

Event Timer

Overview Document

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https://github.com/TeamPracticalProjects/Event_Timer/tree/main/Documents/Terms_of_Use_License_and_Disclaimer.pdf



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DOCUMENT OVERVIEW.

This document describes the **Event Timer** project from Team Practical Projects. The Event Timer is a standalone component that is intended to be used to automate other projects that are based upon Particle¹ IoT devices. The Event Timer keeps accurate local time and can run very complex schedules for time-based events. Upon reaching the date/time for each event, the Event Timer publishes an event to the Particle Cloud. Particle-based subscribers can then subscribe to the published event and execute a suitable function based upon the event's data.

The Event Timer has been deployed at Maker Nexus as an "Announcement Timer". Maker Nexus is a 501(c)(3) educational non-profit maker space located in Sunnyvale CA. Maker Nexus has a Help System² that includes Annunciators³ located throughout the facility. The Annunciators play pre-recorded announcements through internal loudspeakers. Audio announcement clips are included that play closing time announcements. The Event Timer publishes events to the Particle Cloud that are subscribed to by all of the Annunciators. The Event Timer software includes schedules that are pre-defined based upon closing time rules established by Maker Nexus management.

This document provides an overview of the Event Timer as a component of a Particle-based system. It also describes the hardware and software for the Event Timer.

EVENT TIMER SYSTEM OVERVIEW.

Figure 1 is an overview of the use of an Event Timer in a Particle-based IoT system. There is normally one Event Timer in a system. A "system" would normally consist of all Particle based devices that are deployed at a single location over which there are a series of date/time-based rules for routine operation.

When it is time for a scheduled event, the Event Timer publishes an event to the Particle Cloud. Other Particle-based devices (in the same Particle account) can subscribe to this event and execute their functionality accordingly.

Figure 1 shows two such subscribers. An Annunciator may subscribe to an event and play a pre-recorded audio clip based upon the event's data. A project based upon the Team Practical

¹ Particle.io

² https://github.com/TeamPracticalProjects/MN_Help_System

³ <https://github.com/TeamPracticalProjects/Annunciator>

Projects *Wireless I/O Board*⁴ could subscribe to one or more events and control devices such as lights and electronic locks accordingly.

In addition to Particle-based subscribers, a Particle Webhook can be created that subscribes to Event Timer events and uses a Google Apps Script to log these to a Google sheet. The specifics of what is logged in this manner is project dependent. A description of this process can be found at:

https://github.com/TeamPracticalProjects/Connectivity_Tools_with_Particle_Devices

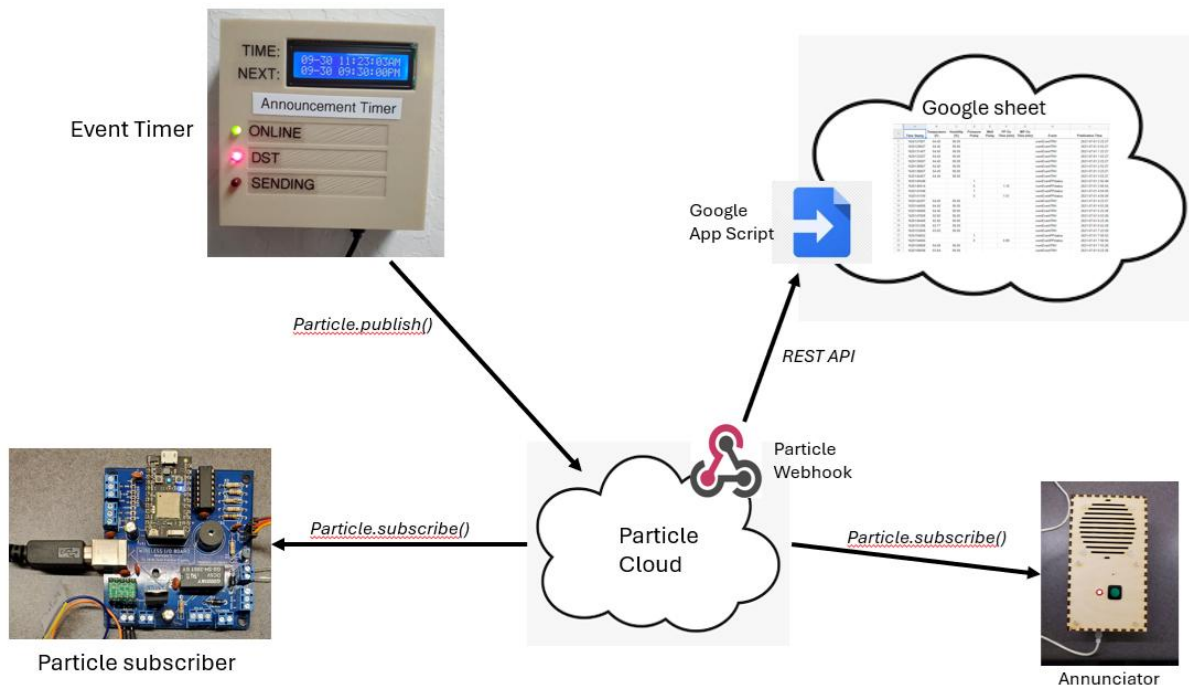


Figure 1. Event Timer System Overview.

The Event Timer software uses the Particle *LocalTimeRK* library to handle all of the complexities of timekeeping, timezone and DST conversion, flexible scheduling, and schedule management. This library is used by the Event Timer software to:

- Set up and maintain the current date/time in a localized manner, i.e. properly adjusted for the local timezone and daylight savings time (if applicable).
- Perform date/time format conversions for a human readable display on the Event Timer LCD display panel.

⁴ https://github.com/TeamPracticalProjects/Wireless_IO_Board

- Create and utilize schedules to determine the date/time of events that are to be published to the Particle Cloud. Very complex schedules can be specified using the *LocalTimeRK* library.
- Manage several schedules in order to publish different events (or at least the same event with different event data) that trigger different actions by the subscribers.

In addition to publishing events to the Particle Cloud, the Event Timer software:

- Displays the current date/time on a 2 line, 16 character LCD display panel.
- Displays the date/time of the next upcoming event (of all schedules that it manages) on a 2 line, 16 character LCD display panel.
- Adjusts for daylight savings time and indicates, via an LED, whether the displayed date/time is daylight savings time or standard time.
- Indicates when an event is being published by flashing an LED.
- Indicates when the Event Timer is powered up, initialized, and connected to the Internet. Internet connection is essential (1) because the Event Timer keeps accurate time by acquiring the current time (in UTC) from the Internet via the Particle *Time.now()* function, and (2) Particle publish/subscribe is Internet based.

EVENT TIMER HARDWARE.

EVENT TIMER USER INTERFACE.

Figure 2 shows the front panel of the Event Timer. There is nothing for the user to control. The Event Timer can be mounted anywhere that there is power. The Event Timer is powered via a USB cable connected directly to its Photon 2 USB connector. The other end of the USB cable needs to be connected to a 5 volt USB power supply.



Figure 2. Event Timer Front Panel.

Referring to figure 2:

- The top line of the 2 line LCD display shows the **current date and time**. This display is in local time and reflects daylight savings time, as applicable.
- The second line of the 2 line LCD display shows the **date and time of the next scheduled event** in the Event Timer's set of schedules.
- An LED (green) indicates that the Event Timer is **Online**. Online means that the Event Timer is powered on, is connected to the Internet, is synchronized with Internet time, is initialized and is processing the internal list of events and is ready to publish an event to the Particle Cloud.
- An LED (white/yellow) is lit if the current time in the locale is daylight savings time (**DST**). It is unlit if the current local time is standard time.
- An LED (red) is normally unlit but **lights up briefly** whenever an event is published to the Particle Cloud (**Sending**).

EVENT TIMER ELECTRONICS.

Figure 3 shows the Event Timer electronics:

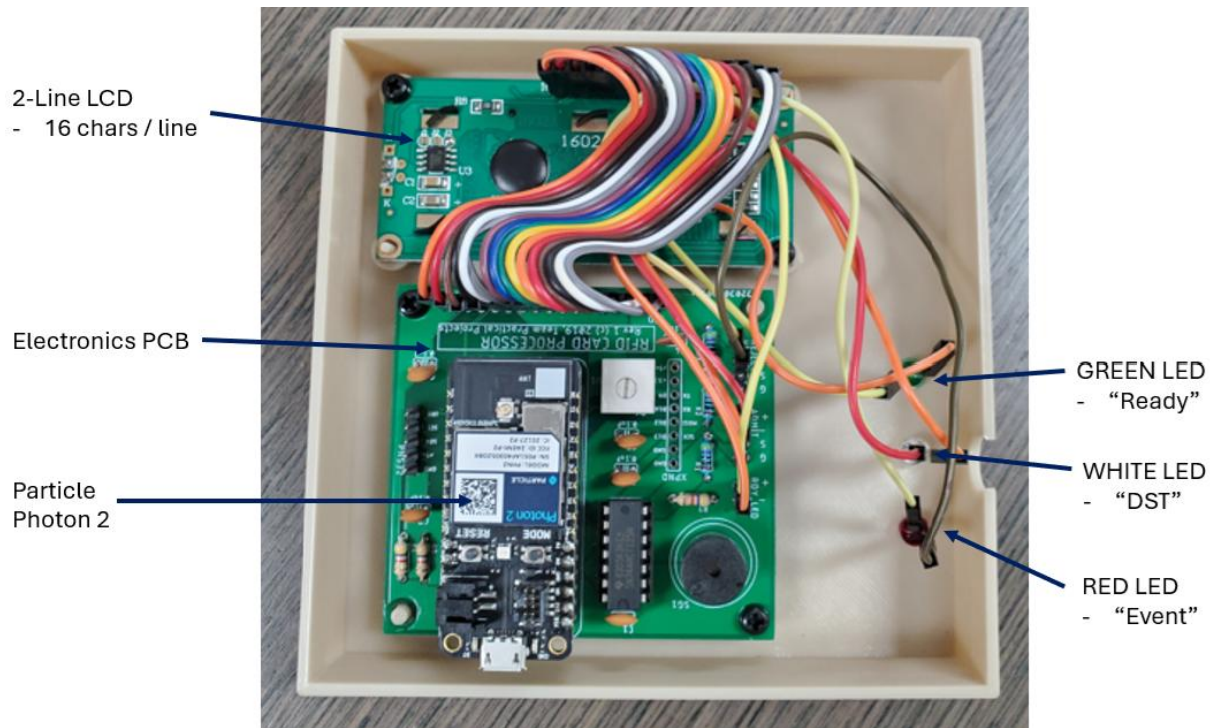


Figure 3. Event Timer electronics.

All electronic components are mounted onto the back side of the **front panel** of the Event Timer enclosure. The electronics consist of the following:

- Printed circuit board.
- 2 line, 16 character per line LCD display.
- Three LEDs of differing colors.
- Female pin header jumper cables.

Printed Circuit Board.

The Event Timer uses the same printed circuit board as the Maker Nexus Access Control System RFID Card Stations. A schematic and Cadsoft Eagle source files can be found at:

https://github.com/TeamPracticalProjects/MN_ACL/tree/master/Hardware/PC_board

Note that this board is labeled “RFID Card Processor Rev 1”. Instructions for assembling this printed circuit board can be found in the following document:

https://github.com/TeamPracticalProjects/MN_ACL/blob/master/Hardware/RFID_Station_Build_And_Installation_Instructions.pdf

The printed circuit board should be fully assembled as per the instructions in this document *with the following one exception*: a Particle Photon 2 is used in lieu of the Particle Argon. The Argon

has been deprecated and the Photon 2 is a plug in replacement. The Photon 2 form factor and pin arrangements are fully compatible with the Argon, however the labeling of some pins differs. The Event Timer software uses the Photon 2 pinout.

Not all of the I/O pins that are brought out to the edge of this printed circuit board are used in the Event Timer. The following pins are used:

- **RDY LED.** These two pins connect to the “Online” LED. Note the + and – polarity designations.
- **ADMIT.** Only the pins labelled + and – are used. These are connected to the “DST” LED. Note the + and – polarity designations. The G and S pins are not used.
- **REJECT.** Only the pins labelled + and – are used. These are connected to the “Sending” LED. Note the + and – polarity designations. The G and S pins are not used.
- **16 pin LCD Connector.** These pins are connected, one to one, to the 16 pin connector on the LCD display module.

Note that the 5 pin “PN532” connector is not used in the Event Timer.

LCD DISPLAY.

A 2 line, 16 character per line LCD display is wired, one to one, to the corresponding 16 pins on the printed circuit board. Any generic “1602” LCD display can be used as long as it is 3.3 volt compatible.

LEDs.

Three LEDs of differing colors are used; nominally green, red, and either yellow or white. Any generic LEDs will do. The mounting holes in the Event Timer front panel are sized to accommodate standard 5 mm LEDs.

Wiring.

The printed circuit board external connections all use standard 0.1” spaced male Dupont pin headers. Standard Dupont mating female – female jumper cables can be used to interconnect the printed circuit board with the LCD module and the LEDs. When using these jumpers to connect to the LEDs, the LED leads should be trimmed so that the connector pin body fits firmly on the LED lead. The connections will appear to be mechanically loose; however, they make a decent electrical connection.

EVENT TIMER ENCLOSURE.

3D CAD (Fusion 360) files for the Event Timer enclosure can be found in this repository at:

https://github.com/TeamPracticalProjects/Event_Timer/tree/main/Case

The .stl files can be exported to a 3D printer slicer program in order to slice them into gcode for 3D printing. Low cost PLA filament can be used, as the enclosure is intended for indoor use.

The enclosure consists of two pieces:

- Event Timer Back: This is the rear of the enclosure. It is intended to be screwed onto a wall.
- Event Timer Front: This is the front face of the enclosure onto which the electronic components are mounted. The Front is fitted to the Back of the enclosure. If the front is loose, electrical tape can be used to hold the Front to the Back securely.

EVENT TIMER SOFTWARE.

The power of the Event Timer is in its software. The software will need to be modified for use with any particular project. To this end, a separate manual is provided that describes the Event Timer Software in great detail; see:

https://github.com/TeamPracticalProjects/Event_Timer/blob/main/Documentation/Event_Timer_Software_Manual.pdf

This software is compiled and linked to the *LocalTimeRK* library using either the Particle Web IDE or the Particle Workbench IDE. The executable software is then Over-the-Air flashed to the Event Timer's Photon 2 processor.