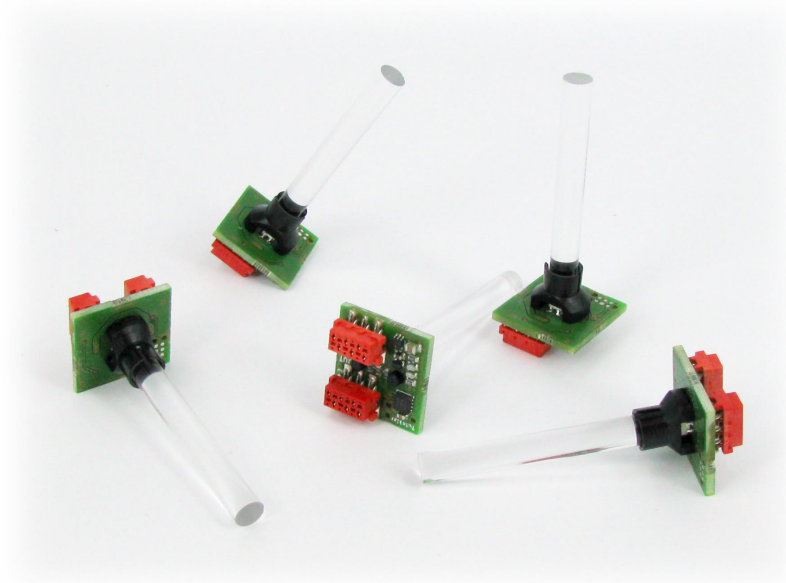# Twinkler – User Guide

The "Twinkler" is a small electronic device for lighting effects. The device embeds an RGB LED, a controller, a voltage regulator and provisions for mounting a light pipe. A Twinkler can run a schedule (with light and colour changes, including fading, blinking and "twinkling" effects) by itself, or accept commands transmitted over a serial line. An arbitrary number of Twinklers can be daisy-chained to form a long LED line, in which each LED can be individually controlled. Power runs over the same cable as the serial communication line.

The on-board controller on the Twinkler manages the dimming, fading, blinking and "twinkling" of the LED, off-loading this task from the PC or the device that drives the Twinkler(s). As a result, the Twinkler boards can be updated relatively quickly with low overhead for the PC or controller that performs this updating.

The daisy chain of Twinklers forms a serial bus that carries commands and data. The input and output lines of each Twinkler are filtered to reduce EMC emission and increase EMC immunity. Each Twinkler also has its own voltage regulator, to annul the effects of voltage drop over a long bus and to reduce EMC on the power lines. Due to the current capacity of common ribbon cable, it is advised to mount a power repeater after every 75 Twinklers in a chain.

Contents

Preliminary

Anti-static handling precautions

Please observe anti-static handling precautions when handling the device, as it contains components that are sensitive to static discharges.

Legal disclaimer

ITB CompuPhase shall not be liable for the incidental or consequential losses or damage to tangible property, injury or death of a person in connection with the use of this device.

Twinkler hardware

A Twinkler board has two sockets for 6-wire ribbon cable with Micro-MaTch connectors. The Twinkler receives both power and data (serial communication) on the connector marked "IN"; it forwards power and data on the connector marked "OUT".
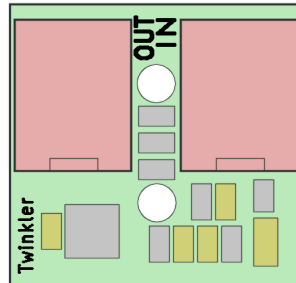

Twinkler "component side" (the LED is at the reverse side)

A Twinkler may optionally be equipped with a light pipe. Several light pipes are available: solid and flexible and from 2 to 5 mm diameter. See the photograph on page 1 for an example of Twinklers with a 5 mm solid straight light pipe).

Connecting a Twinkler to a PC

To connect a Twinkler to a controller device, such as a PC, an interface board is needed. Two interface boards are available: one that connects to an USB port of a PC, and an RS232 port (see Accessories on page 12).
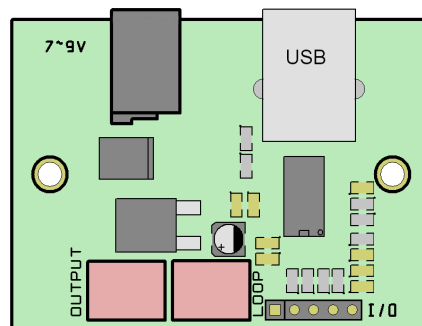
The Twinkler USB interface

The Micro-MaTch connector of the interface (marked "OUTPUT") must be attached to the "IN" connector on the Twinkler (see the above figure and the figure on the next page). The second Micro-MaTch connector on the interface board, labelled "LOOP" or "LOOPBACK", is optionally connected —see the section "Daisy-chaining Twinklers" on page 4 for details.

Both interface boards also supply power to the Twinkler. A suitable power supply is required (7 V to 9 V DC).

The USB interface has an additional connector for general purpose I/O. For example, push-button switches can be connected to the interface. With the programmers toolkit, you can then use these switch inputs to create an interactive presentation. Refer to the data sheet of the USB interface for details.

To power supply (7V to 9V)
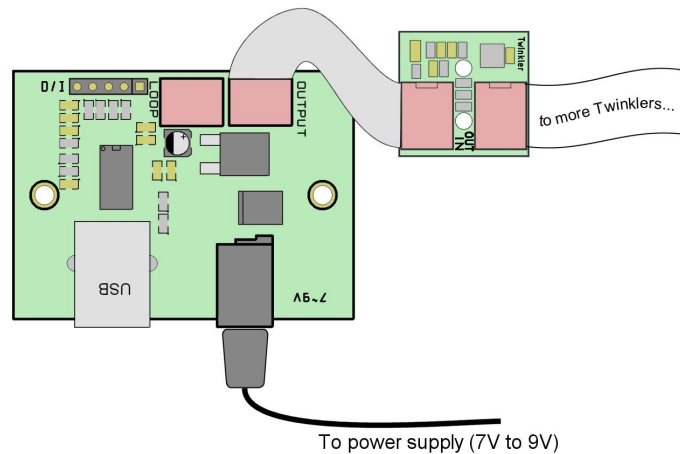
Daisy-chaining Twinklers

Each Twinkler board has two connectors: one is input and the other is output. Both connectors are "Micro-MaTch" connectors for 6-wire ribbon cable (see Accessories on page 12). The connectors have a polarity notch for proper orientation. Daisy-chaining boards is a simple matter of connecting the "OUT" of one board to the "IN" of the next board.
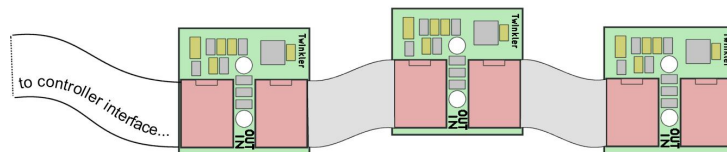

Optionally, you may also connect the "OUT" of the last Twinkler board to the "LOOP" (or "LOOPBACK") connector of the controller interface, thus creating a loop. A loop allows some basic diagnostics; when there is no loop, the controller device cannot read back any data from the daisy-chain. Note that not all controller devices or interface boards have a "LOOP" connector.

The theoretical maximum number of Twinklers in a chain is 16,255. This limit is imposed by the addressing mechanism in the serial communication protocol.

Adding power repeaters

The maximum current consumption of each Twinkler board is specified at a maximum 45 mA. The ribbon cables and the connectors are specified at a maximum of 3.5 A at 20 ˚C. This means that a power line in a daisy-chain should be no longer than approximately 75 Twinklers. When chaining more than 75 Twinklers, a power repeater should be placed in the chain. A power repeater is a passive board with Micro-MaTch connectors for input and output, and a DC-power connector.
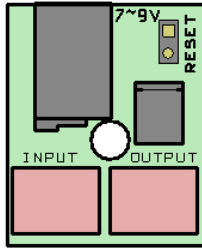
Power repeater board

The power repeater boards (see Accessories on page 12) have a diode to protect against polarity inversion. Because of this diode, the minimal voltage of the power supply is 6 V. The recommended voltage is in the range 7 V to 9 V DC.

To insert a power repeater in a chain, connect the "OUT" of the last Twinkler of a segment to the "INPUT" of the repeater, and the "OUTPUT" of the repeater to the "IN" of the first Twinkler of the next segment. Also connect a power supply to the DC-power connector.

The "RESET" pins on the power repeater are usually left unconnected. For an example of how these pins can be used to run a simple show, see "Storing a scenario on the Twinklers" on page 9.

Note the relative position of the "INPUT" and "OUTPUT" connectors, as compared to the "IN" and "OUT" connectors on a Twinkler board.
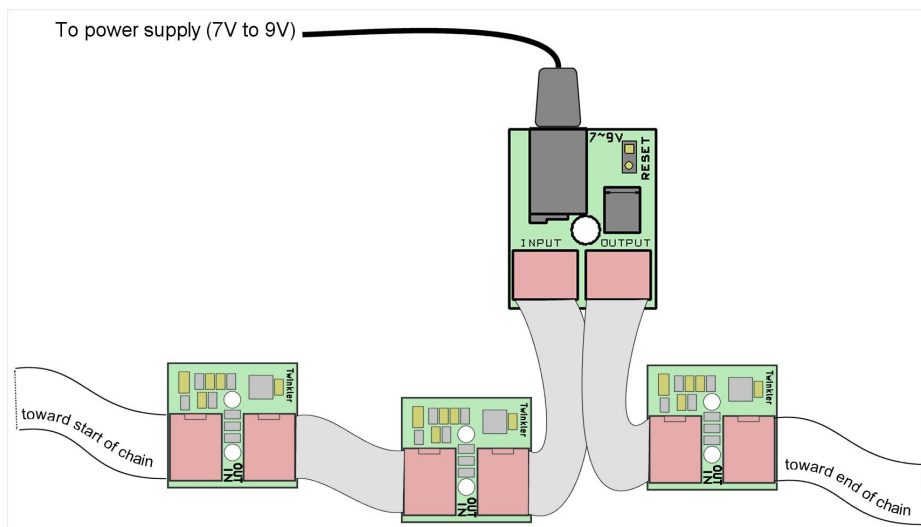
Twinkler software

Obtaining the software

Download the software and associated documentation from the web site:

http://www.compuphase.com/twinkler/

The software for the Twinkler exists for Microsoft Windows and for Linux.

Installing and configuring the software

The Twinkler software is distributed as a "setup" program for Microsoft Windows and a self-installing "autopackage" for Linux. In both cases, run the program to install the software.
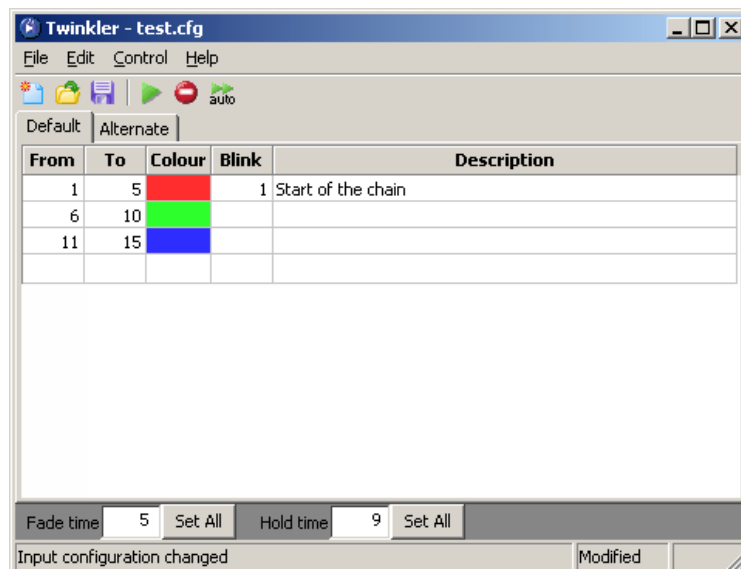
The Twinkler configuration utility (Microsoft Windows version)

After installation, run the program, and adjust the settings (menu "Control", then "Settings"). You should select a COM port for the program to use. For Microsoft Windows, the ports are called "COM1", "COM2", etc. In Linux, standard serial ports are called "ttyS0", "ttyS1", etc. and USB virtual ports are called "ttyUSB0", "ttyUSB1", etc.

If you have a USB interface board (see page 3) and if the drivers for that USB interface are installed, the settings dialog also lists a port with the name "Twinkler USB". You may select this port for enhanced functionality, specifically the support of external switch inputs. See the section "Configuration of auxiliary inputs" on page 9 for details. When running in Linux, you may need to run with "root" privileges to access the "Twinkler USB" port.

The Baud rate to use depends on the maximum length of the cables between

Twinkler boards and the background radiation level (EMC) in the area. For short cables (below 1 metre), the high Baud rate setting of 115,200 bps is almost always fine.

Creating a scene (set the colours of all Twinklers in a chain)

A scene defines a state (colour) for all Twinklers in a chain. Each scene consists of a set of ranges. A range can be a single Twinkler, or a series of consecutive Twinklers. The range is specified with the index numbers of the first and the last Twinkler that is part of it. The very first Twinkler in a daisy chain is number 1, all other Twinklers are numbered sequentially from that.

For a range, enter the first and last index numbers in de fields below the columns "From" and "To", then click on the "Colour" field to choose a colour. If a range is for a single Twinkler, the "To" field may be left empty. If you do not plan using ranges, you can hide the "To" column, see the "Edit" menu.

When selecting a colour, please note that the Twinkler has a limited range for its red, green and blue channels. The configuration software therefore rounds the colours that you select to the nearest approximation that the Twinkler hardware can display. Therefore, the software may show a (slightly) different colour than the one that you chose.

The colour selection dialog allows you to insert the selected colour into a custom palette. The custom palette is saved in the file with the scenes. Therefore, the custom palette may help you to use a consistent set of colours over several ranges, or over several scenes.

Optionally, you may also enter a description for the range. This text is only for your own reference; the program does not use the description in any way.

When right-clicking with the mouse on a row, a pop-up menu appears, from which you can choose to insert or to delete a row; or to move a row up and down.

The fields for the hold time are relevant only when there are multiple scenes in a configuration file (a "scenario") —see "Creating a scenario" on page 8.

Effects

There are two effects: fading and blinking. The fade setting is applies to all Twinklers in a chain —but it may change per scene; there is a field for the fade setting below the grid with colour definitions (just above the status bar). The blink field can be set for each range of Twinklers. Thus, in a chain, you can have some Twinklers blinking and some Twinklers non-blinking.

The fade speed is given as a value between 0 and 215. Values between 1 and 10 are fairly fast fades (0 = "no fade"). Values above 20 are fairly slow fades. The duration of a fade depends on the original and the target colours.

The fade duration is taken into account when blinking is active (see below), and when moving to a next scene (see "Running the scenario" on page 8). Note that the with slow fades and quick blinks or scene switches, the fade may not have finished before it starts a next fade.

The "Blink" column for each row in the grid must be a value between 0 and 14. Values between 1 and 10 indicate blinking, at various speeds; values between 11 and 14 are for "twinkling" at several speeds; and a value of 0 is solid on (no blinking, no twinkling).

For blinking (a value between 1 and 10), the value is the number of on-off cycles in a 3 second period. So if you fill in "2" in the "Blink" column, the Twinkler will blink twice per 3 seconds, or once every 1.5 second.

Twinkling is similar to blinking, but with a random interval. The value gives the average speed of the random blinks, with the value 11 being a slow twinkle effect and 14 a fast twinkle effect. In practice, twinkle effects work best in combination with a quick fade (e.g. set the fade to 1 or 2 when doing twinkling).

Loading and saving scenes

The application automatically saves configuration files when they are modified. On start-up, it loads the file that was active at the most recent usage of the application. To explicitly save a configuration file, to create a new configuration, or to load an existing configuration, use the "File" menu.

If the Twinkler chain is not connected to the PC on which you run the configuration application, you often need to save a configuration *twice*: first on the local PC (as the base configuration file for further editing at a later date), and second on an USB memory stick or a memory card, which you then insert in the controller device. For example, you may use a solid-state mini PC without display to drive the Twinkler chain and do the editing on a laptop.

For this situation, the application has the menu option "Save copy as…" (in the File menu). This command allows you to save the configuration in a different location, but it does not alter the name and location of the base file.

Creating a scenario (sequence of scenes)

From the "Edit" menu, you can select the option to add another scene to the configuration. When there are multiple scenes in a scenario, there should be a "hold time" for every scene. The hold time is the time that the scene stays up, before moving to the next scene. You may optionally also specify a fade speed.

Running the scenario

Before running a scenario, make sure that the Twinkler chain is connected to the correct (virtual) RS232 port (or adjust the settings of the configuration utility). Then, select from the menu "Control" the option "Run" (or click on the toolbar button labelled "Run").

When a scenario has multiple scenes, the Twinklers will start with the active scene and move sequentially over the other scenes, taking the hold times and fade speeds into account. After the last scene, the Twinklers loop back to the first scene.

If the hold time for a scene is zero, the scene will *not* move forward to the next scene automatically. If the last scene has a hold time of zero, the scenario stops, without looping back. You can define "inputs" (usually switches) to move forward or backward, if the hold time for a scene is zero.

To run a scenario on start-up, run the Twinkler utility with the name of the scenario file as its (command-line) parameter. If a parameter is present, the utility will load it and automatically start playing it. Alternatively, store the scenario on the Twinklers, so that the scenario runs without requiring a computer. See the section "Storing a scenario on the Twinklers" on page 9 for details.

Configuration of auxiliary inputs

Some interface boards (with which you connect a chain of Twinklers to a PC) have extra pins for external switches. For example, the USB interface has a connector for up to four external switches. To use the auxiliary inputs, you need to use the appropriate driver (usually "Twinkler USB"); see the section "Installing and config-uring the software" on page 6 for details.

For each of the inputs, you can define one of these actions:

- a standard action: *restart scenario,* go to the *next scene*, go to the *previous scene* or *pause/resume the timer*;
- the name of a scene to jump to

Note that jumping to the first scene and restarting a scenario are the same action.

The default configuration is the set of standard actions: input 1 is defined as "restart scenario", input 2 as "next scene", etc. To change the configuration, select the menu "Edit" and then the option "Input configuration". The input configuration is specific for a scenario and it is stored inside the scenario file.

Storing a scenario on the Twinklers

A daisy-chain of Twinklers can run a simple (non-interactive) scenario autonom-ously. A scenario, as created in the configuration utility, can be transmitted to the Twinklers' ROM. After transmission, the Twinkler chain will run the scenario, without requiring connection to a computer or controller.

The maximum number of scenes that can be stored on a Twinkler chain is 64.

To transmit a scenario, select the menu "Control", and then option "Program Twinklers". Please wait until the utility notifies you that it has finished program-ming the Twinklers. During programming, the LEDs of the Twinklers will flicker.

After power-up or reset, the Twinkler chain starts with the first scene and moves sequentially through the scenes, taking the hold times into account. The Twink-lers may loop from the last scene to the first, depending on whether the hold time of the last scene is zero. If the hold time is zero, the scenario will only restart after the chain is reset. The power repeater boards (see page 4) have a reset jumper block for this purpose. Shorting the two pins of this block for 0.1 second (or longer) causes the Twinkler chain to reset and the scenario to run from the

first scene.

Additional documentation

A guide for programmers, "**Programming the Twinklers**", describes the protocol to drive a chain of Twinklers from a PC. The document contains examples in various programming languages and for several platforms. The function libraries are also included as source code.

To obtain additional documentation, software and application notes, please see the web site:

http://www.compuphase.com/twinkler/

Specifications

Absolute maximum ratings

Operating voltage (Vcc)... -0.3 V to +10 V
ESD rating, HBM.............. 2 kV
Input voltage on I/O pins. -0.3 V to 5.3 V

Electrical

Operating voltage (Vcc)... 6 V to 9 V DC.
Current consumption...... < 2 mA when the LED is off; 45 mA max. when the LED is full on (white).
EMC / ESD...................... all I/O lines and pins are EMC-filtered and ESD-protected.
Serial line...................... 5 V TTL logic levels, 9600 and 57600 bps.
Connectors..................... Micro-MaTch, 6-pin.

LED

Refresh frequency (PWM). 72 Hz.
Luminous intensity.......... typical: 230 mcd (red), 480 mcd (green), 110 mcd (blue).
Dominant wave length..... 626 nm (red), 525 nm (green), 470 nm (blue).
Viewing angle.................. 120°.

Operating conditions

Operating temperature.... -30 °C to +85 °C.
Humidity......................... 5% to 90% non-condensing.
Vibration......................... solid-state device, no moving parts.

Mechanical

Board size....................... 18.5 mm x 17.8 mm.
Weight............................ approximately 0.004 kg (without light pipe)
Mounting........................ two holes, Ø2.4 mm; when using a light pipe, the light pipe is fixed in these holes.

Conformity

European Community...... EN 55022 (emission), EN 55024 (immunity).
U.S.A.............................. t.b.a.
RoHS.............................. Compliant with EU Directive 2002/95/EC.

Daisy-chain cables

Type................................ 6-wire ribbon cable, 1.27 mm pitch, AWG28
Current capacity............. 3.5 A for Vcc and ground wires at an ambient temperature of 20 ˚C.

Connector pin-out

Input and Output.............
pin 1 & 2   Vcc
pin 3   reserved (leave unconnected)
pin 4   serial data
pin 5 & 6   GND
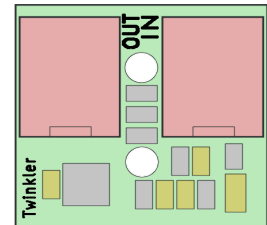
Pin 1 is the pin that is nearest to the polarity notch of the Micro-MaTch connector.

Accessories

Light pipe......................... Choice of 5 mm straight light pipe, length 45 mm; 3 mm straight light pipe, length 45 mm; 2 mm flexible light pipe with 4.2 mm lens, length 80 mm or 150 mm.
USB interface................... Board to interface a Twinkler chain to a controller device with an USB output. The board has an USB connector, a DC-power connector, two Micro-MaTch connectors and an I/O connector.
RS232 interface............... Board to interface a Twinkler chain to a controller device with RS232 output. The board has a 9-pin D-sub connector, a DC-power connector and a Micro-MaTch connector.
Power distribution board. Passive board with two Micro-MaTch connectors and a DC power connector.
Power supply................... Switching power supply, 7.5 V, 4 A (Mean Well P40A), with 2.1×5.5 DC plug; input voltage 90V~264 V AC.