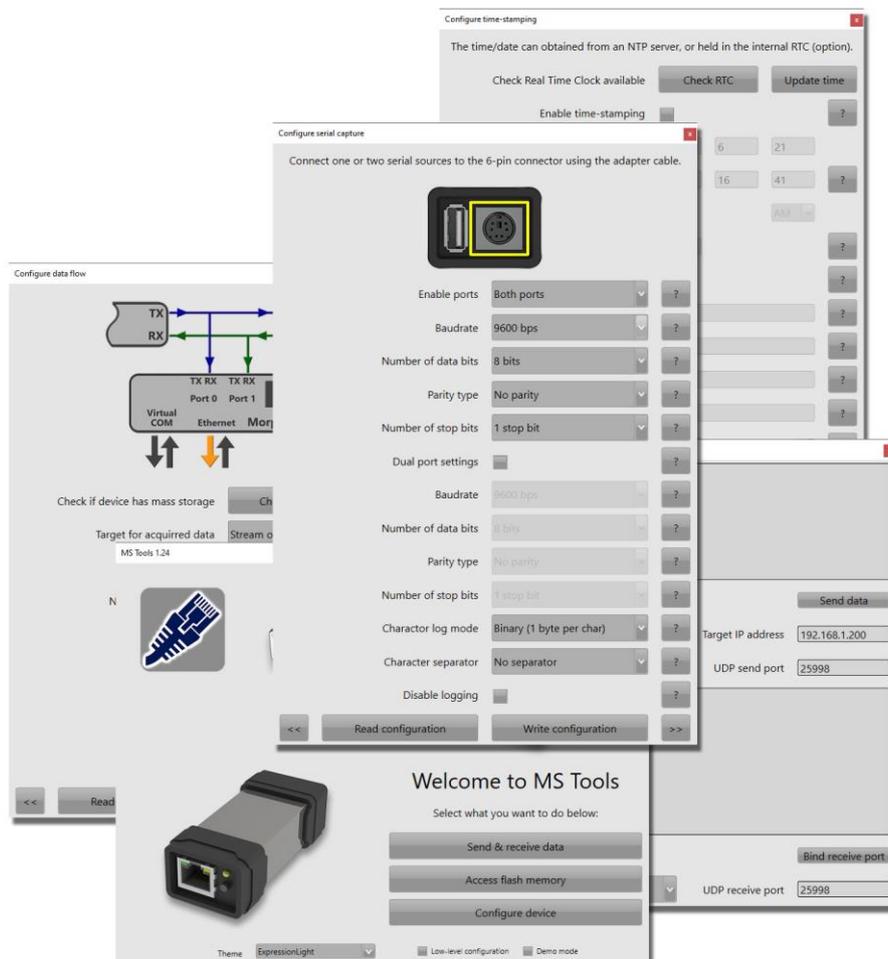
Virtual COM mode

Virtual COM mode is a special mode available in the *SerialGhost Module* in which the device connects as a serial COM port. The CDC (Communications Device Class) driver class will be used, which is built-in most operating systems. To enable Virtual COM mode, the following entry needs to be present in CONFIG.TXT (refer to the **Configuration** section for details):

```
UsbMode=Com
```

Make sure the CONFIG.TXT file is properly saved in the flash drive root folder. Upon next power-up, the device will connect as a Virtual COM port.

Virtual COM mode allows live data streaming of acquired data, and communication with the device using a proprietary command set. Several software examples are delivered to take advantage of this mode, and demonstrate the principles of communication. *MS Tools* is a free application delivered with source code and is a good starting point.



Specifications

| | |
|--|--|
| Power supply | 4.5 V – 5.5 V DC (USB) or 9.0 V – 24.0 V DC (external power) |
| Max. power consumption | 80 mA (recommended 200 mA power supply) |
| Maximum continuous log speed (approx.) | 100 kB/s (both streams) |
| Data retention | 100 years |
| Device support | Asynchronous serial devices operating at RS-232 logic levels |
| Maximum log read speed | 1 MB/s |
| Dimensions including connectors (L x W x H) | 72 mm x 16 mm x 16 mm (2.8" x 0.6" x 0.6") |

Troubleshooting

The *SerialGhost Module (SerialGhost Module TimeKeeper)* will **not** work with the following hardware configurations:

1. Synchronous serial buses
2. Devices operating at speeds higher than 230400 bps
3. Serial buses using logic levels different than RS-232 logic levels
4. SPI, I2C, TWI, USB, PS/2, SATA, FireWire, etc. buses

The SerialGhost Module does not switch to flash drive mode

Please check the following:

1. Is your device connected to USB and are you shorting and then releasing MODE to GND?
2. Does the operating system support removable USB flash disks?
3. Have you checked the drive list?
4. Have you tried on a different USB port?
5. Have you checked on a different computer?

I can't find any data after switching to flash drive mode

Please check the following:

1. Have you powered the device from the USB port or external power supply while recording?
2. Did you properly configure the device through CONFIG.TXT?
3. Have you actually transmitted any data over the serial bus while recording?

The SerialGhost Module always shows up as a removable drive

Check if MODE isn't permanently shorted to GND.

Problems with time-stamps

Set the correct time by creating a clock configuration file TIME.TXT. Make sure you have not disabled time-stamping. Refer to the **Clock configuration** section for detailed instructions.

I've checked everything, nothing helps!

If you are still experiencing problems, please do the following:

1. Check if the problem appears with a different baud rate and serial bus configuration.
2. Check if the problem appears with a different serial bus driver.
3. Check if the problem appears using a different USB port.

4. Contact the dealer you have purchased the device from. Please supply all necessary information (hardware type, model and manufacturer, OS type and version, and a short description of the problem).

Legal disclaimer

No responsibility is taken for any damage, harm or legal actions caused by misuse of this product. The user should follow the guidelines contained in this document, otherwise no liability will be assumed. It is the user's responsibility to obey all effective laws in his/her country, which may prohibit usage of this product.

For more information, visit the following websites:

<http://www.keelog.com/>

<http://www.airdrivewifi.com/>