OWNER's MANUAL

LCD2022 STOPWATCH

DIGITAL STOPWATCH
LCD2022
with PIC16F883
and LCD Module 1602

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AVVERTENZE DI SICUREZZA E CONDIZIONI D'USO (SCHEDA NUDA): Questo manuale si riferisce a una scheda elettronica fornita esclusivamente in versione nuda, priva di contenitore e di isolamento esterno (open-frame). Si tratta di una realizzazione artigianale in pezzo unico o tiratura limitata, priva di certificazione e marcatura CE, da considerarsi come sub-assemblaggio o modulo sperimentale destinato unicamente all'integrazione in altri apparati o all'uso in ambiente di laboratorio da parte di personale qualificato.

FEATURES / CARATTERISTICHE

- ❒ Power Supply: **8-12Vdc** (current < 40mA).
- ❒ Range of measurement: 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 **Microcontroller**.
- ❒ User setting **stored in the microcontroller memory**
- ❒ **LCD Backlight** Display.
- ❒ Adjustment of the **LCD contrast** (with a trimmer on-board).
- ❒ 4 on-board command buttons: **START**, **INTERMEDIATE**, **STOP** and **RESET**.
- ❒ 3 Screw terminal blocks for the **START**, **INTERMEDIATE** and **STOP** external commands.
- ❒ Reverse polarity **protection**.

- ❒ Alimentazione: **8-12Vcc** (consumo < 40mA).
- ❒ Range di misura: fino a **99***h* **59***min* **59***sec* **999***ms*.
- ❒ Risoluzione **0.001**s (1 ms).
- ❒ Clock con **precisione al quarzo**.
- ❒ Rilevamento dei **tempi intermedi**.
- ❒ **4 modalità** di funzionamento.
- ❒ Gestione con **Microcontrollore**.
- ❒ Memorizzazione e richiamo automatico delle **impostazioni utente**.
- ❒ Modulo LCD 1602 **retroilluminato**.
- ❒ Regolazione (a mezzo trimmer) del **contrasto LCD**.
- ❒ 4 pulsanti di comando on Board: **START**, **INTERMEDIATE**, **STOP** e **RESET**.
- ❒ 3 Morsettiere per il collegamento di attuatori esterni per **START**, **INTERMEDIATE** e **STOP**.
- ❒ Protezione contro l'**inversione di polarità** dell'alimentazione.

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CHOICE OF OPERATING MODEs

The **LCD2022 stopwatch** can work with **4 different OPERATING MODES**: two for the COUNTING and two for the COMMANDs.

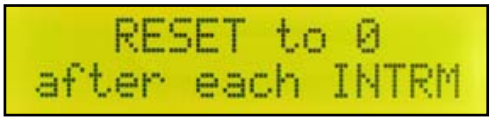
To set the desired modes, the stopwatch must be stopped ("**Ready to START**"). The set value will be shown for a few seconds on the display (see following paragraphs).

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.

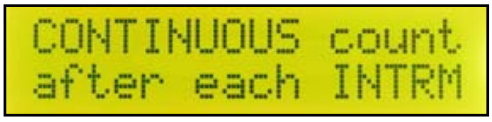
Choice of COUNTING MODE

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

- **RESET to 0 after each INTRM** - The stopwatch starts by pressing the **START** button (or, from the outside, with a sensor applied to the terminal board **M1** - **pSTA**): the real time (**Tmr**) shown on the first line of display is restart to 0 automatically after each **INTERMEDIATE**.



- **CONTINUOUS count after each INTRM** - The stopwatch starts by pressing the **START** button (or, from the outside, with a sensor applied to the terminal board **M1** - **pSTA**): the real time (**Tmr**) shown on the first line of display continues to flow without ever setting to zero.



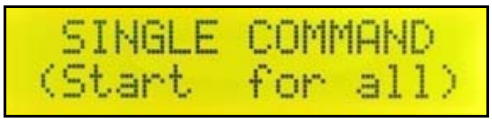
Choice of COMMAND MODE

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

- **DOUBLE COMAND (Start & Interm)** - The stopwatch starts by pressing the **START** button (or, from the outside, with a sensor applied to the terminal board **M1** - **pSTA**). To detect the INTERMEDIATEs, press the **INTERMEDIATE** button (or, from the outside, with a sensor applied to the terminal board **M2** - **pINT**).

To stop the stopwatch, press the **STOP** button (or, from the outside, with a sensor applied to the terminal board **M3** - **pSTO**).

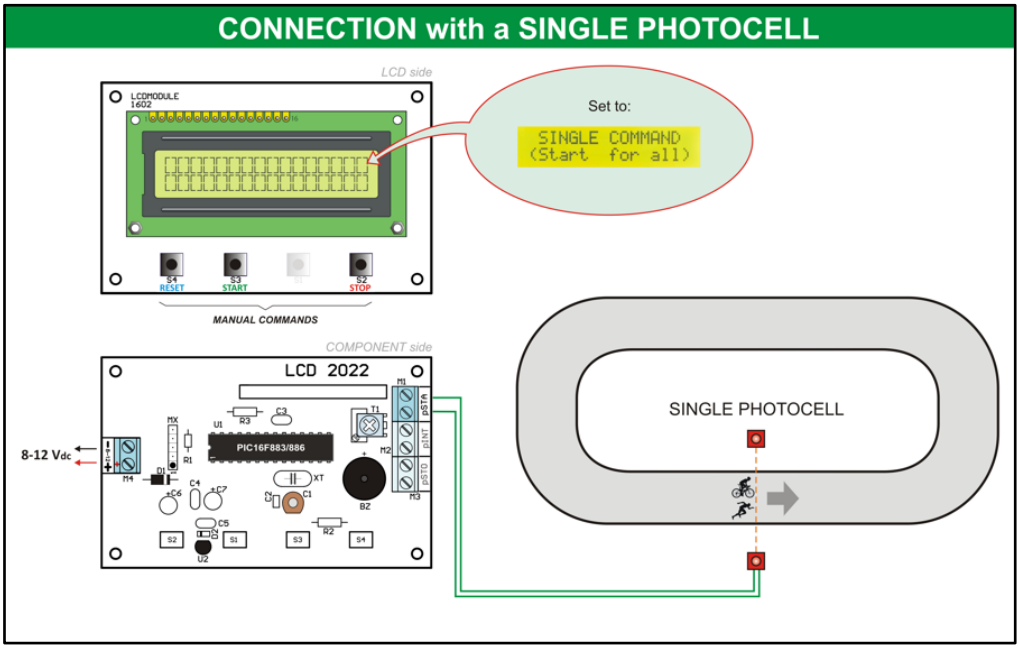
■ **SINGLE COMMAND (Start for all)** - The stopwatch works only with the **START** button. The stopwatch starts by pressing the **START** button (or, from the outside, with a sensor applied to the terminal board **M1** - **pSTA**) and then, by pressing every time the **START** button, the intermediate times will be detected.

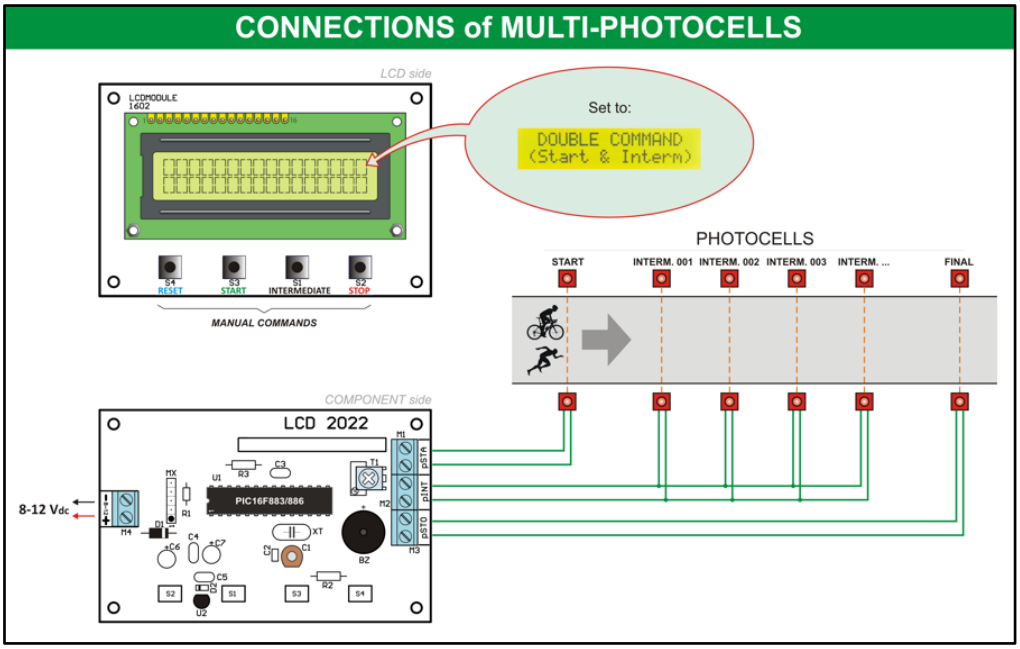


To stop the stopwatch, press the **STOP** button (or, from the outside, with a sensor applied to the terminal board **M3** - **pSTO**).

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

The following images shown the samples of wiring with options **SINGLE** and **DOUBLE** command.



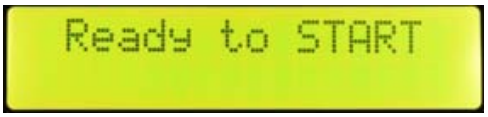


USING THE LCD2022 STOPWATCH

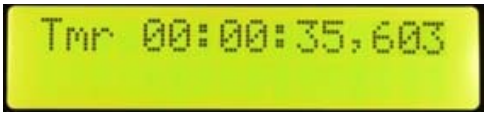
The command buttons for using the stopwatch are **START**, **INTERMEDIATE**, **STOP** and **RESET**.

The **START**, **INTERMEDIATE** and **STOP** commands also can be manage by external photocells (or other actuators) to connect to the terminal board **pSTA** (M1), **pINT** (M2) and **pSTO** (M3).

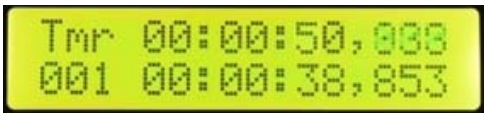
■ On power-on, after the firmware screen and the currently selected options screen, the Display shows "**Ready to START**" on the first line.



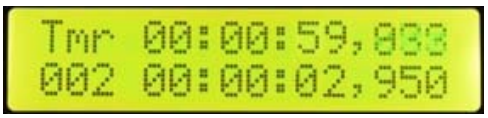
■ By pressing the **START** button, the stopwatch starts and the real-time is displayed on the first row of the Display (**Tmr** = Realtime).



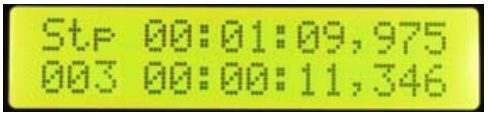
■ By pressing the **INTERMEDIATE** button, the **intermediate time** is displayes to the second row of the Display toghether its **progressive number** (e.g. 001, 002, 003, etc.).



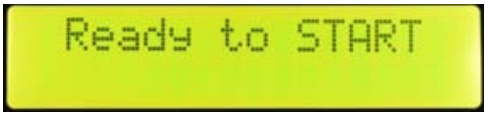
■ Each time the **INTERMEDIATE** button is pressed, the new value of **intermediate time** (and its **progressive number**) will shown in the second row of the Display.



■ To stop the Stopwatch, press the **STOP** button: in this case, the real time on the first row of the Display 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**").



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

SETTING the TIMEOUT

To prevent the stopwatch detecting more values within a few milliseconds after the START (or after an INTERMEDIATE and the next), the **TIMEOUT** can be set.

The TIMEOUT is the minimum value that must elapse between an INTERMEDIATE time and the next (or between START and the first INTERMEDIATE).

This time is very important especially when using external actuators (such as photocells, infrared rays, etc.). For example, when an external actuator is used to detecting the times of a cyclist, the photocell could detect several INTERMEDIATES between the front and rear wheel: if a TIMEOUT time is not set, it is very likely that the photocell detects more INTERMEDIATE times before the bicycle completely leaves the detection range of the photocell itself.

In this stopwatch, a TIMEOUT can be set from a minimum of **0.76 seconds** (approximately) to a maximum of **1.86 seconds** (approximately) through **16 preset values**, as shown in the following table:

To set the TIMEOUT, with the stopwatch is ready ("**Ready to START**"), press and hold the STOP button: as long as the button is pressed, the display will show the TIMEOUT values available in sequence. The values are shown on the LCD display for about one second: when the display shows the desired value, release the STOP button.

0,76 sec.	**1,34** sec.
0,83 sec.	**1,42** sec.
0,91 sec.	**1,49** sec.
0,98 sec.	**1,56** sec.
1,05 sec.	**1,64** sec.
1,13 sec.	**1,71** sec.
1,20 sec.	**1,78** sec.
1,27 sec.	**1,86** sec.

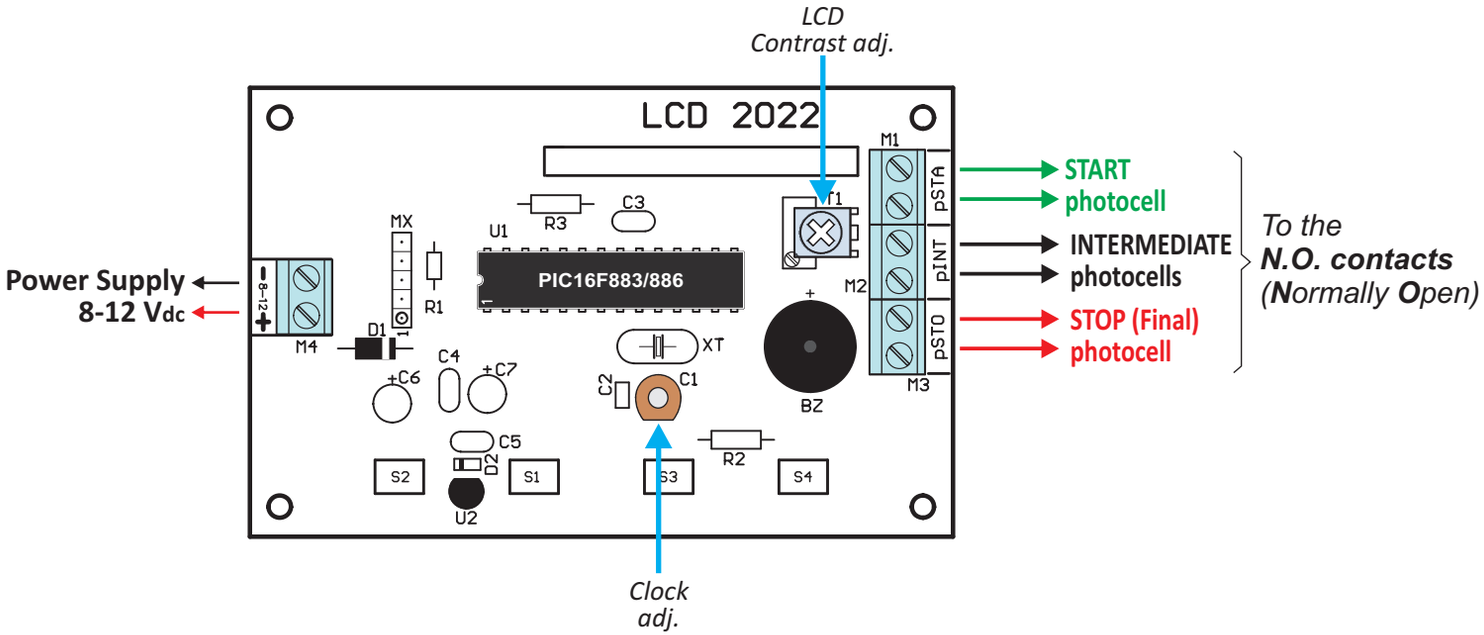
The following screenshots shown the first and the last value of the TIMEOUT:

To see the value currently set, press and hold the STOP button until the first value (the one currently set in the stopwatch) appears and then immediately release the button without waiting for all the other values to scroll.

NOTE - The TIMEOUT selected value, also is shown at Power-On.

NOTE - The TIMEOUT does not affect the chronometric times in any way.

WIRING and ADJUSTMENT



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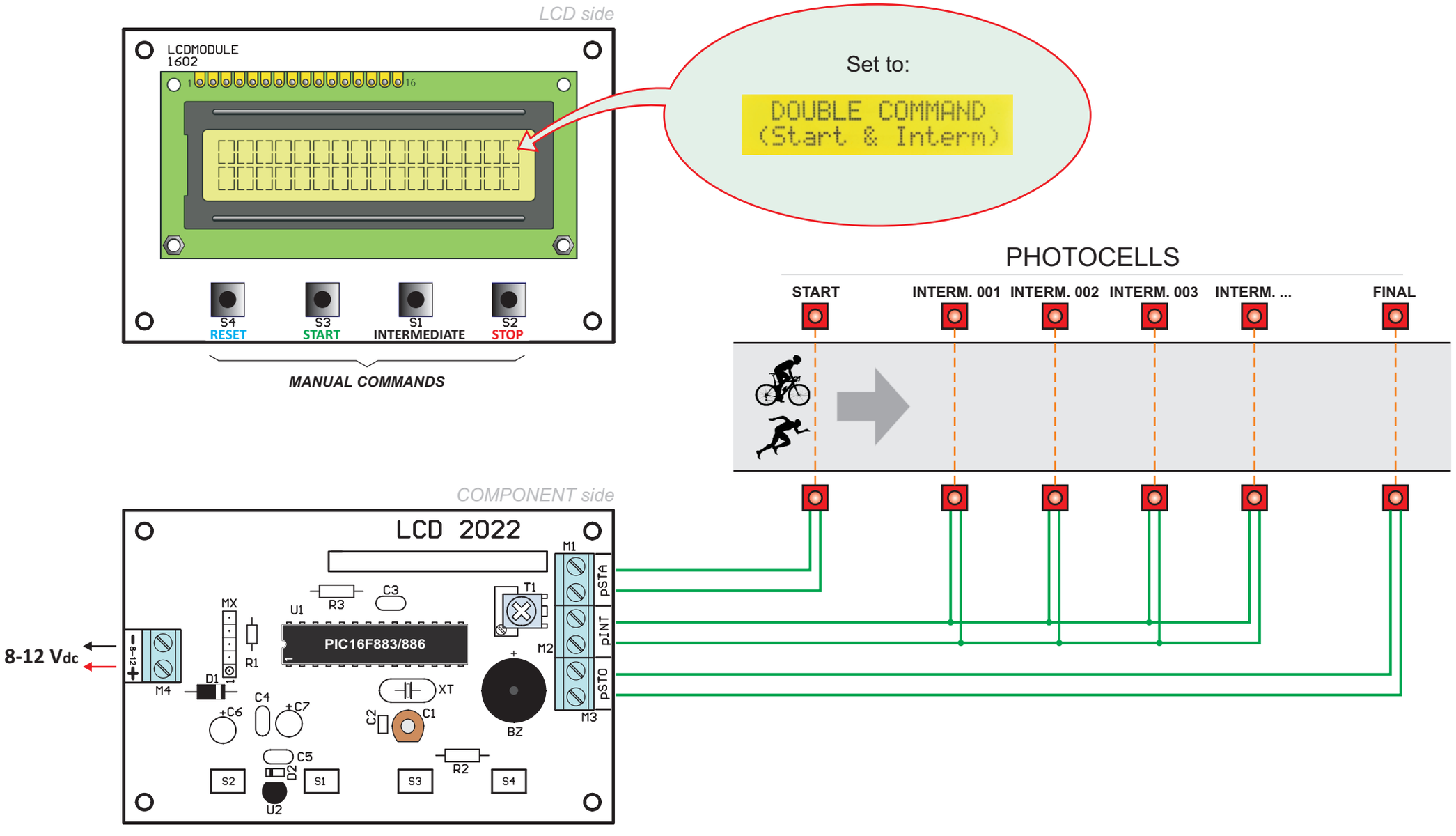
CONNECTIONS of MULTI-PHOTOCELLS



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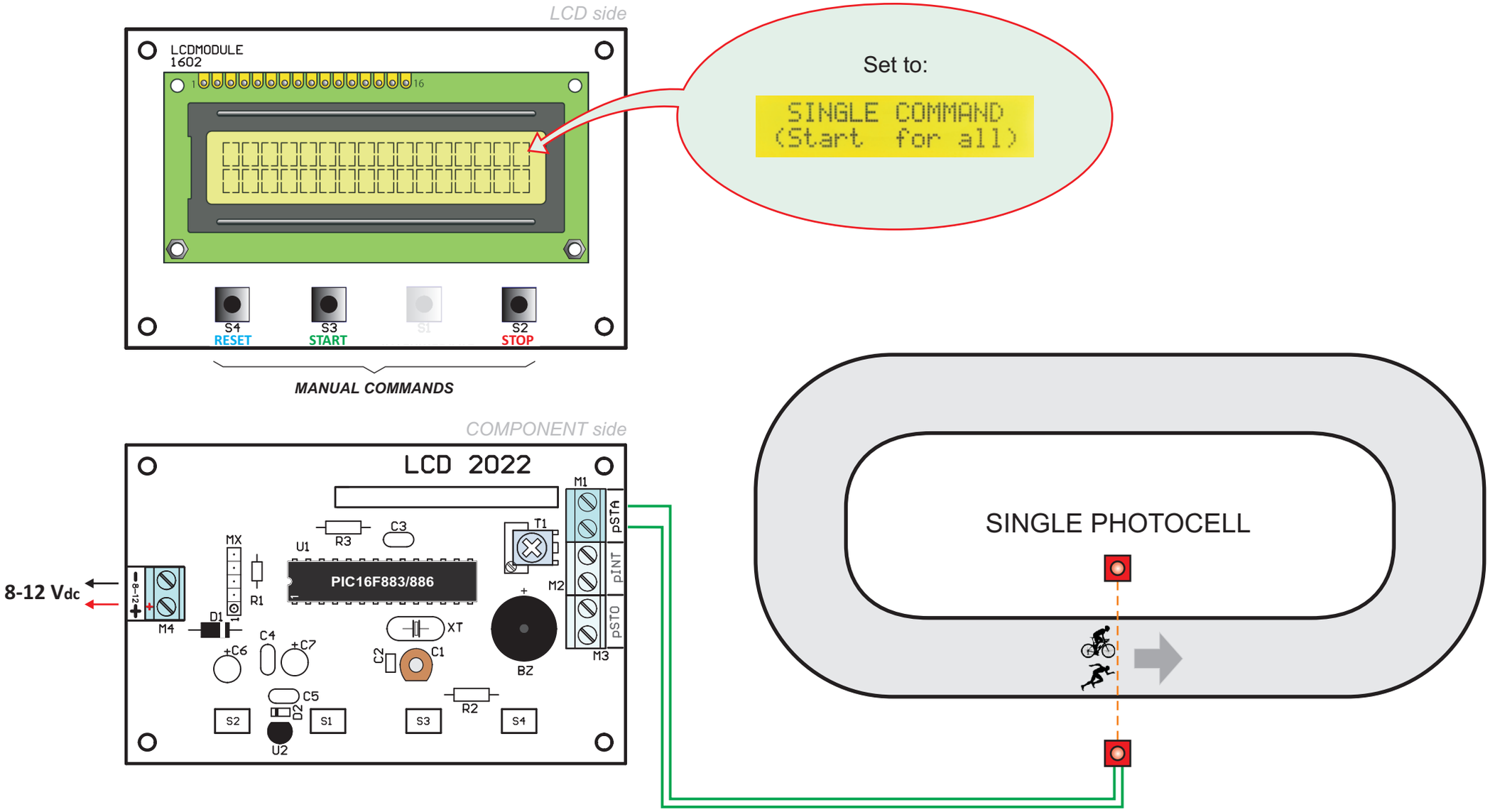
CONNECTION with a SINGLE PHOTOCELL



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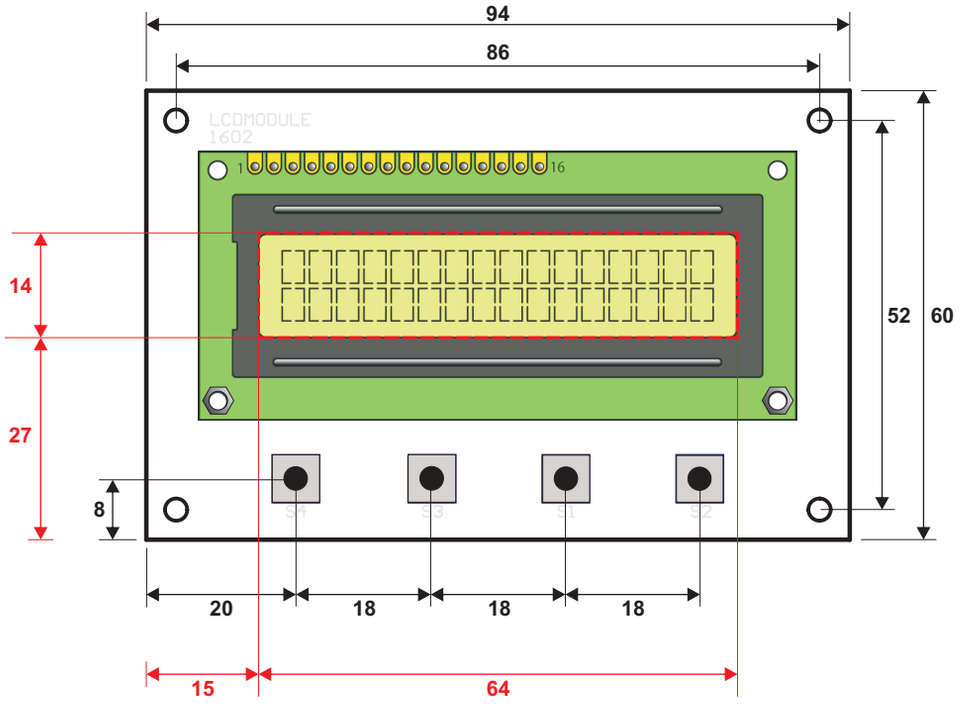

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