# Picapot 328 - Irrigation Controller
# User's Manual

## Features

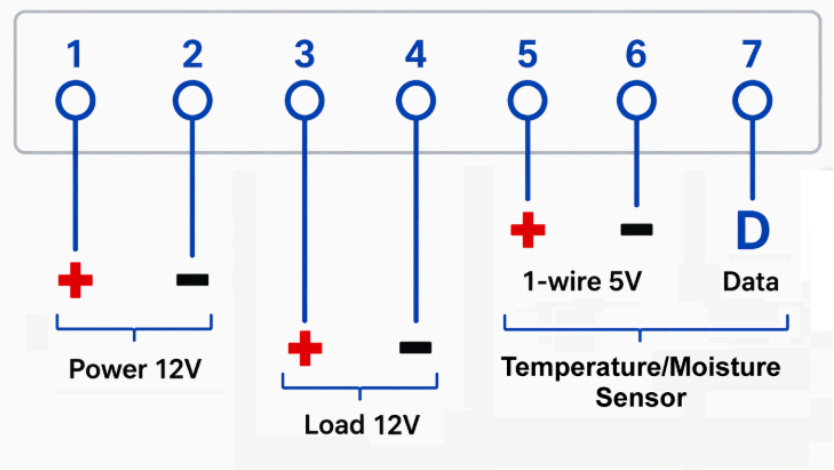
- Picapot 328 can control one 12-volt load (such as a solenoid valve, water pump, or relay) with a maximum power of 30 watts.
- Real-time clock with optional automatic daylight saving, geolocation-based sunrise/sunset, fractional timezone support, leap year handling, calibration, and CR2032 battery backup.
- Four watering modes: Fixed time, sunrise/sunset-automatic, sunrise/sunset-advanced, and fixed interval. Duration can range from 15 seconds to 1 hour.
- Optional automatic seasonal adjustment of duration and watering interval*.
- Boost watering during heatwaves.
- Frost protection: skip watering when the temperature is below 5 degrees to safeguard plants and the valve.
- Manual watering with a timer for immediate valve control.
- Skip watering based on soil moisture (requires an external soil moisture sensor).
- Date/time/duration recording of the last alarms.
- Low power consumption, ideal for off-grid systems.

* The season is calculated as a function of the length of the day. This works well in most countries, but not those very close to the equator or the poles.

## Control Unit

## Installation

The control unit is NOT waterproof and must be enclosed in a waterproof box if installed outdoors. The connector block has seven terminals. Connect them as described below.




| Terminal | Description |
|---|---|
| 1, 2 | Connect these two terminals to a 12 V power source. The power source must provide at least 0.25 A to supply the control unit and the sensor, in addition to the current required by the load. The total current drawn by the system is limited by a 3 A fuse. The unit is protected against reverse polarity.<br><br>• 1) Positive (+12 V)<br>• 2) Negative |
| 3, 4 | Connect these two terminals to the load, which must operate at the same voltage as the power source. Irrigation systems typically use a solenoid valve and/or a water pump. Solenoid valves are not polarity-sensitive, so the wires can be connected either way. Water pumps, however, must be connected with the correct polarity. If you need to control a load rated above 30 W, you can use a relay driven by the Picapot controller.<br><br>• 3) Positive (+ 12 V)<br>• 4) Negative |
| 5, 6, 7 | Connect these three terminals to the optional external sensor. The sensor can be a single DS18B20, which provides soil temperature, or the Picapot sensor, which provides both temperature and soil moisture.<br><br>• 5) Positive (+ 5 V)<br>• 6) Negative<br>• 7) Data line |

## Operation

Information and settings are organized in 8 screens:

| N. | Screen | Modes | Description |
|---|---|---|---|
| 1 | Date/Time | View/Edit | The main screen shows the date, time, and sensor data. |
| 2 | Schedule | View/Edit | Configuration of the waterings. |
| 3 | Location | View/Edit | Unit geolocation, timezone, and daylight saving. |
| 4 | Options | View/Edit | |
| 5 | Events | View | Recording of the last watering events. |
| 6 | Diagnostic | View | |
| 7 | Sensor | View | Minimum and maximum temperatures and moisture levels of the day. |
| 8 | Manual | View/Edit | Immediate watering. |

Screens can be managed using three buttons:

| Button | Position | Functions |
|---|---|---|
| 1 | Left | Enter/exit edit mode when pressed for more than 2 seconds.<br>In edit mode, move to the next edit cell.<br>Stops watering when pressed for more than 2 seconds. |
| 2 | Middle | In view mode, move to the previous screen.<br>In edit mode, decrease the edit cell by one unit. |
| 3 | Right | In view mode, move to the next screen.<br>In edit mode, increase the edit cell by one unit. |

Use buttons 2 and 3 to navigate between screens.
To change values, enter edit mode by pressing and holding button 1 for more than 2 seconds. Then use buttons 2 and 3 to set the current field's value. Press button 1 to move to the next field.
When all values have been set, press and hold button 1 for more than 2 seconds to exit edit mode.

The monitor is turned off after 60 seconds of inactivity. To wake it up, press one of the buttons. You can change the timeout from the Options screen.

The system will notify you when the RTC battery (CR2032) needs replacement.

## Screen 1 - Date/Time

This is the main screen that appears after the system reboots or wakes from sleep mode.
This screen shows the following information:

| Ord | Name | Description |
|---|---|---|
| 1 | Weekday | |
| 2 | Day | |
| 3 | Month | The transition from February to March on leap years is automatically managed. |
| 4 | Year | |
| 5 | Hour | Time is shown in 24H format.<br>If the option Daylight Saving is ON (screen LOCATION), the time will be automatically adjusted on the last Sunday of March and October. |
| 6 | Minute | |
| 7 | Second | |
| 8 | Temperature and Moisture | Temperature and soil moisture readings from the external sensor. If no external sensor is present, the internal DS18B20 sensor is used as the system’s reference temperature. |
| 9 | Season Level | A value from 0 to 99%, representing the day length scaled between the minimum and maximum day length of the year. It requires the controller’s longitude and latitude position. More info from Screen 3 - Location. |
| 10 | Last Watering | Date and time of the last watering. |

During watering, this screen displays a blinking “WATERING” message and a timer showing the remaining time. You can stop watering at any time by pressing and holding button 1 for more than 2 seconds.

## Screen 2 - Schedule

This screen allows you to view and edit the watering settings.

| Ord | Name | Description |
|---|---|---|
| 1 | Mode | The working mode of the watering. It can be one of the following options:<br>● OFF: Watering disabled<br>● FIXED TIME: The user can specify two exact times of the day for watering. Each watering can be disabled.<br>● AUTO DUSK2DAWN: Watering is performed 3 hours after dawn and 3 hours before dusk. The user can only change the duration; the rest of the screen settings are set to AUTO mode.<br>● ADVANCED DUSK2DAWN: Watering is performed after dawn and before dusk, with a time offset specified by the setting D2D. All the screen settings can be configured by the user.<br>● FIXED INTERVAL: Watering is performed at user-defined regular intervals, starting from a specified time. The interval can be 5, 10, 15, or 30 minutes, or 1, 2, 4, 8, 12, or 24 hours. An optional end time can be set for the same day; if the end time is OFF, watering runs continuously for 24 hours. If defined, the end time must be later than the start time on the same day. |
| 2 | Duration | Watering duration can be set to:<br>● A value between 15 seconds and 1 hour. |
| 3 | Season Compensation | The maximum increase applied to the alarm duration based on the current season. The longer the daylight period, the greater the increase.<br>For example, if the duration is 5 minutes and the Season Compensation is set to 100%, the effective duration will be 5 minutes on the shortest day of the year and 10 minutes on the longest day of the year. It can be:<br>● OFF: No adjustment applied to the Duration.<br>● AUTO: It is equal to 150% when mode = AUTO DUSK2DAWN.<br>● A value of maximum increase between +50% and +400%. |
| 4 | Skip Watering Days | Number of days to skip between two waterings. It can be:<br>● OFF: Never skip watering days.<br>● AUTO: If the Season Level (see screen 1) is less than 25%, watering occurs once every 3 days (skips 2 days). If the Season Level is between 25% ad 44%, watering occurs once every 2 days (skip 1 day). If the Season Level is between 45% and 66%, watering occurs every day, once a day. If the Season Level exceeds 66%, watering occurs twice daily.<br>● A value between 1 and 6. |
| 5 | Dusk to Dawn (D2D) | Time offset when Watering Mode is set to ADVANCED DUSK2DAWN.<br>It can be one of the following options:<br>● DAWN+1H DUSK-1H<br>● DAWN+2H DUSK-2H<br>● DAWN+3H DUSK-3H<br>● DAWN+4H DUSK-4H |

## Screen 3 - Location

Use this screen to enter the controller's geolocation.
Using this information, the controller can schedule watering at dawn and dusk, adjust the watering duration based on day length, and skip watering days when the option is set to AUTO.

| Ord | Name | Description |
|---|---|---|
| 1 | Timezone | Timezone where the unit is located. It can be a value:<br>● between -12 and +14 with 15-minute increments |
| 2 | Daylight Saving* | When the Daylight Saving option is ON, the time will be automatically adjusted by 1 hour on the last Sunday of March and October. It can be one of the following options:<br>● ON (time is adjusted)<br>● OFF (time is not adjusted) |
| 3 | Latitude | Latitude of the unit. It can be a value:<br>● between -90 and +90 |
| 4 | Longitude | Longitude of the unit. It can be a value:<br>● between -180 and +180 |

* DST follows European daylight saving rules. For countries with different DST rules, you have two options:

- Disable DST and adjust the timezone manually if needed.
- If your location uses American/Canadian DST or inverted DST (Australia), set the IS_AMERICAN_DST and INVERTED_DST defines in the code, then recompile and upload the firmware to the microcontroller.

## Screen 4 - Options

With this screen, you can view/edit the remaining options.

| Ord | Name | Description |
|---|---|---|
| 1 | Sensor | Model of the external sensor connected to the controller.<br>It can be one of the following options:<br>● NONE: No sensor connected, the internal DS18B20 is used as a temperature reference.<br>● DS18B20: Waterproof version of the DS18B20 temperature sensor.<br>● PICAPOT: Temperature/moisture sensor from Picapot. |
| 2 | Temperature Unit | The measurement unit of temperature. It can be one of the following options:<br>● CELSIUS<br>● FAHRENHEIT |
| 3 | Heat Boost | When the day's maximum recorded temperature is equal to or greater than the specified value, the watering duration is increased by the specified percentage. It can be one of the following options:<br>● OFF: Never adjust the watering duration due to high temperature.<br>● A value of temperature between +30 and +55 Celsius (+86 and +131 Fahrenheit) and a value of percentage between 10% and 90%. |
| 4 | Moisture Limit | When the moisture level is equal to or greater than the specified value, skip the watering. It can be one of the following options:<br>● OFF: Never skip watering due to the moisture level.<br>● A value of moisture between 1% and 99%. |
| 5 | Clock Calibration | The number of seconds of calibration applied every day to the clock.<br>For example, if the clock loses one second every 24 hours, insert +1 to compensate for the loss. It can be one of the following options:<br>● A value of seconds between -240 and +240 |
| 6 | Screen Timeout | The screen turns off after a period of user inactivity defined by the specified timeout. It can be one of the following options:<br>● A value of minutes between 1 and 60. |

## Screen 5 - Events

This screen displays the last six watering events. In the event of a controller reset, only the last two events are restored from battery-backed memory.

## Screen 6 - Diagnostic

This screen shows the following diagnostic information:

- The voltage in mV of the power source, the logic, and the backup battery.
- Skip Watering Days, Active waterings, RTC battery charge.
- Scheduled time of watering 1, Scheduled time of watering 2.
- Index of the internal sensor, Index of the external sensor, Sensor error count, Sensors count.
- Last 2 bytes of the internal sensor address (saved to eeprom), Last 2 bytes of the sensor with index=0, Last 2 bytes of the sensor with index=1.

## Screen 7 - Sensor

This screen displays the current temperature and soil moisture level, along with the minimum and maximum values recorded for the current day.

## Screen 8 - Manual

With this screen, you can manually open the valve for the specified duration.
Press and hold the LEFT button for more than 2 seconds to enter edit mode. Select the desired watering duration, then press and hold the LEFT button again for more than 2 seconds to start watering.
You can stop watering by pressing and holding the LEFT button on the Date/Time screen for more than 2 seconds.

| Ord | Name | Description |
|---|---|---|
| 1 | Duration | Watering duration. It can be<br>● A value from 15 seconds to 1 hour. |