# LCD2021 STOPWATCH

LCD2021
1/1000 DIGITAL STOPWATCH
with PIC16F886
and 1602 LCD module

FEATURES

☐ Power Supply: **12Vdc** (current < 50mA).

☐ Range of measurement: from **50**$_{ms}$ up to **99**$_h$ **59**$_{min}$ **59**$_{sec}$ **999**$_{ms}$.

☐ Resolution: **0.001 s** (1 ms).

☐ **Quartz accuracy**.

☐ Detection of **INTERMEDIATE times**.

☐ **4 operating mode**.

☐ Management by a Microchip **PIC16F886** microcontroller.

☐ User setting **stored in the microcontroller memory**

☐ **LCD Backlight** Display.

☐ Manual adjustment of the **LCD contrast** (with a trimmer on-board).

☐ 4 on-board command buttons: **START**, **INTERMEDIATE**, **STOP** and **RESET**.

☐ Screw terminal block for the **START**, **INTERMEDIATE** and **STOP** remote commands.

☐ Can be used a **9V battery** (alkaline or rechargeable).

☐ Protection diode against **inversion of polarity** of power supply.
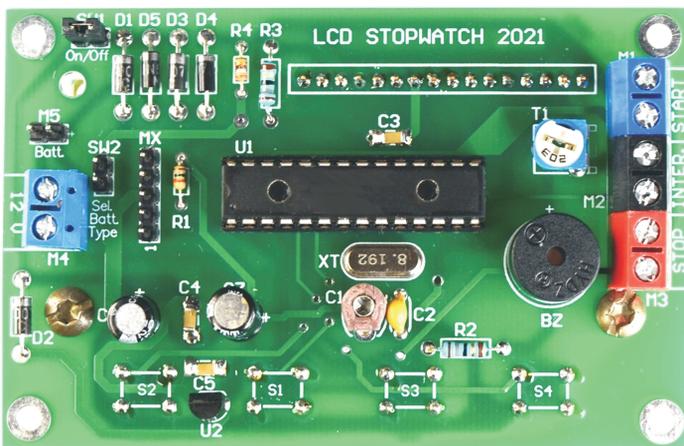
CHOICE OF OPERATING MODEs

The **LCD2021 stopwatch** can work with **4 different OPERATING MODES**.

To set the desired modes, the stopwatch <u>must be stopped</u> ("**Ready to START**"). The set value will be shown for a few seconds on the display (see following paragraphs).

NOTE - The selected OPERATING MODEs are automatically stored in the memory of microcontroller: in this way, each time the stopwatch will power on, it will work with the last modes chosen by the user.

Choice COUNTING MODE (press INTERMEDIATE + RESET)

To set the mode **RESET to 0 or CONTINUOUS count** after each intermediate, first, press and hold the **INTERMEDIATE** button and then press and hold also the **RESET** button until the display shown one of following messages (release the button when display shown the desidered option):

■ **RESET to 0 after each INTRM** - The stopwatch is activated by pressing the **START** button: the real time (**Tmr**) on the first line of display is restart to 0 automatically after each **INTERMEDIATE**.

```
RESET to 0
after each INTRM
```
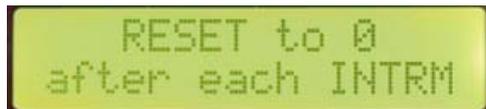
■ **CONTINUOUS count after each INTRM** - The stopwatch is activated by pressing the **START** button: after each **INTERMEDIATE**, the real time (**Tmr**) on the first line of display continue without never zeroing.

```
CONTINUOUS count
after each INTRM
```
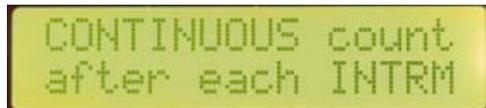
Choice COMMAND MODE (press STOP + RESET)

To set the mode **DOUBLE or SINGLE command** after each intermediate, first, press and hold the **STOP** button and then press and hold also the **RESET** button until the display shown one of following messages (release the button when display shown the desidered option):

■ **DOUBLE COMAND (Start & Interm)** - The stopwatch start by pressing the **START** button (or remotely, with a sensor to be applied to the terminal block **M1** - **START**). To detect the INTERMEDIATEs, press the **INTERMEDIATE** button (or remotely, with a sensor applied to the terminal **M2 - INTER**).

```
DOUBLE COMMAND
(Start & Interm)
```

NOTE - When using the stopwatch with "**DOUBLE COMMAND**" mode, at least 1 second must elapse between one intermediate and the next.

NOTE – Optionally, you can use a sensor to be applied to the terminal STOP to stopped the count definitively.

■ **SINGLE COMMAND (Start for all)** - The stopwatch works only with the START button (or remotely, with a single sensor to be applied to the terminal block **M1** - **START**). At first **START**, the stopwatch starts. Then, by pressing every time the START button, the intermediate times will be detected.
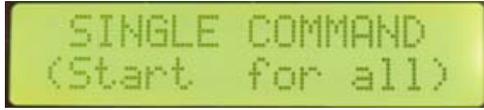

NOTE - When using the stopwatch with "**SINGLE COMMAND**" mode, at least 1 second must elapse between one intermediate and the next.

NOTE - When using the stopwatch with "**SINGLE COMMAND**" mode, the INTERMEDIATE button and relative terminal block are not active.

Following shown the samples of wiring with options **DOUBLE** and **SINGLE** commands.
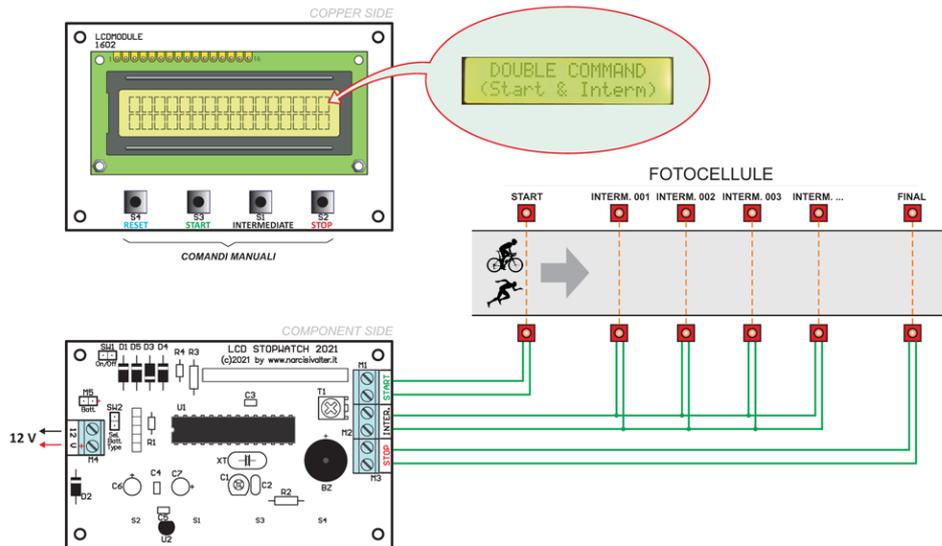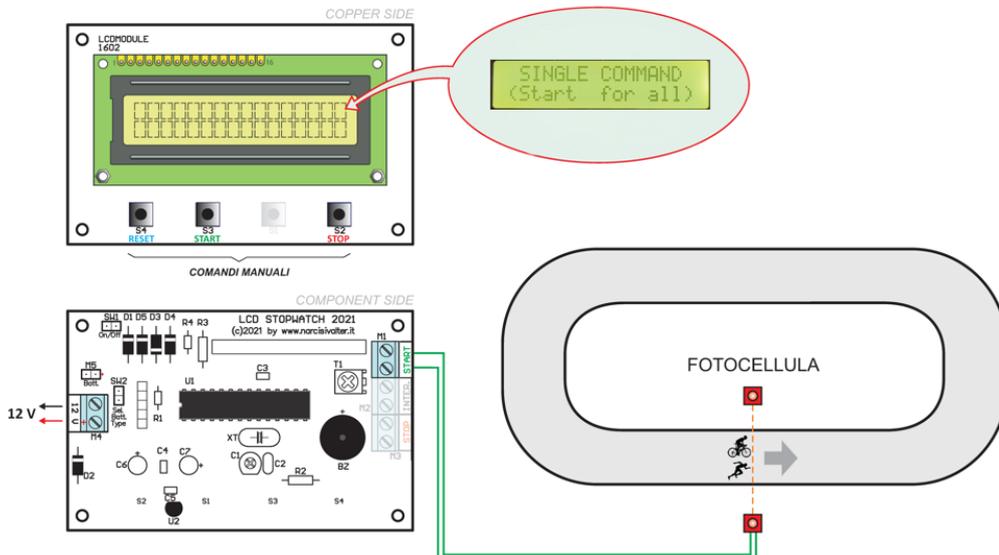
USING THE STOPWATCH

The command buttons for using the stopwatch are `START` , `INTERMEDIATE` , `STOP` and `RESET` .

The `START` , `INTERMEDIATE` and `STOP` commands also can be manage by remote photocells to connect to the screw terminal block **M1**, **M2** and **M3**.

■ On power-on, after the firmware screen and the currently selected operating mode screen, the LCD display shows "**Ready to START**" on the first line.
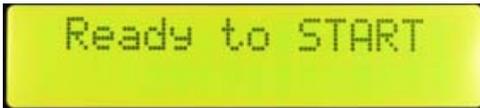
■ By pressing the `START` button, the stopwatch starts and the real-time is displayed on the first row of LCD screen (**Tmr** = Realtime).
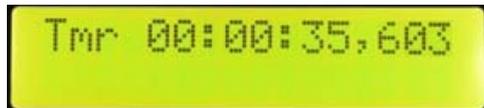
■ By pressing the `INTERMEDIATE` button, the **intermediate time** is displays to the second row of LCD screen toghether its **progressive number** (e.g. 001, 002, 003, etc.).
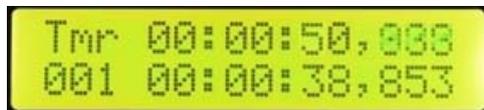

■ Each time the `INTERMEDIATE` button is pressed, the new value of **intermediate time** (and its **progressive number**) will shown in the second row of LCD screen.
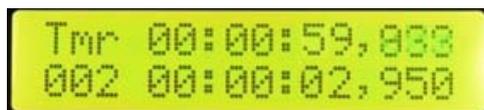
■ To stop the Stopwatch, press the `STOP` button: in this case, the real time on the first row of LCD screen will paused (**Stp** = Stop/Pause).
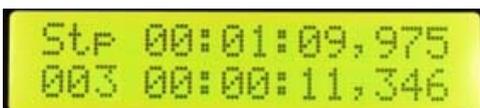

■ To restart the stopwatch, press the `START` button otherwise press the `RESET` button to cancel and reset the count: in this latter case, the initial screen appears on the display (**Ready to START**).
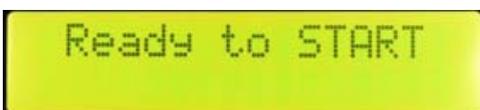

NOTA - To avoid accidental reset during the count, the RESET button is **ONLY** active when the stopwatch is in PAUSE (**Stp**).

WIRING

ON/OFF

SW2		
9V Battery type selector		
OFF	⊙ ⊙	Alkaline
ON		Rechargeable (Ni-Cd / Ni-MH)

LCD contrast adj.

LCD STOPWATCH 2021
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PIC16F886

START
photocell

INTERMEDIATE
photocells

STOP (Final)
photocell

To the
N.O. contacts
(Normally Open)

9v
Ni-Cd
Ni-MH
or
Alkaline

Power Supply
12 Vdc

NOTE
The battery is optional

Clock adj.

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SAMPLE of CONNECTIONS MULTI-PHOTOCELLS

COPPER SIDE

LCDMODULE
1602

set to:

DOUBLE COMMAND
(Start & Interm)

S4
RESET

S3
START

S1
INTERMEDIATE

S2
STOP
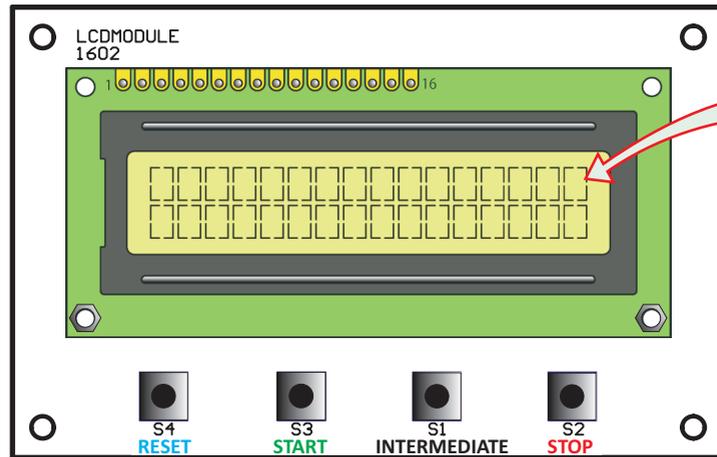
MANUAL COMMANDS

FOTOCELLS

START   INTERM. 001   INTERM. 002   INTERM. 003   INTERM. ...   FINAL

COMPONENT SIDE

SW1 D1 D5 D3 D4
On/Off

R4 R3

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M1

M5
Batt.

SW2
Sel.
Batt.
Type

U1

C3

T1

START

12 Vdc

12 V

M4

R1

XT

C1   C2

R2

M2

INTER.

STOP

M3

C4 C7

C6

+

D2

S2

C5

U2

S1

S3

S4

BZ

+
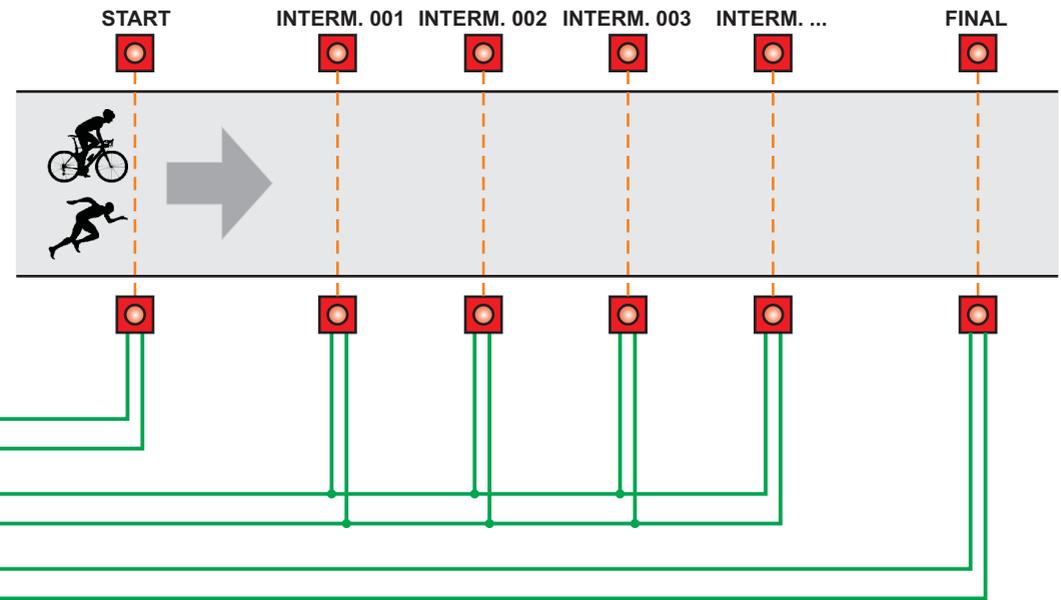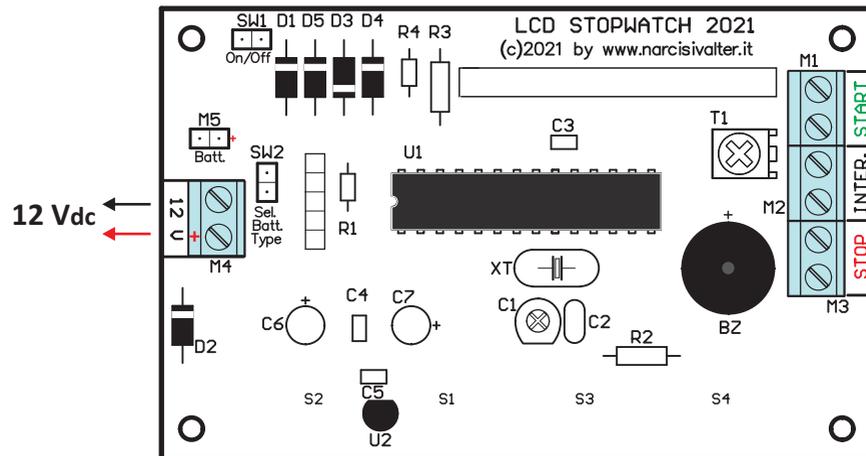
SAMPLE of CONNECTION with a SINGLE PHOTOCELL

COPPER SIDE

LCDMODULE 1602

set to:

SINGLE COMMAND
(Start for all)

S4 **RESET**   S3 **START**   S1   S2 **STOP**
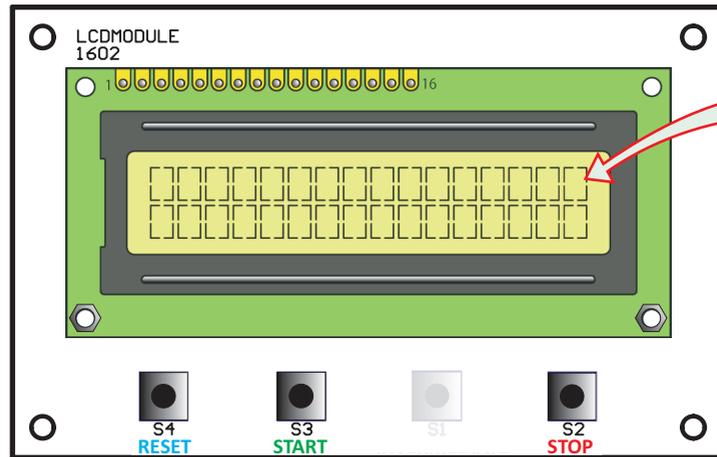
COMANDI MANUALI

COMPONENT SIDE

SW1 D1 D5 D3 D4 R4 R3 LCD STOPWATCH 2021
On/Off   (c)2021 by www.narcisivalter.it

M5 Batt.   SW2 Sel. Batt. Type

12 Vdc   12 V   M4

U1   C3   T1   M1 START

M2 INTER.

M3 STOP

PHOTOCELL