Agriculture

galcon

IOM - Installation Operation and Maintenance Manual

GALILEO CLOUD

Total cloud-based agriculture controller

TOTAL CONTROL

AT1072.2

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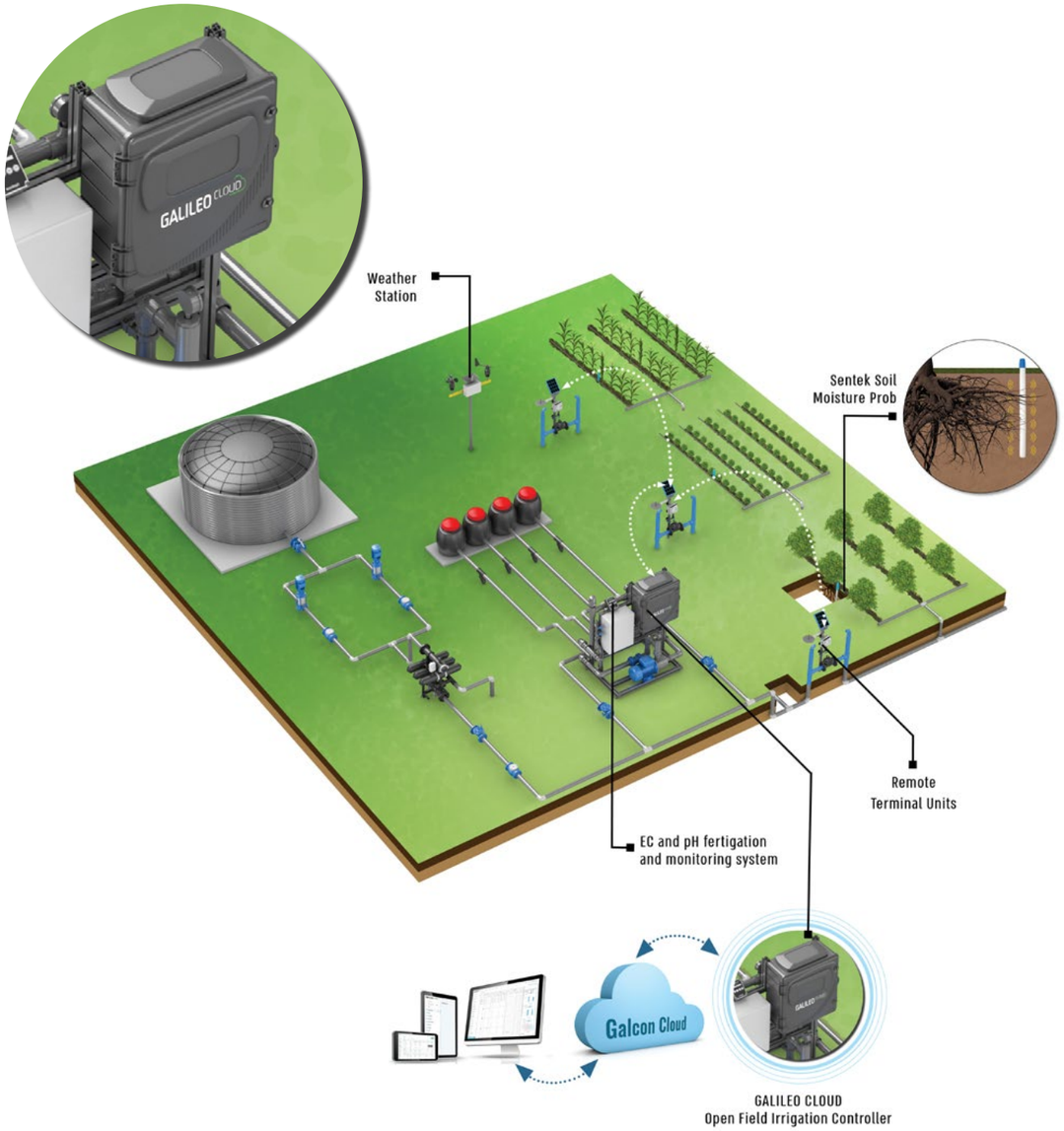
A. Galileo Cloud Introduction

Galileo Cloud- An advanced cloud based modular controller for irrigation and fertigation, in large complex areas with multiple valves and various hydraulic elements.

Efficient and precise Irrigation and fertigation are among the largest challenges facing farmers.

Nowadays, farmers are more focused than ever on managing a precise, high-quality and cost-effective production plant, in order to make informed decisions about the right amount of fertigation, according to changing weather and plant needs, to attain optimal results and productivity.

Galileo cloud Irrigation controllers is the brain of any agricultural area. The controller is able to combine the parameters according to the farmer's definitions, aimed at matching the needs of the plant with a precise fertigation and Irrigation operation. Proper design of the irrigation control system makes it possible to maximize the crop and its quality, as well as pinpoint the precise supply of fertilizer and water required for the actual needs of the plant.



B. Safety First

Without derogating from and in addition to the terms of the LIMITED WARRANTY AND TERMS OF SERVICE of GALCON, that fully control the use of GALCON's products (including the Galileo system/products), the following safety instructions shall apply on the use of GALCON's Galileo system/products.

General Safety Instructions:

- Prior to installation, operation, maintenance, or any other type of action carried out on the Galileo system, read the safety, installation and operation instructions carefully.
- Installation, operation or maintenance of the Galileo system should be done only by qualified workers, technicians, electricians, and/or contractors using only good engineering practices, complying with and observing all conventional safety instructions in order to minimize risk and/or danger and/or hazard to workers, the public or to property in the vicinity in accordance with all relevant local standards.
- Galileo products operate in larger agricultural systems; it is essential for system designers, installers and operators to comply with all the relevant safety instructions and standards.
- Use the system only for its intended purpose as designed by GALCON Kfar Blum, Israel 1215000, any misuse of the system may lead to undesired damage and may affect your warranty coverage. Please consult with GALCON prior to any other use of this equipment.
- No change or modification to the equipment is permitted without a written notification provided in advance by the manufacturer or by its representative, on the manufacturer's behalf.
- Use only appropriate standard tools and equipment operated by qualified operators when installing, operating and maintaining the Galileo system.

Safety in Shipping and Handling:

- Shipping and transporting the Galileo system components must be done in a safe and stable manner and in accordance with the relevant standards and regulations.
- For shipping, lifting and installing the Galileo system components, use only approved lifting equipment operated by authorized employees and contractors.
- Storage should be in the original delivery crates, cases or packages. Storage prior to the system installation should be off the ground in a clean, dry, indoor area.
- Prior to the installation verify visually that the system components were not damaged during shipment to the installation site.
- Do not leave equipment lifted when not necessary. Avoid working below lifted equipment.

Safety During Installation:

- Install the Galileo system according to the detailed Installation Instructions provided with it by GALCON and according to the description shown in this manual.
- At all installation sites, make sure users have good visibility, good clearance for easy access, and verify that the work and auxiliary equipment used are in accordance with the relevant local authorized standards.
- Electric wiring should be performed by an authorized electrician only, using only standard and approved components.
- Install a Main Power Cut-off Switch close to the Galileo panel.
- Installation of the system should be performed so as to avoid direct water splashing on the electrical and the electronic components and panels.

Safety during Commissioning and Operation:

- Read the operation instructions carefully prior to any attempt at operating the Galileo system.
- In order to achieve maximum performance and smooth operation of the system, it is crucial to perform the startup and first operation procedures exactly as described in this manual.
- In cases where a formal commissioning procedure is required, it should be done by an authorized Galcon technician or authorized specialist prior to operating the system for the first time.
- Never use the system for anything other than its original intended purpose.

Safety During Maintenance:

- Servicing the Galileo system should be done only by people qualified for this type of work.
- Disconnect the system from power supply before performing any maintenance or a non-regular operation action.
- Avoid splashing and water leaking so as to minimize slipping, electrifying or damage to people and the equipment, caused by moisture.
- Before returning to regular operation follow the First-time Start-up Operation instructions as detailed in your user manual.

C. About this Document

This document is an Installation, Operation, and Maintenance (IOM) manual for Galcon's Open Field Galileo Cloud System.

Galileo is an advanced modular controller for irrigation and fertigation control in large, complex areas with multiple valves and various hydraulic elements. Galileo Cloud is a cloud based, bi-directional central control system that allows its operators to remotely command and control theirs Galileo Controllers.

This manual describes the Galileo Cloud site screens, and provides the users with detailed installation, configuration, operation, monitoring, and maintenance instructions.

D. General Description of the Galileo Cloud System Components

This chapter describes the Galileo Cloud System components, layout, hierarchy and communication methods; it presents the terminology used by the system in order to shorten the operator's learning curve and enhance the operation efficiency.

D.1. The technology - system topology illustration

D.2. The major components of the Galileo Cloud system are:

- The Galileo Cloud Controller - the heart of the system, executes all the field operations. Has a multilingual local user interface.
- Local I/Os - local Inputs and outputs of the Galileo Cloud controller.
- RTUs - Remote Terminal Units, a remote extension of the Controller's I/Os.
- Cloud based smart sensors - remote sensors that transmit data to the system.
- Smart fertigation - Fertilizer's dosing machines, controlled by the Galileo Cloud Controller.
- Filtration systems - controlled by the Galileo Cloud Controller.
- Communication systems - various communication systems that connect the Galileo Cloud Controller to its RTUs, the Smart sensors, and to the Galileo Cloud servers. Galileo typical communication systems include 4G Cellular Modem, Lan, WIFI, Bluetooth, and Radio.
- The Galileo Cloud Web Site - Cloud servers at the highest hierarchy of the system that enables the user to command and control the whole system from PC computers, Tablets, and mobile phones. Please note: Galileo Cloud Web Site components and their operation are described later chapters of this document.

D.3. Control Philosophy

This chapter is brought here for broadening the user's knowledge on the control philosophy behind the Galileo System, it describes the major logical components of the system together with each component's role and relations with the other components of the system.

In the physical dimension the Galileo System consists of Controllers, I/Os, Sensors, Cards, Communication Cards and equipment, Power supply, and other such elements; please refer to the installation documentation provided by Galcon for information on these physical components.

The following list describes the Galileo software components and their assigned tasks:

Please note: that the system's components are organized in a hierarchal order, e.g., a User may have several Projects and a Project may have several Controllers.

User:

This is the software entity that represents the human being who controls the system. The system recognizes several types of users, where each one of them has different authorization for performing tasks within the system. Typical users may be: Site manager, Admin, Member, etc.

Project:

A project is a software entity that groups together all the physical real-world components that belong together to a specific agricultural area, a project may include a whole farm or a section within a farm such as orchards, field crops fields, vegetables fields, etc.

Controller:

This is the software entity that represent a specific Galileo electronic controller which is installed within a project. The controller software entity controls the actual operation of the physical components connected to the Galileo electronic Controller. Galileo Cloud System can control several types of controllers such as Field Crops controllers or Greenhouse controllers.

Pumping station:

This software entity controls a group of water pumps and sensors that are together responsible to supply water to the irrigation system according to its real-time flow-rate, pressure demand, or logical conditions.

Water Pump:

This is the software entity that controls a single physical pump within a pumping station or as a single pump connected to a line.

Plot:
This software entity represents a real-world agricultural section. A Plot may include several irrigation valves and it is used for administration, graphical drawings, and reporting purposes. Zooming into a plot enables the user to monitor and control the elements assigned to the plot.

Crop:
This software entity represents a real-world specific crop such as Wheat, Corn, Apples, Oranges, etc. Each crop has its own agrotechnical irrigation requirements, and it is used for reporting purposes.

Valve:
This software entity represents a real-world physical valve, which its operation is controlled by the Galileo system. The valve's software includes the parameters required for the system to operate the valve, e.g., the water meter used for measuring the water used by the valve, the flow rate of the valve, the irrigated area by this valve, the crop, and other such parameters.

Please note:
- The water amount to be irrigated, and the scheduling of the valve's operation, is calculated and controlled by the Irrigation Program.
- A valve can be also defined as a Co Valve, in such case the valve is used as a secondary entity of an irrigation valve and it opened and closed together with its designated Irrigation Valve.

Valve Group:
The irrigation program of the Galileo can operate a group of valves instead of a single valve (please refer to the Irrigation Program description later in this chapter), a group of valves may contain up to 10 valves that are opened together by their designated irrigation program. The water amount to be irrigated by the whole group is entered by the user in the irrigation program, since each valve within the group may have a different flow-rate settings, the system may end each valve's operation separately according to its flow-rate calculation or may end all the group's valves together. The user can select the required behavior by setting the type of irrigation ending parameter in the Irrigation Program.

The Valve Group setting screen allows the user to set a different Multiplication Factor to each valve within the group due to specific agrotechnical requirements. This parameter is used to change the water amount calculation, as done by the system according to the valve flow-rate and the irrigated area of the valve, and multiply it by this set factor. In such case the system calculates first the water amount to be irrigated by the valve and then multiplies it by the factor.

Line:
This software entity represents a real-world physical single pipeline that is used to irrigate and fertigate specific valves within a specific plot. Gallio controls the system's water and fertilizer supply, by taking into account the structure of the system lines, in order to avoid fertigation malfunctions. The Line software is responsible for the opening and closing order of its irrigation valves and it is also used for reporting and graphics purposes.

Main Valve:
This software entity controls a main valve, which is installed in the entry point of a Line and controls the flow of water into it.

Sensors:
These are the software elements that read real world physical sensors and control system actions accordingly. This may include Meteorology sensors, such as Temperature, Humidity, Radiation, Wind speed, Wind Direction, and Rain meter, that affect the irrigation operation according to conditions set in the system. The system also loges the readings of the sensors for further analysis and charts drawing.

Shared:
The shared sensors are part of the system's shared parameters between controllers. These are sensors, that are connected to a specific Galileo Controller within a Project, and their readings are shared with other Galileo Controllers within the same project; the readings are transmitted via the communication system and are used by the receiving controller as its own physical sensors.

Water meter:
This software entity reads the real-world water meters and provides these readings to other components of the system (such as Valves), the system also records the flow-rate of the water meters and present the reading for further analysis and chart drawing.

Filters:
This software entity controls the real-world filtration system that filters the raw water of the irrigation system. The Galileo system can control filter units that are organized in groups. Each such group can be assigned to a specific line and/or specific water meter; the user can define the numbers of filters participating in the group, and the back-flushing parameters of the group, e.g., timings, delays, D.P switch, fault statuses, etc.

Fertilizer pump:
This software entity controls a real-world fertilizer injector (digital or analog) that applies fertilizer to specific irrigation programs. Via the Irrigation Program screen, the user can define the parameters required for assigning and configuring the fertilizer pump to be used by that irrigation program. This includes parameters such as the number of the physical fertilizer pump, the fertilizer units, amount, water before and water after. Since all the irrigation valves of an irrigation program are opened together, the Irrigation Program calculates the required fertilizer flow according to the total water flow of the irrigating valves.

Fertilizer Center:
Fertilizer center is the software entity that controls up 6 fertilizer injectors grouped together to apply a unique combination of fertilizers to a specific irrigation line. The system can control up to 8 fertilizer centers. For each fertilizer center the user can define the participating injectors and all the operation parameters and restrictions required for the center to operate in conjunction with the system's irrigation programs. Fertilizer centers may be operated according to E/C and pH sensors reading, in such case the fertigation program should be set only by liters per cubic meter of water that are changed automatically by the required level of the E/C and pH real time readings. In other fertigation methods, E/C and pH sensors may be used only for monitoring and setting alarms in case of abnormal fertigation conditions.

Irrigation Programs and methods:
The Irrigation programs are the core of the Open Fields Galileo System operation, each irrigation program can control 1-5 irrigation valves, or valves groups', that are opened together once the program starts and closed together or separately according to the user's selection of the "Valve Finish Method" parameter of the specific irrigation program.

The irrigation program controls the operation schedule, the water amount to be irrigated, and the fertilization operation of its valves:

The Scheduling of the program includes parameters such as timing methods, start time, interval days, irrigation by the days of a week, number of cycles per day and end time. The scheduling section includes also parameters that control the conditions for scheduling the next irrigation cycles.

The amount of water to be irrigated by the program is controlled by the water data section of the program. The user enters the required water amount (by time or quantity) for the whole program and the system automatically calculates the water amount per each valve or valves group of the program. the system calculates first the required amount of water for each one of its 5 valves and in case some of these valves are defined as valves groups, the system divides the calculated valve amount between the valves participating in the group.

For calculating the required water amount per each valve, the system takes into account the valve's parameters, such as the its flow-rate, its irrigated area, the assigned water meter, the crop, and other such parameters and also general parameters such as weather conditions, time of season, etc.

The fertilizing section of the irrigation program enables the user to select the fertilization method for the program (by local fertilizer pump or via a fertilizer center), the amount of fertilizer, water before, and after and other such parameters. The system contains parameters used to protect against applying fertilizer to the wrong valve on the irrigation line when other valve on the same line is in fertigation mode. This parameter works only when all valves involved are set to proportional fertigation only. The options are:

- Irrig. Forbidden During Other Prog. Fertilization - all other valves' irrigation will be paused while the irrigating valve is operational.

- Enable Irrigation During Water Before Only - While the irrigating valve is still in "Water before" mode other valves on the line can be started.
- Enable Irrigation During Water After Only - While the irrigating valve is in "Water after" mode other valves on the line can be started.
- Enable Irrigation During Water Before or After - While the irrigating valve is in "Water before" or "Water after" modes other valves on the line can be started.
- Before starting an irrigation program, the controller checks the communication to all the components involved in this irrigation program. in case not all these components are in communication the irrigation program enters to pause. When the communication returns the program exits it pause state and starts the irrigation.
- In case where the communication to a RTU is disconnected during irrigation, the RTU continues to read and register its inputs (water meter, fertilizer meter, etc.). When the communication returns the RTU sends all these readings to the controller at once. In such case the controller's alarms are not active so an alarm such as uncontrolled water will be ignored by the controller.

Please not that when the communication to the RTU is disconnected the RTU closes its outputs after 3 minutes.

Water Quota:

In geographic areas with limited water sources the farmers have monthly water quota. Galileo system's water quota feature is used to control the daily usage of water, the system divides the monthly quota to daily quota and monitor the usage of water. The user can set the system reaction in cases where the usage exceeds the assigned quota by setting alarms, stopping the irrigation for the day, or by other such actions. The Galileo system also generate reports and charts that allow the user to analyze his water usage.

Priority groups:

Due to agrotechnical conditions and limitations there are cases where the user needs to set priorities for his irrigation programs. Each irrigation program can be assigned to a specific priority group and have a priority level within the group (1-10 where 10 is the highest priority). Only a single irrigation program can irrigate at the same time within the group. The programs operate according to the order of their priority within the group. When a higher priority irrigation program needs to start irrigating while a lower priority program is active, the lower priority program may be immediately stopped or may complete its operation first, depends on the settings of the group. The user can set a maximal pause time for the programs, so a paused low-priority program will not wait too long for its turn.

General Counter:

This software entity includes a real-world counter input that can be used for specific tasks such as: counting evaporation, electricity usage, water tank filling, etc.

Water Junction:

In cases where an irrigation project contains several water sources with various levels of salinity, the Galileo system can provide a solution for mixing saline or brackish water with fresh water in order to produce water suitable for irrigating crops sensitive to salinity. The software entity for controlling this feature named Water Junction and it includes two water sources controlled by control valves according to E/C (Electrical Conductivity) sensor, by percentage of water-flow from each source, or by setting manually a required level. The water junction can be assigned to supply water to specific lines of the system.

Logical Conditions:

This are advanced special features of the Galileo system that enables the user to set "What If" conditions to the system. Each such condition can monitor a specific parameter, at one of the system controllers, that once it changes to a predefined logic or numeric value, the system performs a predefined action in one of its controllers or issues a predefined message to the users. The Conditions feature of the Galileo system can also add special control capabilities that enable the user to perform operation tasks that are not predefined in the system.

Condition Inputs:

These are system inputs that can be defined to perform special tasks once they are activated, tasks such as pausing an irrigation program, ending a running program, sending an alarm message, opening an output, and any other such tasks. The condition Inputs feature of the Galileo system adds special control capabilities that enable the user to perform operation tasks that are not predefined in the system.

Auxiliary Outputs:

These are special controller outputs that can be assigned to auxiliary programs. According to the program settings, these outputs may be opened and closed on specific timings or according to a predefined reading of a sensor. They are usually used to perform tasks that are not found within the regular operations of the Open Field Galileo system, tasks such as operating foggers, greenhouse curtains or cooling systems, or any other such tasks.

Alarms:

The Galileo system includes alarms generating feature. The system has special Alarm outputs that are operated according to a user setting. In general, the settings define what to monitor, when to monitor, which alarm output to open, and to whom the system sends an SMS or an e-mail message.

Events:

The events feature of the Galileo system controls the collection, generation, and sending of predefined reports, text messages, data files, etc. to the system users for agricultural management and analysis purposes.

Burst Protection:

This important feature of the Galileo system helps the user to prevent damage caused by burst in pipes or by out of order water meters. The system manages a water balance calculation that compares in real time the flow of water that enters the system from its various sources with the flow of water of all the irrigating valves, any deviation in this balance may point on burst pipe or on out of order water meter and alert the user accordingly.

Irrigation according to water source

This feature of the Galileo system is very useful in systems that their water sources has fluctuating E/C levels. In order to prevent damages due to improper fertigation the system may alter the fertigation programs according to changes in the E/C level of the water source.

E. What's New

E.1. General

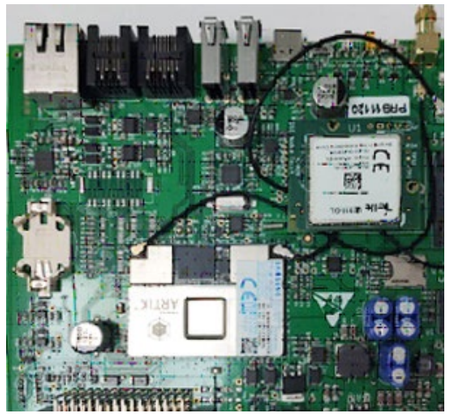
Galileo controllers are well known, and well established, in the world-wide agricultural industry. Galileo Cloud is the latest addition of Galcon's central control and command system. This chapter lists the new features of the system and its differences from the previous central system. If you are existing Galileo owner who are upgrading to the new version, please refer to the following list, however if you are new customers of Galileo system, feel free to skip this chapter:

The new and updated features

- User friendly Cloud based web site.
- Interactive live map of the farm and its irrigation and fertigation devices and components.
- Sensors Graphic Module that collects and displays filed sensors and weather station charts.
- LAN, Cellular Modem, WIFI, Bluetooth, RS485, and Modbus communication options.
- Reports generator for configuring reports layout and their scheduling.
- Upgraded Galileo controller with SOM (System on module) based central processing unit.

E.2. The SOM Unit of the Galileo Controller

The following is a general picture of the Galileo Controller SOM card.



The SOM unit's LEDs:

Two LEDs on the external connections side of the SOM card are found; Red LED and Green/Orange Led.

The Red LED

When rx/tx operations are taking place via the TCP or the Serial ports, the Red LED blinks in 2 seconds intervolves (one second ON and one second OFF). In case there is no rx/tx communication between the server and the controller for more than five seconds (even when the connection to the server exists), the Red LED turns OFF.

The Green LRD

During startup the Green LED blinks for few seconds.

The Green LED turns ON for 2 seconds and OFF for 1/8 of a second periodically, when the SOM card programs run correctly.

The Orange LED

The Orange LED is currently not operational.

Note: The information on this page might be changed in the future.

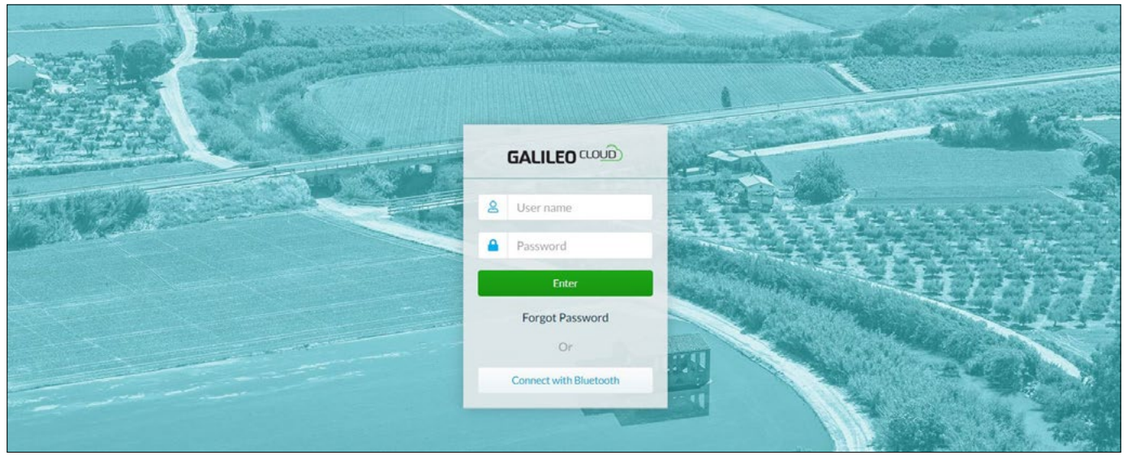
F. The Hardware - Controller

G. The Galileo Cloud Center

G.1. Accessing the Galileo Cloud Center

Using your web browser please navigate to the following URL: https://galileo.galcon-smart.com/#/login

The following screen appears:



For logging to Galileo Center, a user name and a password is required; Please obtain your user-name and password from your Galcon dealer.

All users must be authorized by Galcon's marketing department. Accessing screens, configuring the system's components, and operating the system, depend on the authorization level of the user; Galcon can grant its end-users customers the following users' levels types:

Site manager - Controls the admins of its designated projects

Admin - Controls its designated projects, can create new Members and Payments accounts for his projects

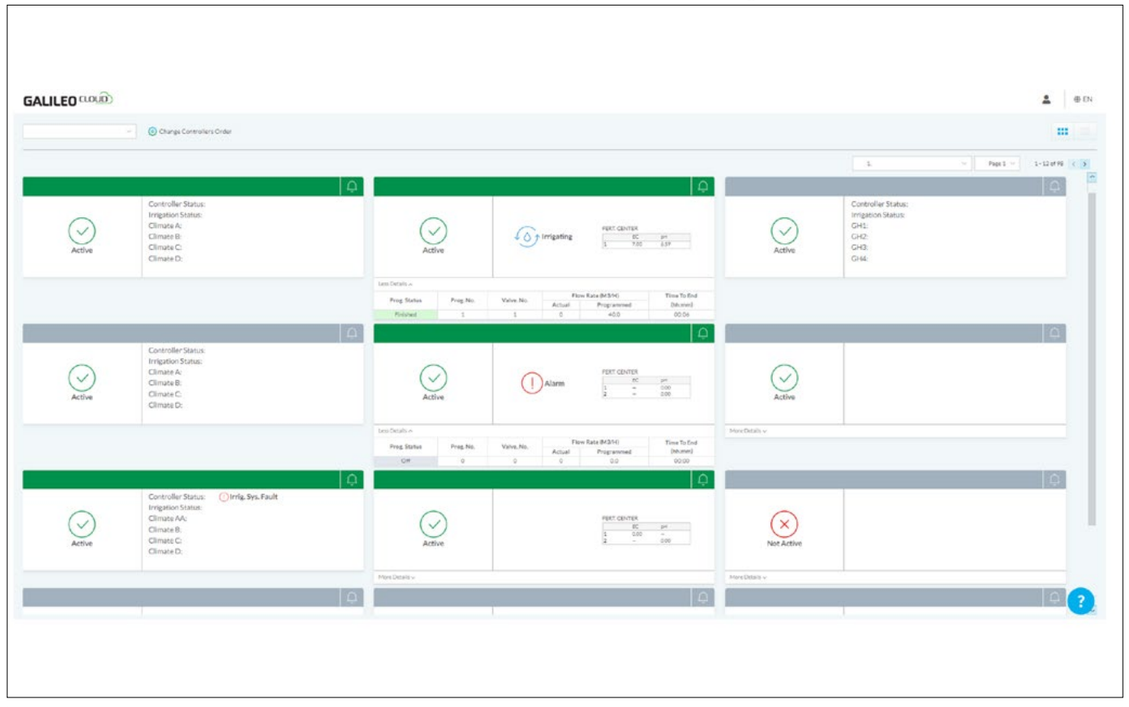
Member - Can edits existing projects and users

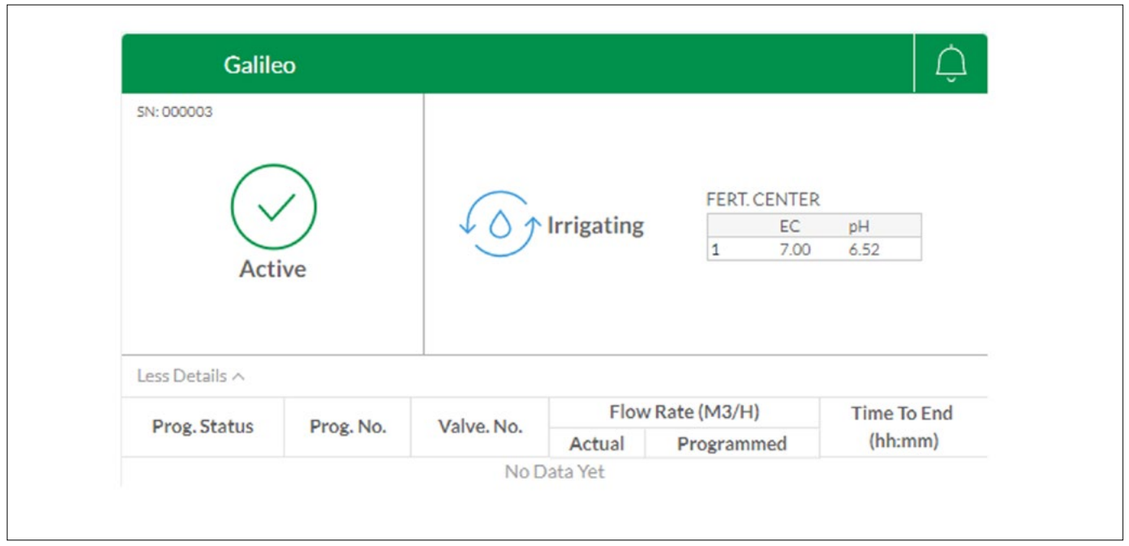
Payment - An administrative account - can only pay for purchased controllers and other equipment

Since using the Galileo system requires an appropriate license, it is important to understand the following notes:

- Upon the first entry to the Galileo system, all new users are requested to read and accept the "Terms of Usage" document, which is displayed on the first Galileo's system screen. Please Read this document and accept it by clicking on the appropriate button at its end.
- When accessing the Galileo web site from PC computers, only a single user name can be used at the same time. A trying to log into the system with the same user credential, causes a "This user is already logged" message to appear on screen, the user is getting the option to proceed, but doing so disconnects the user from the other PC computer. When at the end of a day, a user forgets to log-out from his work computer, this feature enables him, for instance, to log-in from his home computer by disconnecting the forgotten user from the work computer.
- Galileo system prevents entry from two different Internet Browsers at the same time from the same PC computer.
- Using Tabs on a single Browser is allowed. The user may use this feature to access more that one of his Galileo Controllers at the same time, when each controller is accessed from a separated Tab.
- The user can log-in to the Galileo system from his Galileo Smart phone or Tablet application, while he is already logged-in from his PC computer.
- Galileo system prevents entry from two different Smart phone or Tablets at the same time, only single Galileo App can be used at the same time.

Once the user's name and password are confirmed by the system the following screen appears:





This screen displays a small window per each controller of the project that the current user has access to.

At the top line of the screen a selection boxes allows the user to: navigate directly to a specific project, change the order of the controllers displayed for the project, jump directly to the page displaying a specific controller by its serial number, and jump to a different page (each page shows up to 12 controllers).

For easy access to each controller, click on that controller's window; the system moves directly to the default entry screen of that controller. e.g., the operation-table. The default screen for each controller can be set by the user at the Account Settings -> User Settings entry of the system main menu.

Each controller's window on this screen, displays the name of the controller, its serial number, an icon showing the general Active / Not Active status of the controller (as set at the Controller Setup Wizard Screen), and a real-time status icon.

The real-time area of the controller's window shows one of the following icons according to the current status of the controller: Initiating (the controller is in its starting process), Irrigating, Pause, Alarm, Active, or Not Active.

At the right side of the window, the system displays a table with the controller's FERT.CENTER details. This table displays data only for defined and configured fertilizer centers that has EC or pH sensors (fertilizer centers with at least one fertilizer pump and one sensor). The table shows the sensors readings of each such fertilizer center.

At the bottom line of the controller's window, a More Details icon appears; pressing this icon opens another section of the window with details on the controller's irrigation programs. Out of the controller's first 30 irrigation programs, the table shows only the currently operating programs (irrigating, or fertilizing, or paused or at fault). For each such program the table shows the program's status, number, the number of the first valve of the program, the flow-rate data and the time left till the end of the program.

Clicking on a program's line in the More Details table moves the system to the system's operation table screen where the program's name is highlighted in blue.

The top line of the controller's window changes its color according to the controller's status: Green – connected to the communication and active, Gray – not connected to the communication, or Red – the controller is in fault mode that stopped at least a single irrigation program.

The bell icon on the upper line of the controller screen allows the user to open a list showing the current alarms of the controller.

By clicking on a specific controller's window, the system enters to the main screen of the Galileo web site of the selected controller.

G.2. The system hierarchy - Web

Project - For each customer, "Project" appears at the top of the Galileo Cloud hierarchy; each customer can have several projects. Note that the projects are separated from each other, therefore control conditions cannot be performed between different projects.

Controller - Each project may include unlimited number of Galileo controllers; each controller may perform different irrigation and/or fertigation task, and can control different sections and plots within the farm.

Note: it is possible to assign a single controller to several projects but communication between controllers can be performed only within the same project.

Important: For enabling the operation of Projects and Controllers in the Galileo Cloud system, Galcon has to register and authorize them to the customer's database. Please contact your Galcon dealer for adding projects and controllers to your system.

G.3. The system hierarchy - Communication and Controller

Please refer to the system topology drawing on chapter D.1. of this document

Web Site - The Galileo Cloud Internet site; serves as the user interface of the system

Server - The storage of all the system and projects data

Communication - The hardware and software components of the communication system

Galileo Controllers - The in-field hardware and software of the system

Galileo local I/O cards - I/O cards located within the Galileo Controller housing:

- Galileo analog in 16 AC
- Galileo 8 in 8 out DC
- Galileo I/O 8/16 AC
- Galileo out 24 AC
- MODBUS Analog Out 4 ADAM4024

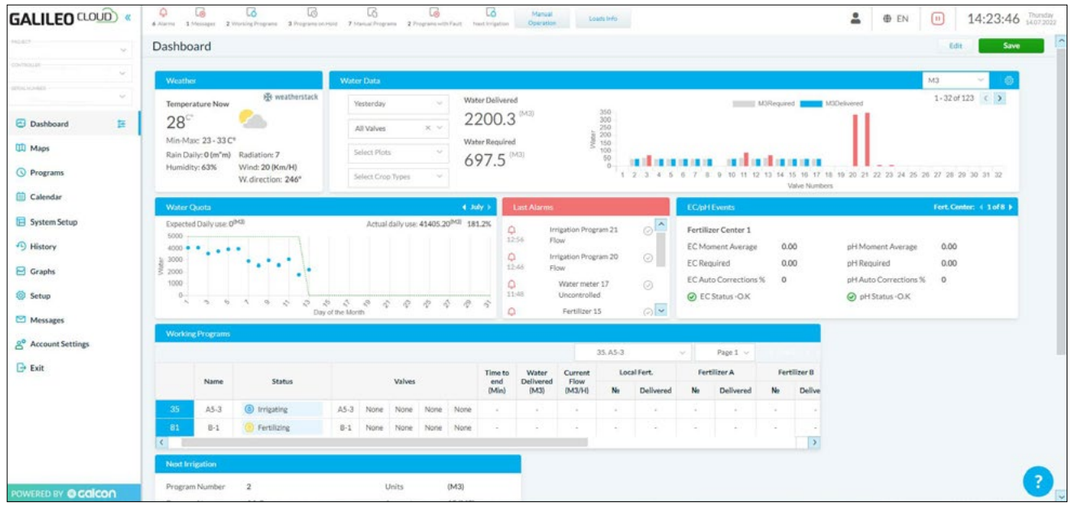
- Galileo RRTU 2 WAY
- Galileo CRTU
- Galileo RRTU 1WAY

Galileo Remote I/O cards - In-field I/O cards, controlled by the controller via communication system

- RRTU_8 2 WAY
- RRTU_4 2 WAY
- CRTU_2 DC
- CRTU_4 DC
- RRTU_2 1 WAY
- RRTU_4 1 WAY

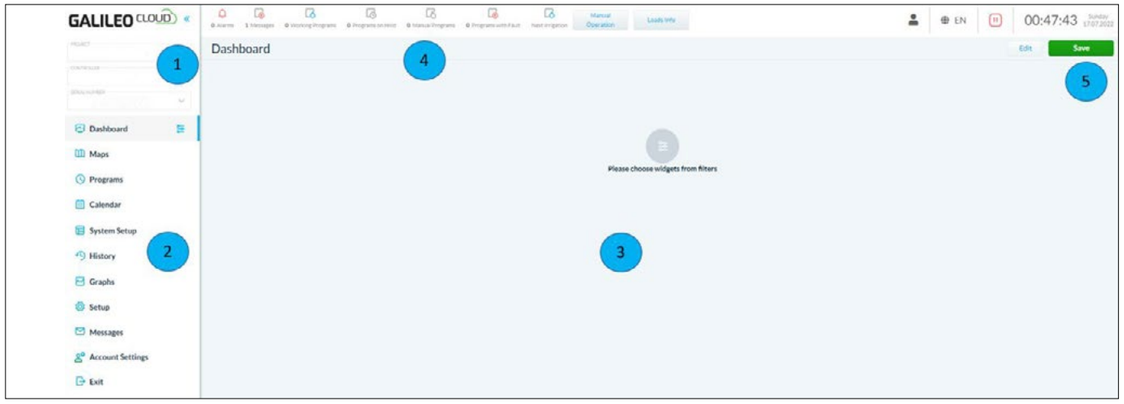
H. The Galileo Cloud Center User Interface

Once the login process is completed, the following screen appears:



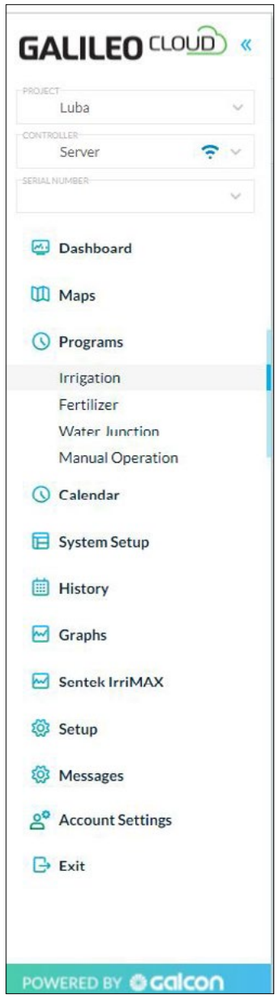
This is the Dashboard (Home) screen of the system; you may always return to it by clicking on the Galcon Logo at the top left corner of the screen.

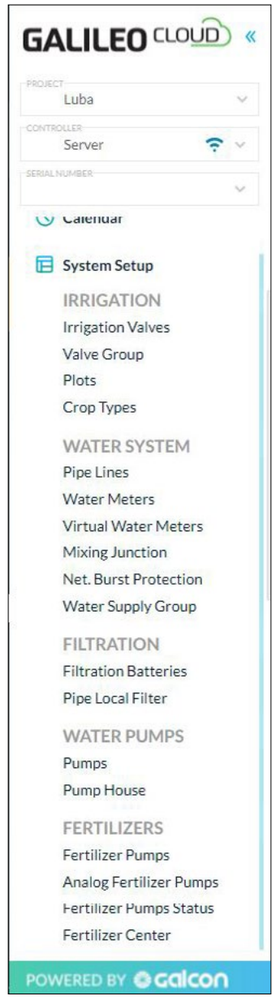
H.1. The main sections of the Galileo Cloud screen



The following are the main sections of the Galileo Cloud screen:

1. **Project and Controller selection area** - two dropdown lists; one for all the projects of the current user, and the other for all the controllers designated to the selected project.
2. **Main Menu** - This section of the screen contains the entry points to the major system screens.
   The entries of the main menu are divided into two types:
   - Dropdown list type - clicking on the name of the entry opens a dropdown list of screens related to the subject of the main menu entry, see the following examples:



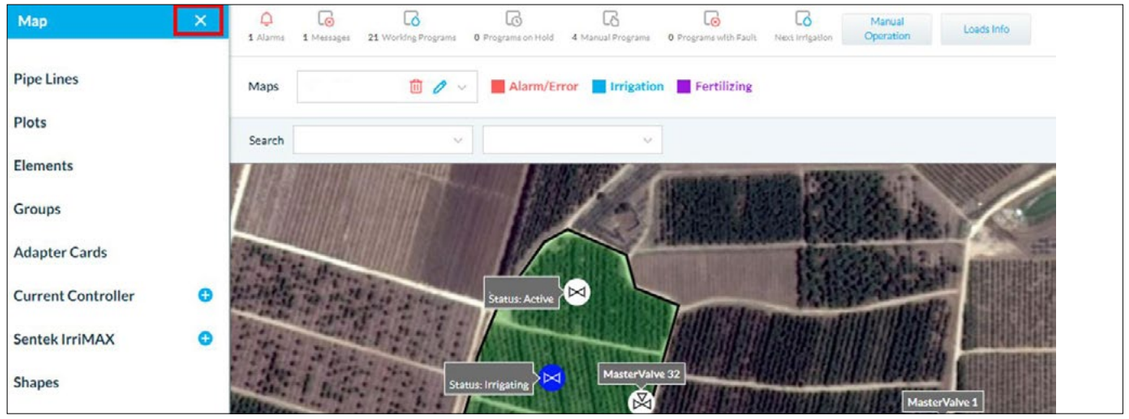


Click again on the main subject's name to collapse the dropdown list.

The communication icon to the right of the controller's name displays the systems method of communication to this controller. Once hovering the mouse cursor over this icon, the communication type appears, the options are: Lan, WIFI, or Modem. Note that this icon does not display a real time data, it displays the communication method of the last time the system communicated with this controller.

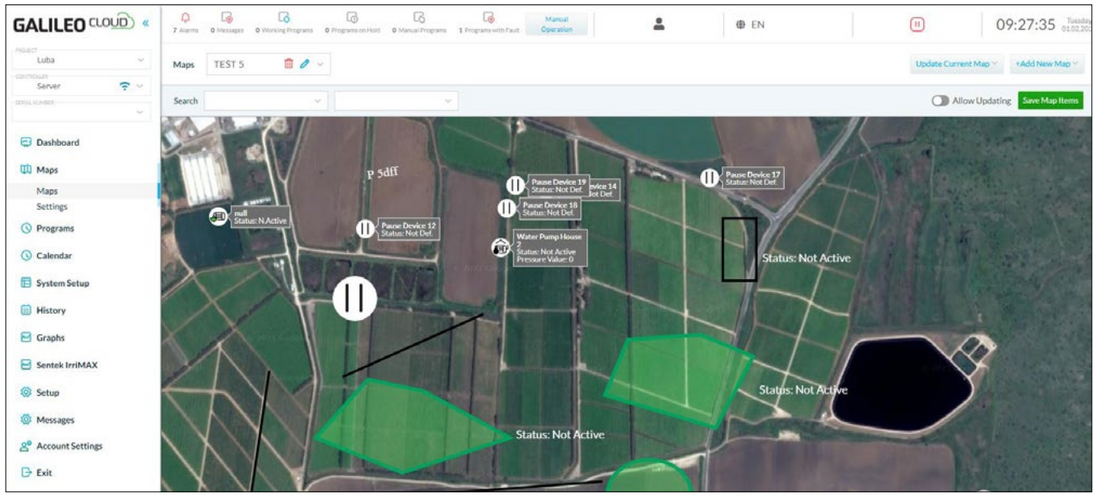
- **Selection and configuration** -clicking on the name of the entry opens the selected subject on the screen's main display area (3), a configuration icon appears to the right of the subject name. Clicking the configuration icon opens a sub menu, that is used for configuring the selected subject, see the following examples:

Click the "X" to close the selection and configuration screen.

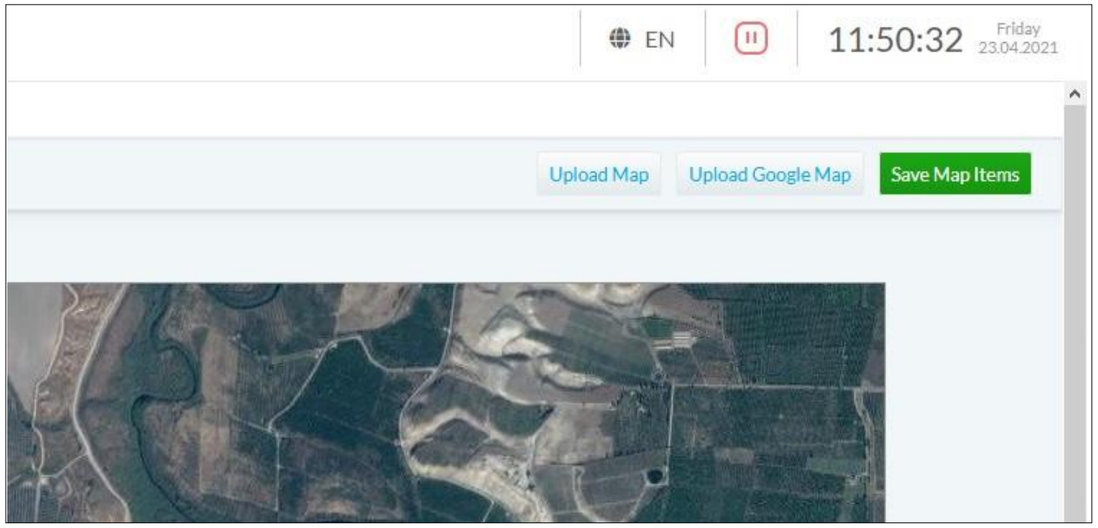


Click the "X" to close the selection and configuration screen.

3. **Main Display Area** - This section of the screen is used for displaying the content of the selected main menu subject.
4. **Monitoring menu** - This menu is the horizontal line above the Main Display Ares, its various icons are the entry points to the most important real-time monitoring components of the system, such as AlarmsMessages, Working Programs, Programs on hold, Programs Next Irrigation, Manual Operations, and Loads Info. fault, etc. Clicking on each such icon opens a window on the screen's Main Display Area with real-time information on the selected icon.



5. **Time/Date, Language, and Pause** - The right upper corner of the screen displays the current time and date and enables the user to set the user interface language. The Pause Icon enables the user to pause all the controller's operations including all the irrigation programs for unlimited time or for specific number of minutes entered by the user.



It has the following options:

- Temporary for: - An option to pause the controller for the specified time entered to this option window (HH:MM). The controller resumes operation once the countdown of this time ends.
- Pause System by Timing – An option to pause the controller between predefined Start and Stop timings. The controller enters into pause, every day, between these timing parameters.
- Pause Now – Enter the controller to pause, it remains paused until the user cancels the pause.

Once the controller enters to pause mode, a red line specifying that the controller is paused appears on the upper line of the screen. In the middle of this line there are two icons: End Pause icon and Info icon. Clicking on the Info icon opens a window that lists the current reasons that entered the controller to pause mode.

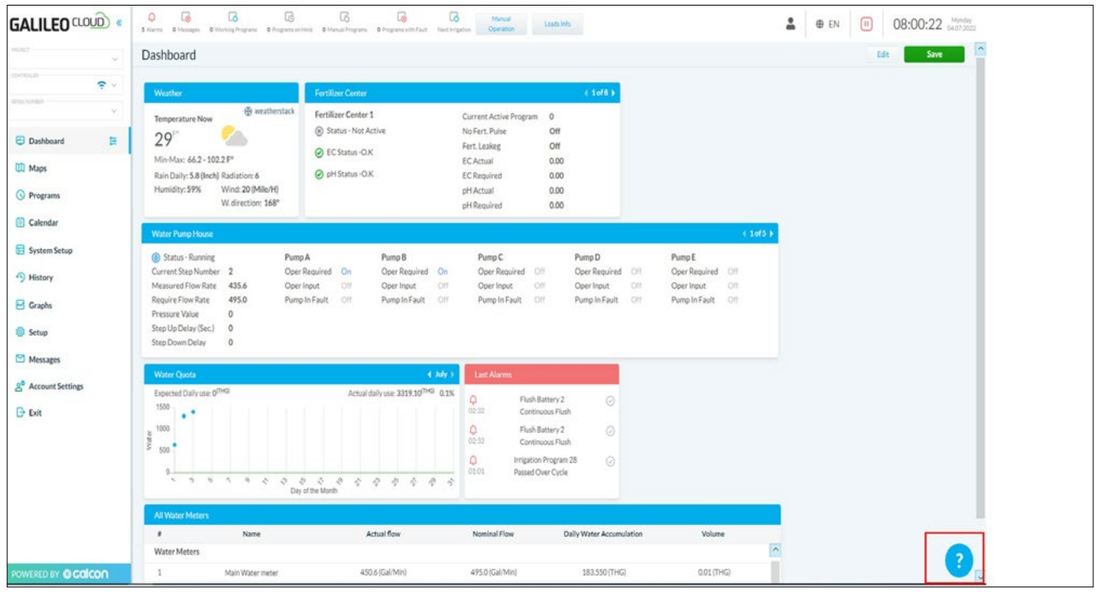
The following is the list of the possible reasons:

- Power up delay – the controller is in its initiating process.
- Check hardware power up delay – the controller checks the connections to all its hardware components.

- Temporary pause – the controller is paused by the user's temporary pause command.
- Permanent pause – the controller is paused by the user pause now command.
- Paused by timing – the controller is paused by its daily pause timing.
- Paused by logic condition – a logic condition paused the controller.
- Paused by low battery – the controller's battery is too low for operation.
- Paused by daily over quota – the controller exceeded its daily water quota.
- Paused by firmware updating – the controller is updating its firmware.
- Paused by outputs check operation – the user started the check outputs process.

H.2. Getting Help:

In order for the user to understand the meaning and the logic of the system parameters, Galileo web provides a help screen on each of its screens' tabs. A floating question mark icon appears on the lower right corner of the screen, clicking on this icon opens a help window over the main screen. The help window displays information specific to the opened screen. Note that the same information can be found on the Galileo system user manual. The following picture shows an opened help window over a system screen.



An OPEN icon appears on the upper right corner of the help window, clicking on this icon opens the help screen in a separated tab. Please check your browser for the reaction to the opening of a new tab, open it in a new window, jump to it immediately, etc. A search box appears also on the help window, allowing the user to search the help text for a specific parameter or word.

Note that the dashboard screen has a connectivity from widget to element; this is a jump function that once the widget is clicked on, the system jumps to the related system screen of the widget element.

I. The Galileo Cloud Main Menu Entries

Upon entering the system, the default screen appears. The default screen is the Dashboard; however, the user can change the default screen by selecting the required screen under the user settings menu of the system, the options are Dashboard, Maps, Multi Programs, Calendar, or Operation Table.
The following is a list of the Galileo Cloud main menu entries with a general description of each entry assigned task.

I.1. Dashboard

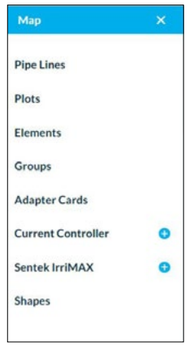
The Dashboard displays widgets, assigned by the system's user, that display real time and analytical information such as current weather, water accumulation, flow-rate, water data chart, pump house info, water quota, sensors information and charts, fertilizers, irrigation schedules, etc.

The number of widgets and their types can be configured by the user by selecting the required ones from the configuration list that is opened when clicking the configuration icon, next to the dashboard headline, at the main menu.

The Save button of the Dashboard saves its layout per user, so each user can organize the dashboard according to his preferences.

It is possible to change the location on screen of the widgets; use the pencil icon (next to the Save icon) to unlock the widgets position status.

I.2. Maps



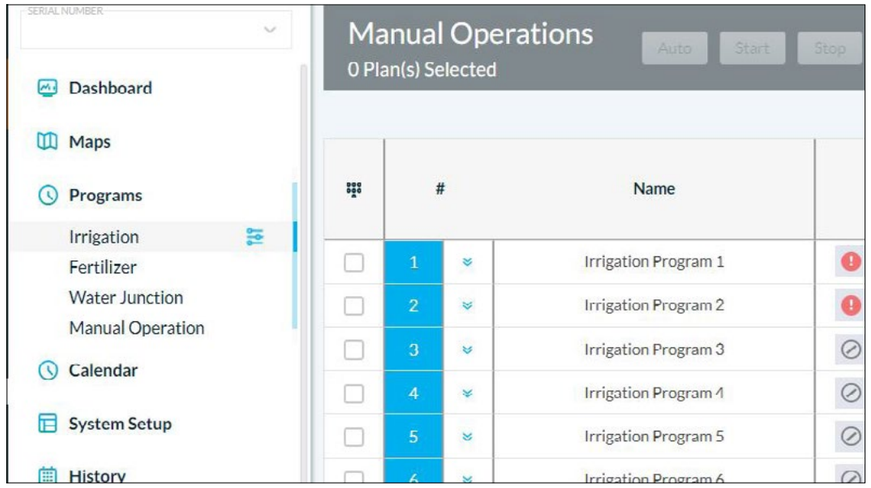
The second entry of the main menu is Maps. Clicking this entry displays the system map on the Main Display Area of the Galileo Cloud site. The map is based on a preloaded map (either from Google or from an external file). On the map the user can configure a layer of symbols such as lines, plots, sections, etc. and system icons, such as controllers, valves, fertilizers, etc. that display real-time information on the map.

The user can define several maps to be selected from the configuration list that is opened when clicking the configuration icon, next to the Maps headline, at the main menu.

The Maps configuration list includes the following secondary dropdown menu entries, that are used to configure the map layers: Pipe lines, Plots, Elements, Groups, Adapter Cards, and Shapes. Please refer to the "Configuring the Map" section of this document for instructions on using and configuring these elements.

I.3. Programs

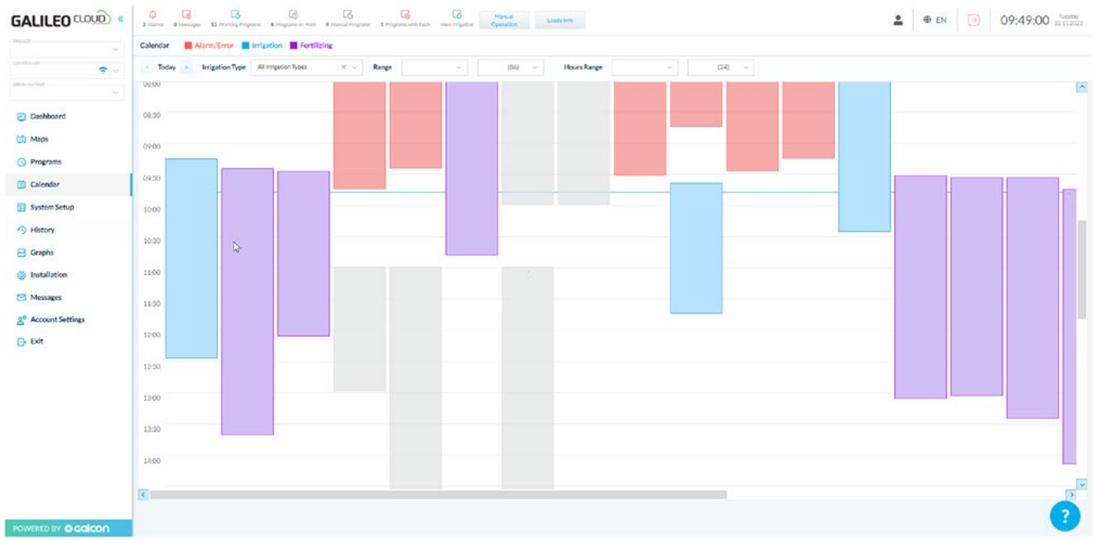
The third entry of the main menu is Programs. Clicking this entry displays a dropdown menu list of items used to configure the various programs of the irrigation system. Clicking on the configuration icon next to each such item displays its designated configuration table on the Main Display Area.



The Programs configuration list includes the following secondary dropdown menu entries, that are used to configure the various irrigation programs: Calendar, Irrigation, Fertilizer, Water Junction, Filter Flush, and Manual Operations. Please refer to the "Configuring the Programs" section of this document for instructions on using and configuring these elements.

I.4. Calendar

Entering the Calendar entry of the Galileo system is done by clicking on the "Calendar" entry of the main menu, the following screen appears:



The calendar displays the current day and the previous day; it displays the irrigation programs of this two days. At the line above the central section of the screen the user can select the required day, the irrigation type, the programs range, and the hours range to be displayed.

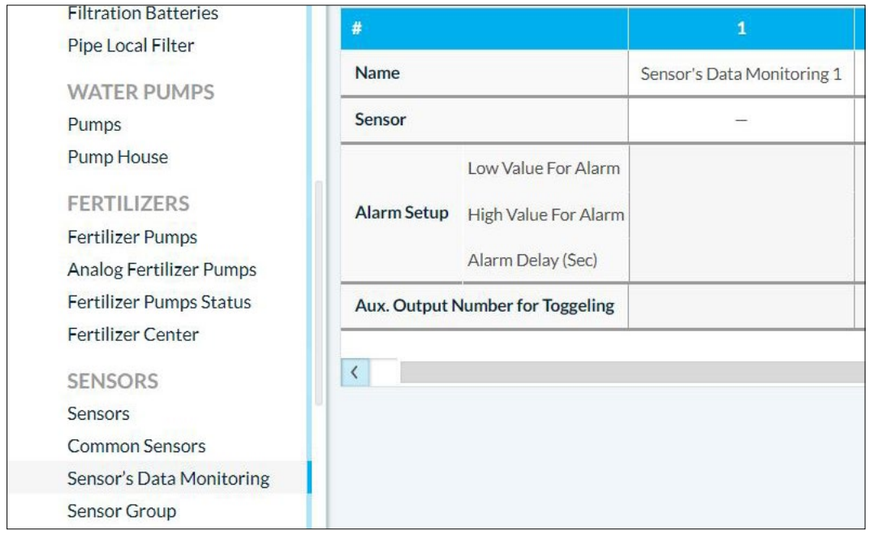
Along the screen the system displays the programs that took place at the selected range, the color of the displayed programs changes according to their status, where on top of each such column the name of the program together with it cycles number appears.

Note that for the current day the calendar displays the programs that are going to start during this day.

The Calendar has a jump feature; when clicking on a program that is presented in the calendar screen the system moves to that program's row on the system operation table.

I.5. Sensors

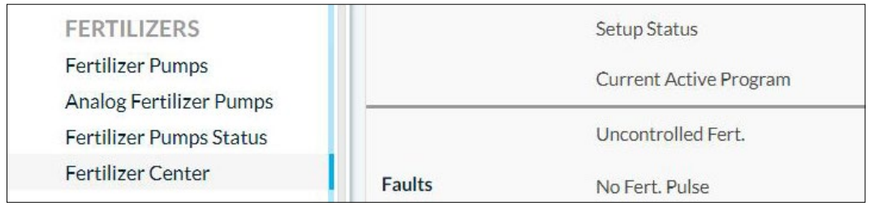
The fourth entry of the main menu is Sensors. Clicking this entry displays a dropdown menu list. Clicking on an item displays its data table on the Main Display Area. The last item on this list is also used to configure The Sensor Graphs; clicking on the configuration icon next to this item displays its designated configuration table on the Main Display Area.



The Sensors list includes the following secondary dropdown menu entries, that are used to display the various system sensors and configure the sensor graph: Sensors, Common Sensors, Data Collection Sensor, Meteorology, Sensor Group, Sensor Values, and Sensor Graph. Please refer to the "Configuring Sensors" section of this document for instructions on using and configuring these elements.

I.6. Fertilizing

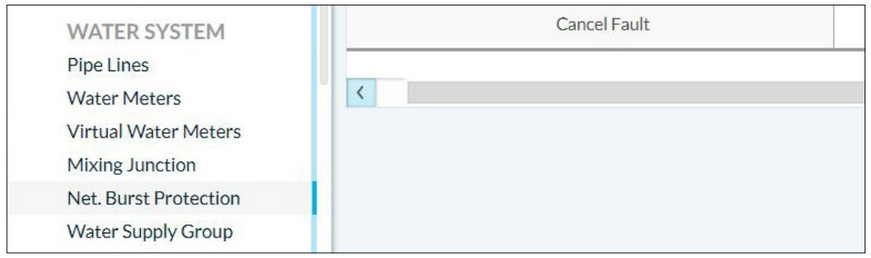
The Fifth entry of the main menu is Fertilizing. Clicking this entry displays a dropdown menu list. Clicking on an item displays its data table on the Main Display Area.



The Fertilizing list includes the following secondary dropdown menu entries, that are used to display the fertilizing data: Fertilizing Center, and Fertilizer Pump. Please refer to the "Configuring Fertilizing" section of this document for instructions on using and configuring these elements.

I.7. Water System

The Sixth entry of the main menu is Water System. Clicking this entry displays a dropdown menu list. Clicking on an item displays its data table on the Main Display Area.

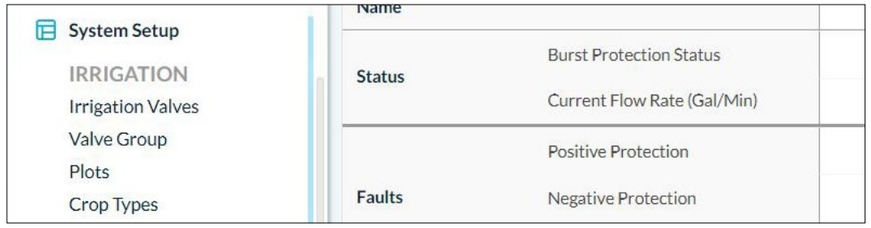


The Water System list includes the following secondary dropdown menu entries, that are used to display the Water System data: Pipe Line, Pipe Local Filter Flush, Water Meter, Virtual Water Meter, Water Pump, Water Pump House, Water Mixing Junction, Fresh Water Counter, Saline Water Counter, System Water Supply, and Burst Protection.

Please refer to the "Configuring the Water System" section of this document for instructions on using and configuring these elements.

I.8. Irrigation

The Seventh entry of the main menu is Irrigation. Clicking this entry displays a dropdown menu list. Clicking on an item displays its data table on the Main Display Area.

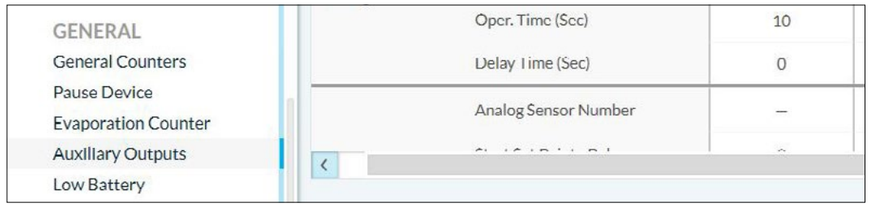


The Irrigation list includes the following secondary dropdown menu entries, that are used to display the Irrigation items: Irrigation Valve, Private Water Meter, Valve Group, Plot, and Crop Type.

Please refer to the "Configuring Irrigation" section of this document for instructions on using and configuring these elements.

I.9. General

The Eighth entry of the main menu is General. Clicking this entry displays a dropdown menu list. Clicking on an item displays its data table on the Main Display Area.

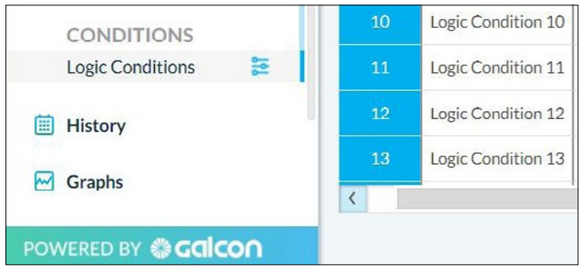


The General list includes the following secondary dropdown menu entries, that are used to display the General Items of the system: General Counter, Pause Device, Evaporation, Auxiliary Output, and Low Battery.

Please refer to the "Configuring the General Items" section of this document for instructions on using and configuring these elements.

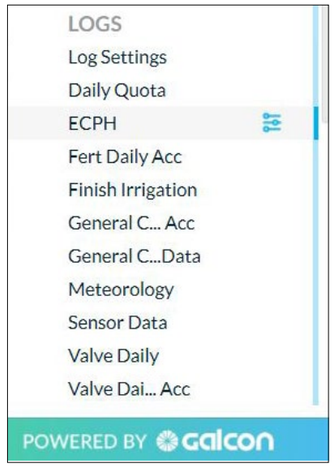
I.10. Conditions

The Nineth entry of the main menu is Conditions. Clicking this entry displays a dropdown menu, with a "Condition Input" and "Logic Condition" entries. Clicking on that item displays its data table on the Main Display Area. Please refer to the "Conditions" section of this document for instructions on using and configuring conditions.



I.11. Logs

The Tenth entry of the main menu is Logs. Clicking this entry displays a dropdown menu list of items used to configure the various Loges of the irrigation system. Except for the first item of the list, clicking on the configuration icon next to each such item displays its designated configuration table on the Main Display Area. Clicking on the first icon of the list, opens its content on the Main Display area.

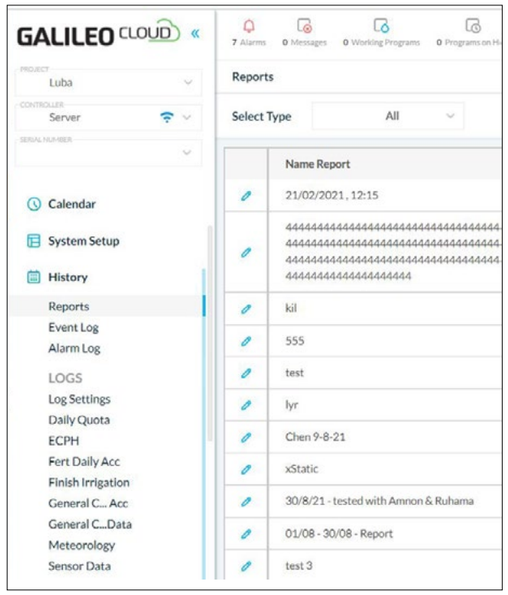


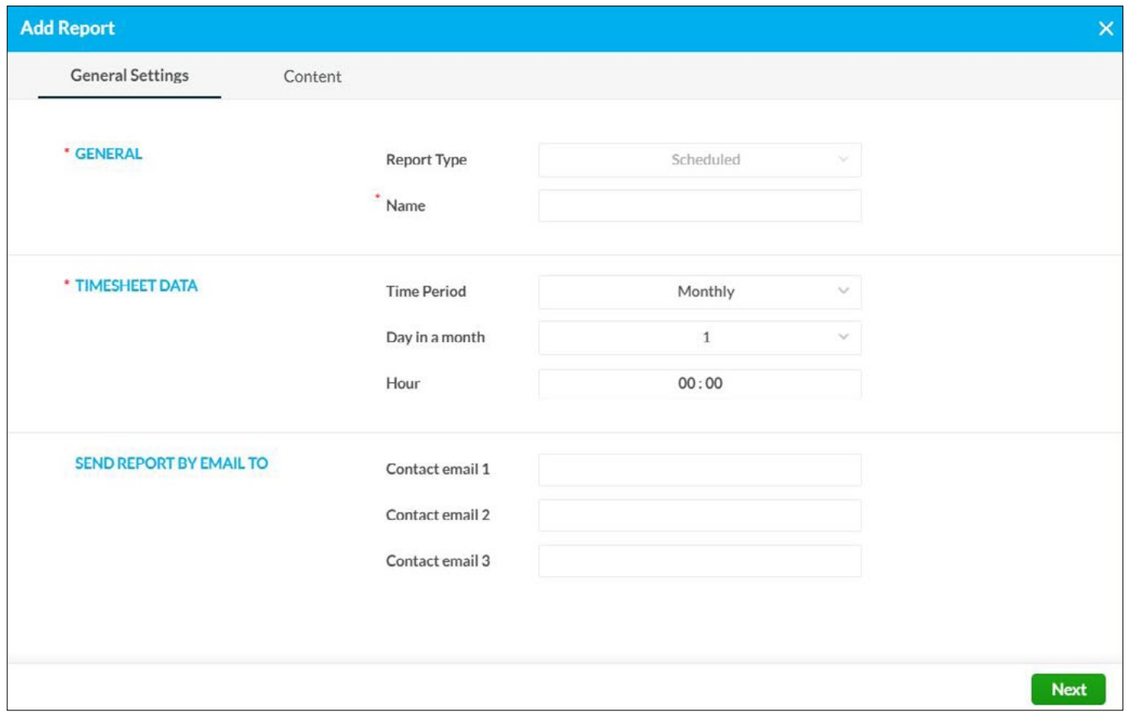
The Logs list includes the following secondary dropdown menu entries, that are used to configure the various system logs: Log Settings, Daily Water Quota, EC/PH, Fertilizing Daily Accumulation, Finish Irrigation, Central Counter daily Accumulation, Central Counter Data, Meteorology, Sensor Data, Valve Daily, Valve Daily Water Accumulation, Virtual Water Counter Accumulation, Virtual Water Counter Data, Water Counter Cyclic Data, Water Counter Daily Accumulation, Water Junction daily Water Accumulation, and Water Junction Data.

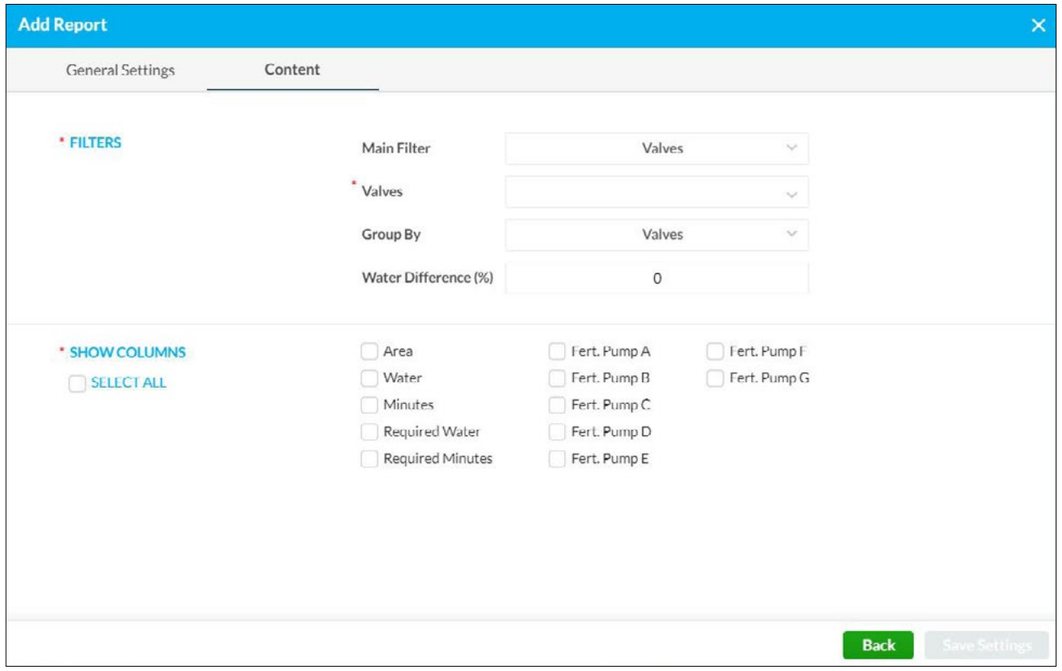
Please refer to the "Configuring Logs" section of this document for instructions on using and configuring these elements.

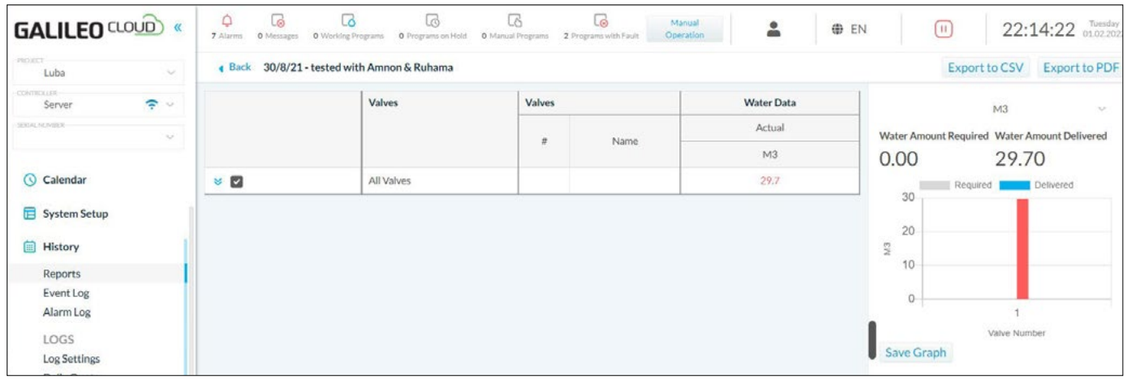
I.12. Reports

The Eleventh entry of the main menu is Reports. The Reports section allows the user to generate and display reports. The user can select to display either "Static" or "All" reports type and can define a new report (or change an existing report) by clicking on the pencil icon next to the report name line on the reports list screen.



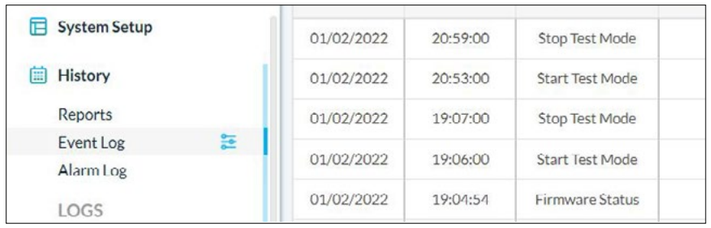




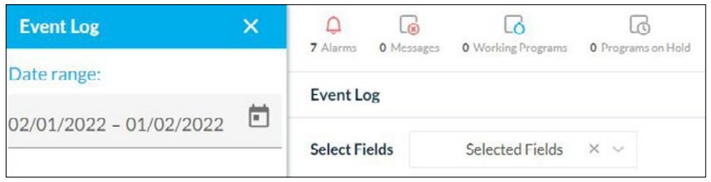


I.13. Event Log

The Twelfth entry of the main menu is Event Log. Clicking this entry displays its data table on the Main Display Area of the screen.

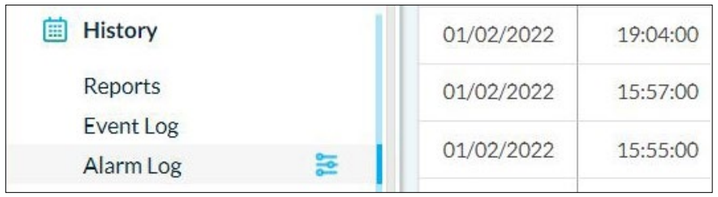


Clicking on the configuration Icon of the Event Log opens a selection list that enables the user to select a date range for the event log.

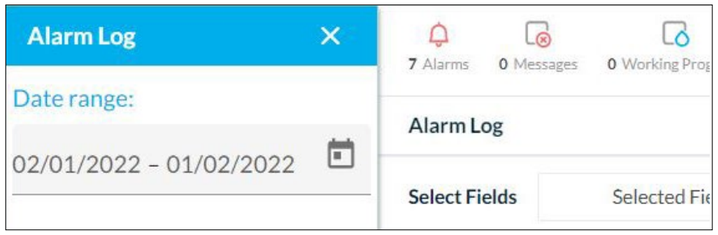


I.14. Alarm Log

The Thirteenth entry of the main menu is Alarm Log. Clicking this entry displays its data table on the Main Display Area of the screen.

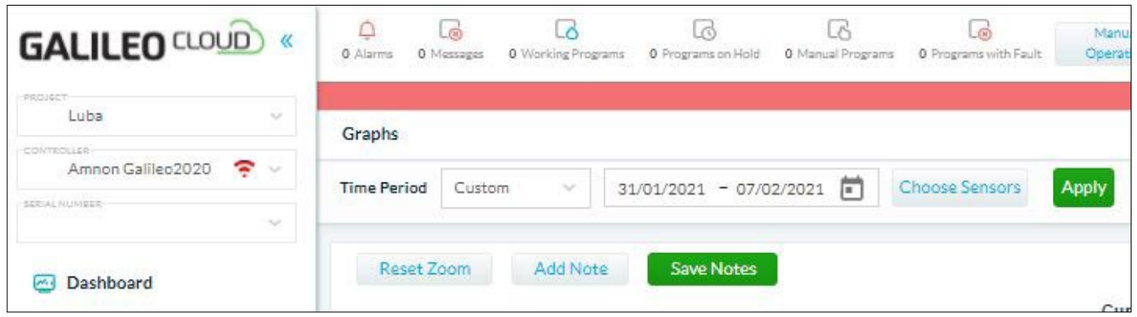


Clicking on the configuration Icon of the Alarm Log opens a selection list that enables the user to select a date range for the alarm log.

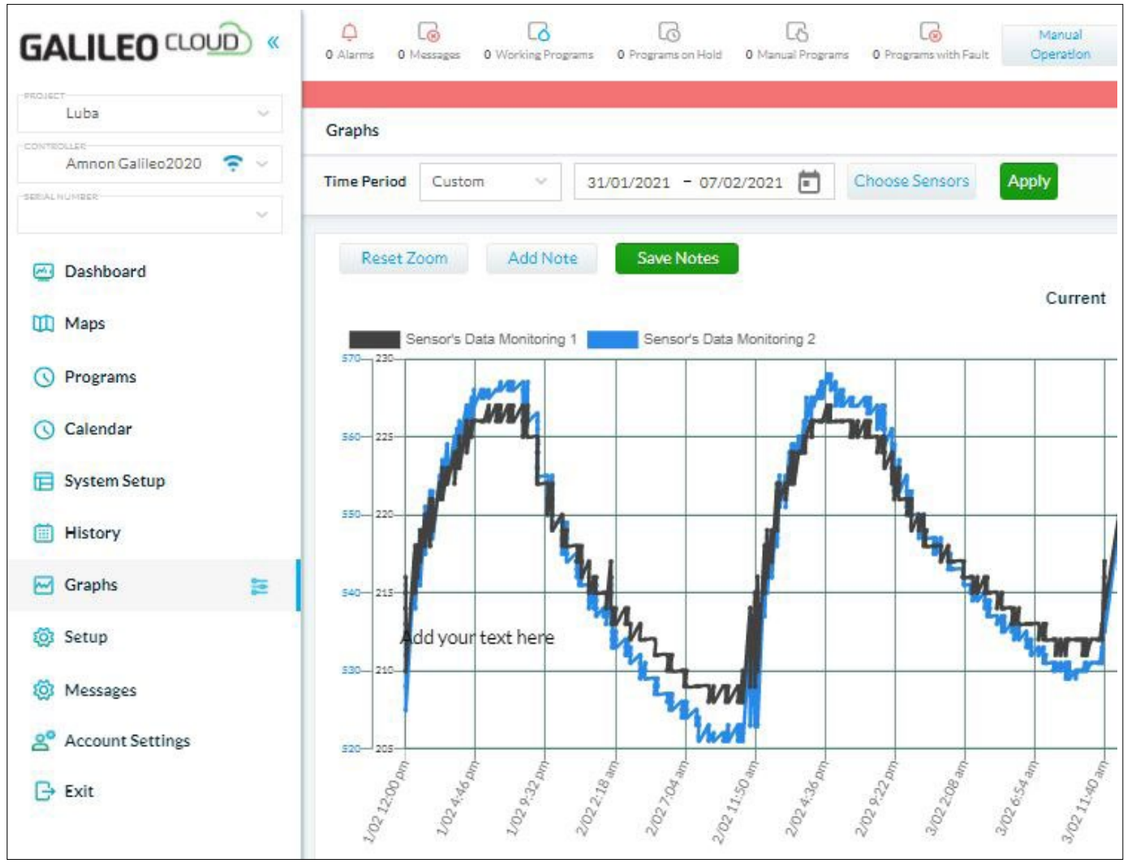


I.15. Graphs

The Fourteenth entry of the main menu is Graphs. Clicking this entry displays its data table on the Main Display Area of the screen.



This screen displays the charts that are configured at the "Sensor Graph" section of the "Sensors" tab at the system's main menu entry.



I.16. Setup

The eighth entry of the main menu is SetupInstallation. Clicking this entry displays a dropdown menu list of items used to configure the various setup items of the system. Clicking on an item in this list, opens its content on the Main Display area.

The SetupInstallation list includes the following secondary dropdown menu entries, that are used to configure the various system items: Connections, Sale table, Sunrise & Sunset, RTU Settings, Users, Projects, Alarms, and Water Quota. Please refer to the "System Setup"Installation" section of this document for instructions on using and configuring these elements.

I.17. Account Settings

The Sixteenth entry of the main menu is Account Settings that contains the Payment section. Via this screen the users can pay for the annual system usage fee.

The Payment screen is divided into two sections, the upper section is used for paying the annual users' fees, and the lower section for paying the Controllers' annual usage fees.

The status column of these tables displays the current payment status: Active, Expired, or New, while the Controllers column of the users table show in red the numbers of the new and the expired controllers of the selected user.

In general, the cost of purchasing and using the Galileo System includes the following stages:

1. Contacting Galcon (or Galcon's dealer) and issuing a purchase order for all the hardware requested, e.g., Controllers, Sensors, etc.
2. Paying the purchase order as per the commercial terms agreed with the supplier.
3. Galcon issues a Project Name, User Name, Password, and Serial Number for the purchased controllers.
4. The user logs in to the Galileo Cloud site, and if the annual fees for the usage of the Galileo Cloud System and the Controllers purchased, are not paid yet the following screens appears:

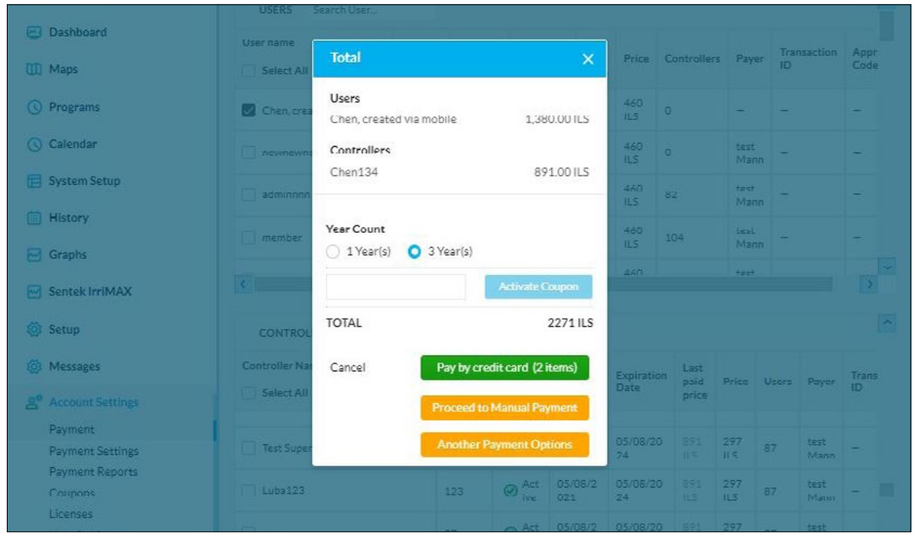
Controller fee is not paid yet

5. Paying for the Galileo Cloud System usage:

For using the cloud system, each user should pay the annual fee as depicted in the payment screen; the screen allows the user to see the list of all the registered users of the current project (or to search for specific user), the payment status of each user (New, Active or Expired), the last payment date, the Expiration date, and the transaction details (Price, Controllers associated with the user, the Payer name, the Transaction ID, and the Approval Code).

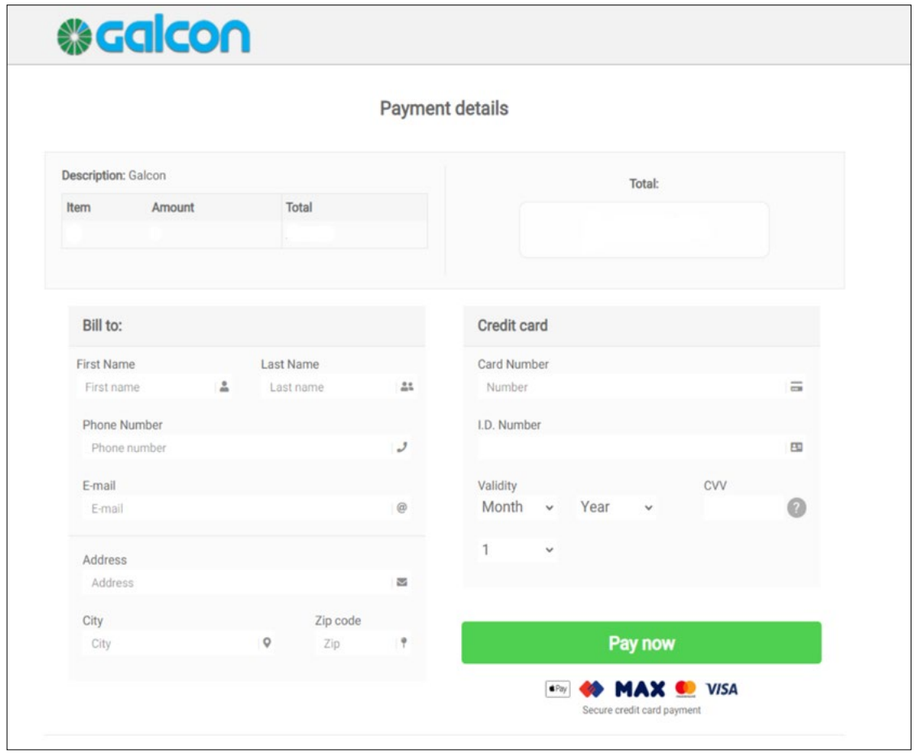
Select the User or the Controller (You may use the Select All option) and press the appropriate Renew button for entering the transaction payment process.

6. There are two main options for paying the annual fees: by credit card, or by other payment method; when pressing the Renew button the following screen appears:



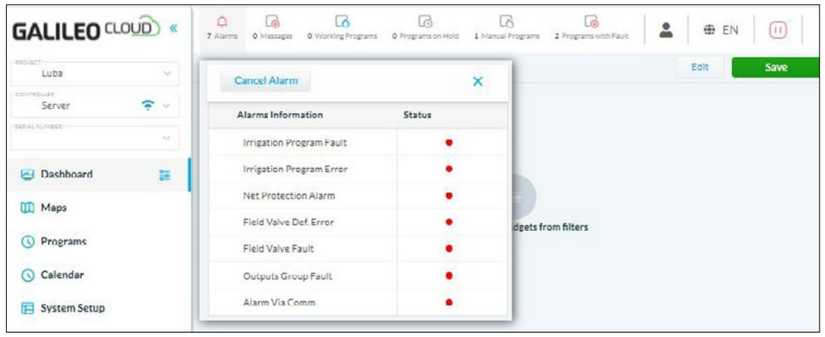
The user should choose first between paying for a single year or for three years, then if applicable enter a discount coupon code. The system calculates the total payment fee and the user then select the payment method.

When pressing the "Pay by credit card" button the payment screen opens:



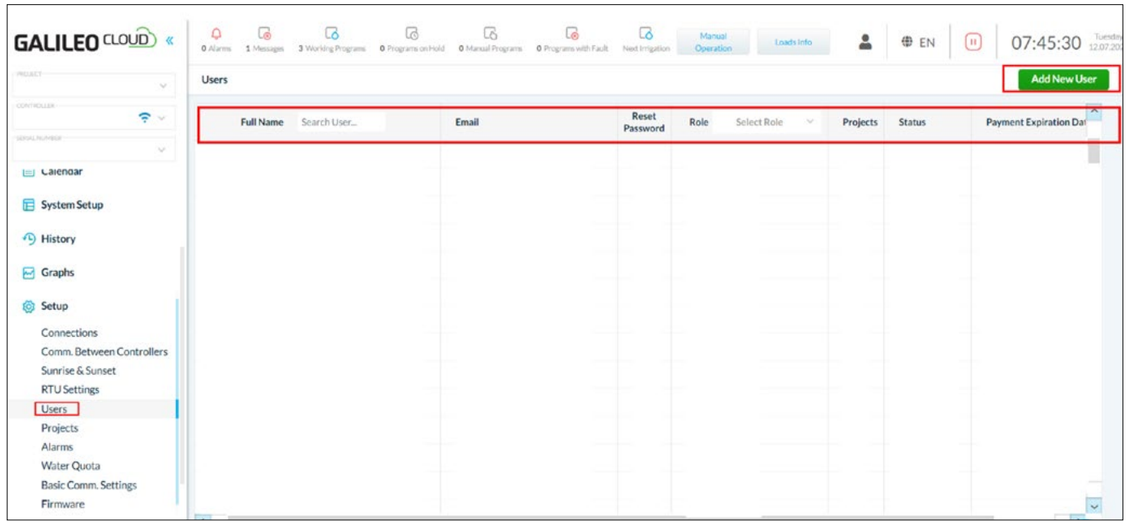
Once the transaction competed the following screen appears:

In case the user prefers to use another payment method the "Another Payment Option" button should be pressed. In this case the system presents a contact information message for the user to contact for paying the annual fees.



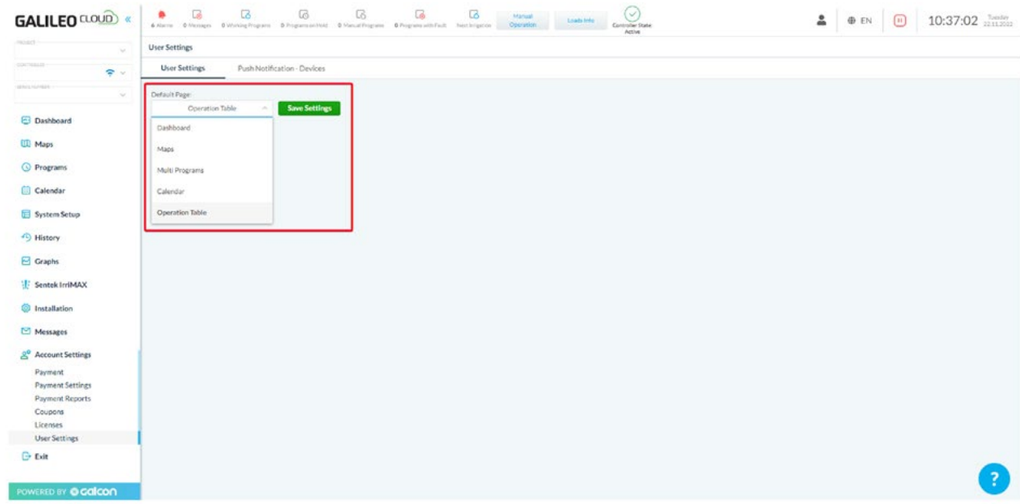
I.18. User Settings and Users Screen:

The User Setting screen that appears under the Account Setting entry of the Galileo web site, allows the managers of the system to define and control the various users of the system. This entry is not accessible for a regular user, However the Users screen under the Installation entry of the Galileo Main Menu provides information on the system's users:



- The upper line of this screen allows an authorized user to add new user.
- The first entry of the users' table is a search box that allows searching a use by his full name.
- Email – the email address of the user; it is used by the system to send the user alarms and messages notifications.
- Reset Password – this entry allows an authorized user to reset the user's password.
- Role – the access level of the user – the options are: Site Manager, Super User, Admin, Distributor, Payment, and User. Please refer to chapter G.1. Accessing the Galileo Cloud Center for description of the roles of each user type.
- Projects – The number of the projects assigned to the user.
- Status – The current status of the user. The options are: Active or Expired.
- Payment Expiration Date – The user's license expected expiration date.

Please note that for a regular user (not a manager) this screen allows the user only to select its required default screen.



The user can change his default entry screen by selecting it in this screen, the options are Dashboard, Maps, Multi Programs, Calendar, or Operation Table.

I.19. Exit:

Click on the Eighteenth entry of the main menu to logout and exit the Galileo Cloud site.

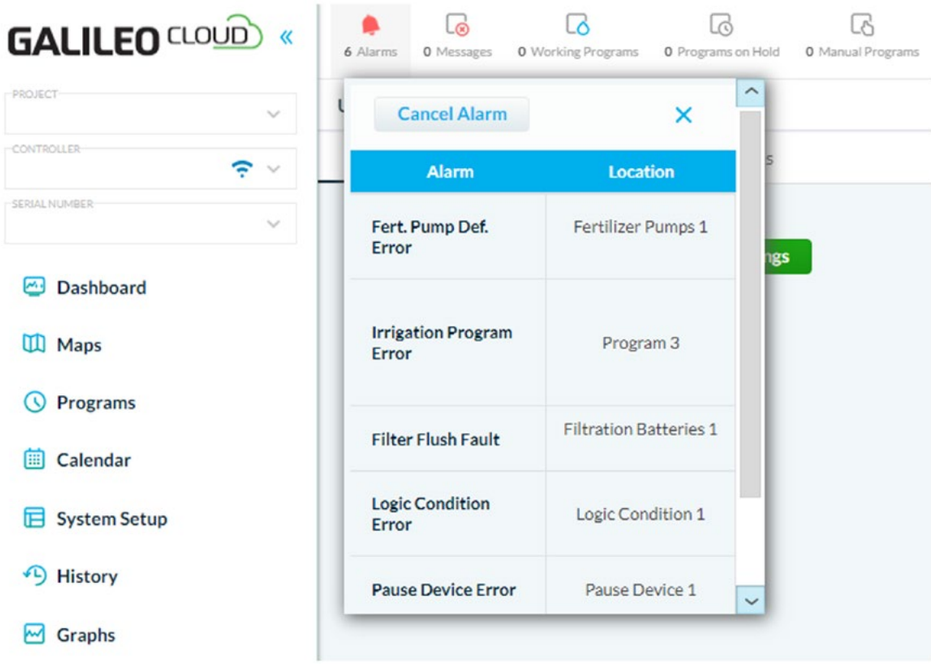
J. The Galileo Cloud Monitoring Menu Entries

The following is a list of the Galileo Cloud Monitoring menu entries with a general description of each entry assigned task. The top line of the screen displays a button for each monitoring option with a number of elements related to the button, e.g., on the working programs button the system displays the currently working programs.

Please note that: when clicking on one of the "Working Programs", "Programs on Hold", Manual Programs", and "Programs with faults" icons the system opens a table displaying the programs that are currently related to this icon, e.g., a table with a row for each working program. When clicking on any row withing this table, the system jumps directly to the system's Operation Table where the number of the selected program is marked in blue.

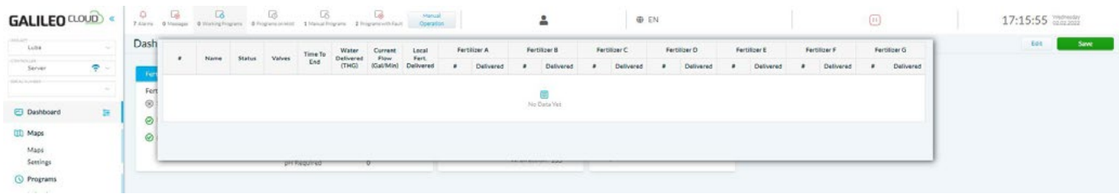
J.1. Alarms

Clicking on the Alarms Icon on the Galileo Cloud Monitoring menu opens a window that lists all the existing alarm messages of the system together with their location within the system (their element number). The Cancel Alarm button enables the user to reset the selected alarm message; see the "Monitoring chapter" of this document for details. When clicking on an alarm message the system jumps to the relevant information screen.



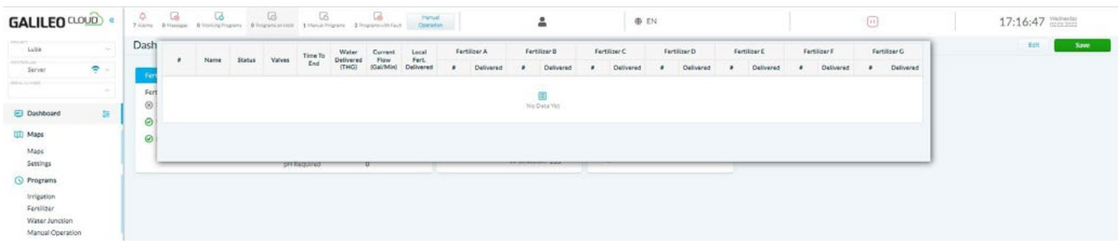
J.2. Working Programs

Clicking on the Working Programs Icon on the Galileo Cloud Monitoring menu opens a window that lists the currently operating programs; see the "Monitoring chapter" of this document for details.



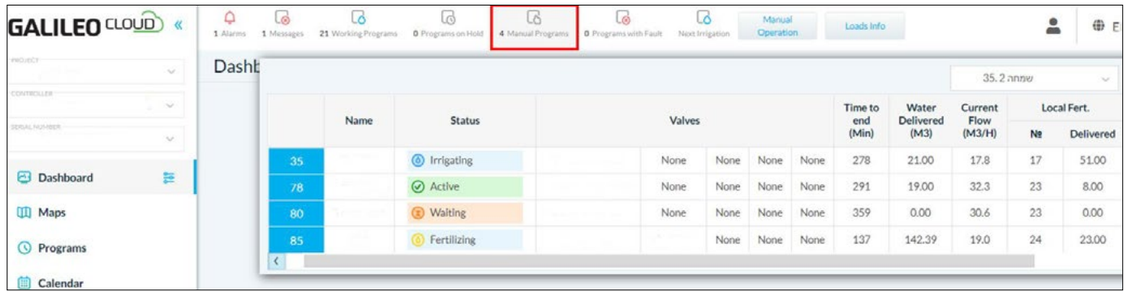
J.3. Programs on Hold

Clicking on the Programs on hold Icon on the Galileo Cloud Monitoring menu opens a window that lists the programs that are currently on hold; see the "Monitoring chapter" of this document for details.



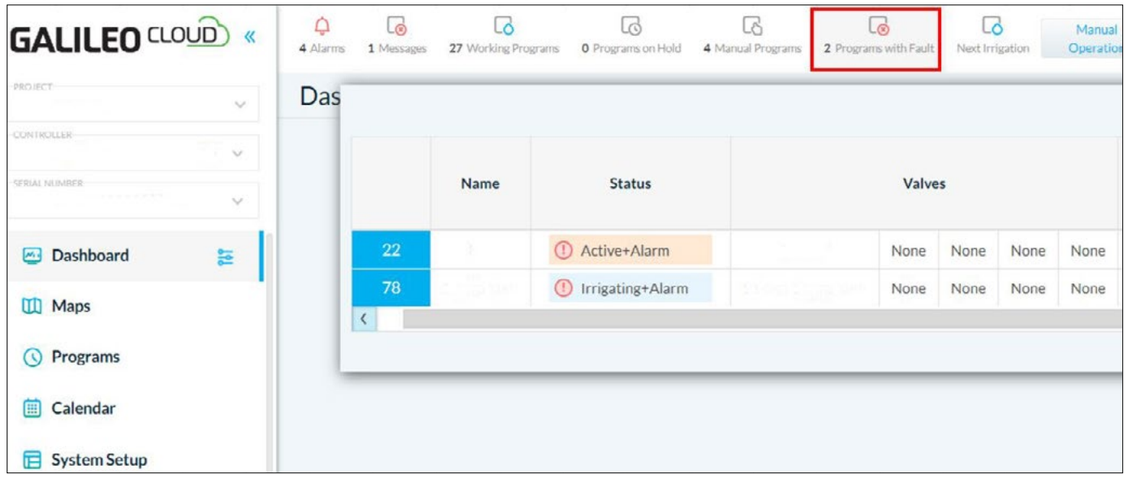
J.4. Manual Programs

Clicking on the Manual Programs Icon on the Galileo Cloud Monitoring menu opens a window that lists the programs that are currently are running, which started by a manual start command; see the "Monitoring chapter" of this document for details.



J.5. Programs with Fault

Clicking on the Programs with Fault Icon on the Galileo Cloud Monitoring menu opens a window that lists the programs that are currently in fault; see the "Monitoring chapter" of this document for details.



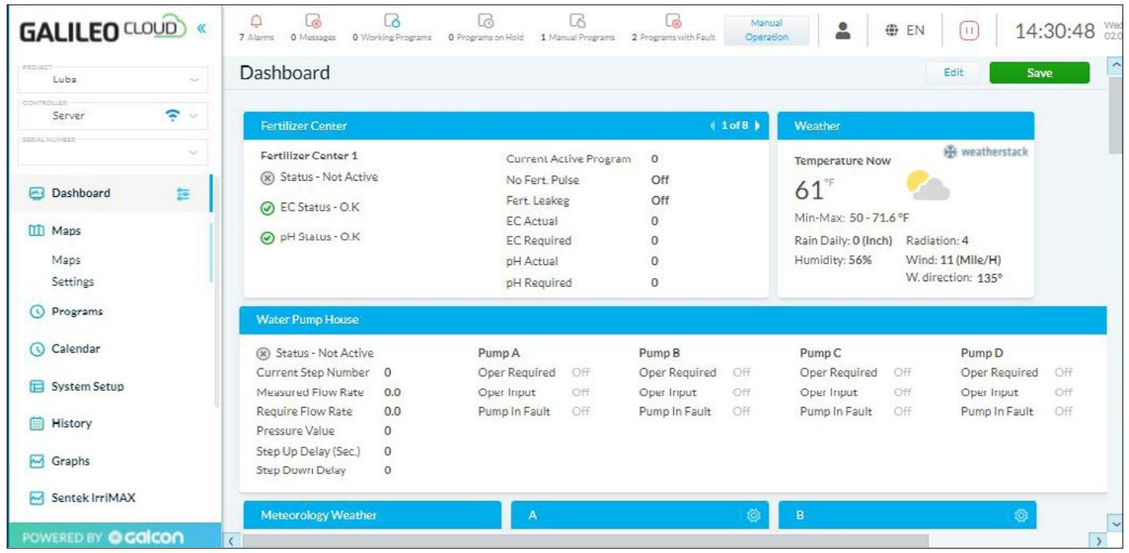
K. Configuration

This chapter describes the stages of configuring a new controller. Please follow the following steps:

Before starting the configuration process, please login to the Galileo web site and verify the following preliminary requirements:

1. The new controller is being added to the required existing project.
2. The controller's and the user's annual fees are paid for.
3. It is connected to the power supply.
4. The communication between the controller and the server is active.
5. The main status of the controller is set to Not Active.

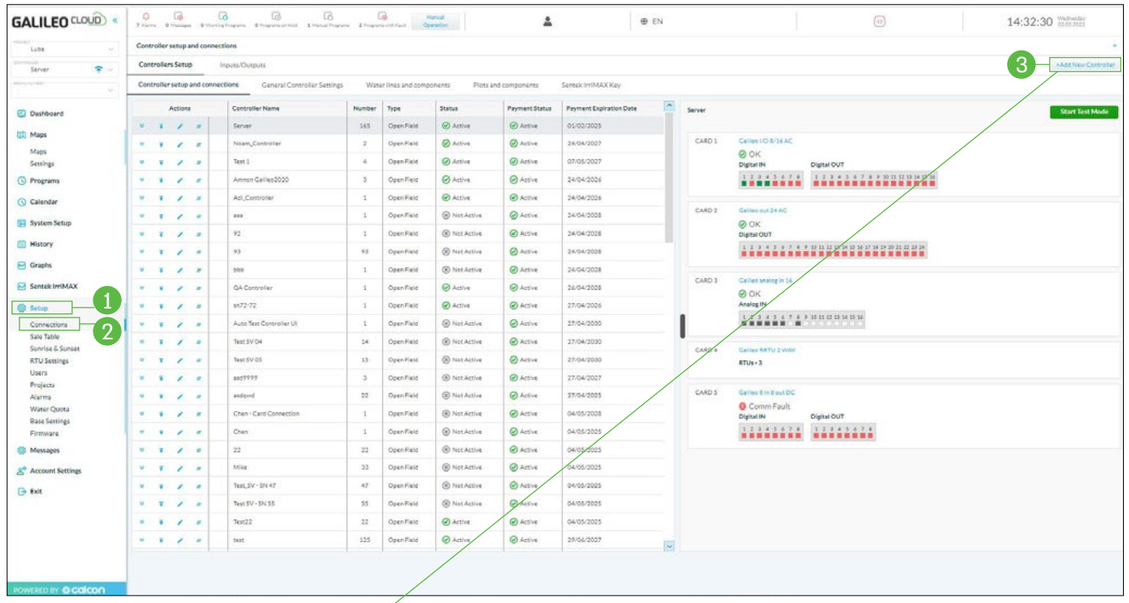
1. Selection of the Required Project:

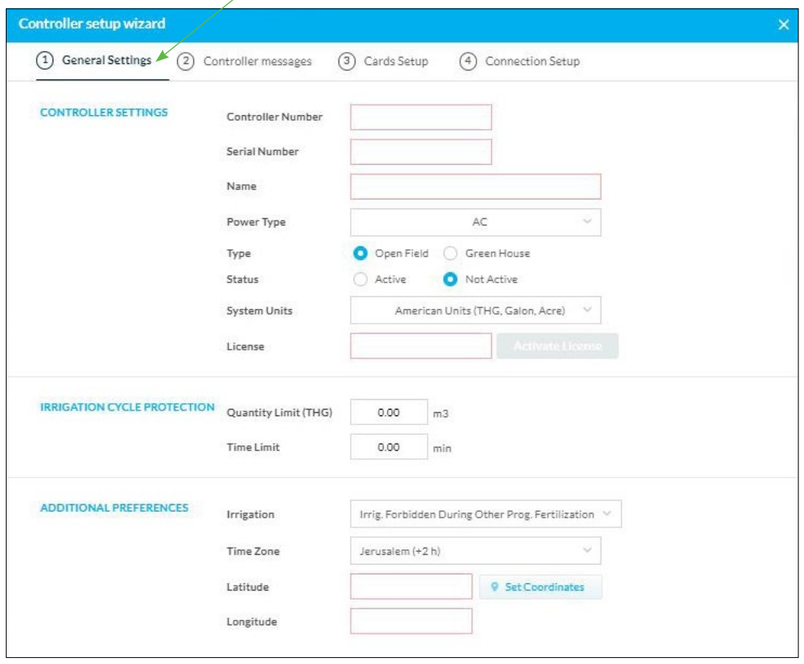


2. The Payment status screen is found in the Payment entry under the Account Settings tab of the Galileo main menu list.
3. Note for Connection to Power: at this stage (June 2021) the controller should be of an AC type.
4. The color of the communication icon below the logged-in user name should be blue, (see the picture of section 1 above).
5. Setting the controller to Not Active is done via the first screen of the Controller Setup Wizard. Once the configuration process is complete, do not forget to return the controller to Active mode.

K.1. The Controller setup wizard

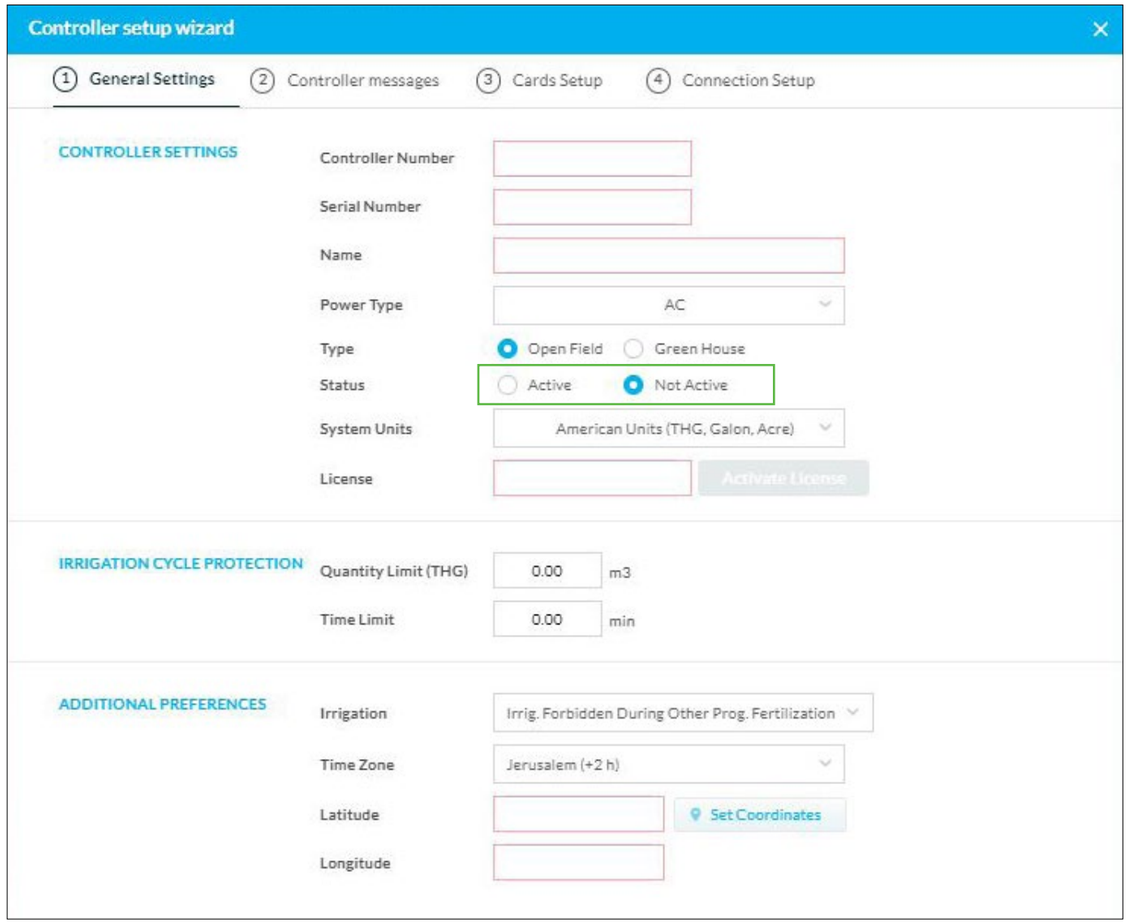
Activating the 4 stages setup wizard is done by clicking on the SETUP -> CONNECTIONS entry of the Galileo main menu, followed by clicking on the "+Add New Controller" button at the upper right side of the screen.





The first Wizard's Tab:

Important: The first action is setting the controller's Status to Not Active Mode



Controller Settings - fill the following details:

- Enter the controller number - the system prevents entering an already exist controller number.
- Verify that the controller's serial number, as appears on the controller's sticker, is identical to your purchase order and in this tab.
- Set a name for this controller.
- Set the controller's power type (currently March 2022 the controller should be of an AC type).
- Set the Controller Type - Open Field for the controller described on this IOM document.
- Set the Controller status - Active or Not Active.
- The user selects the units for the system volumes, and area. Important note: changing the systems' unit cannot be done "on the fly" only after a total reset of the controller! Make sure to check the system units before connecting the controller and starting its operation.
- License - the license ID of the controller.
- Select the applicable System Units - select from the dropdown list.

Irrigation Cycle Protection:

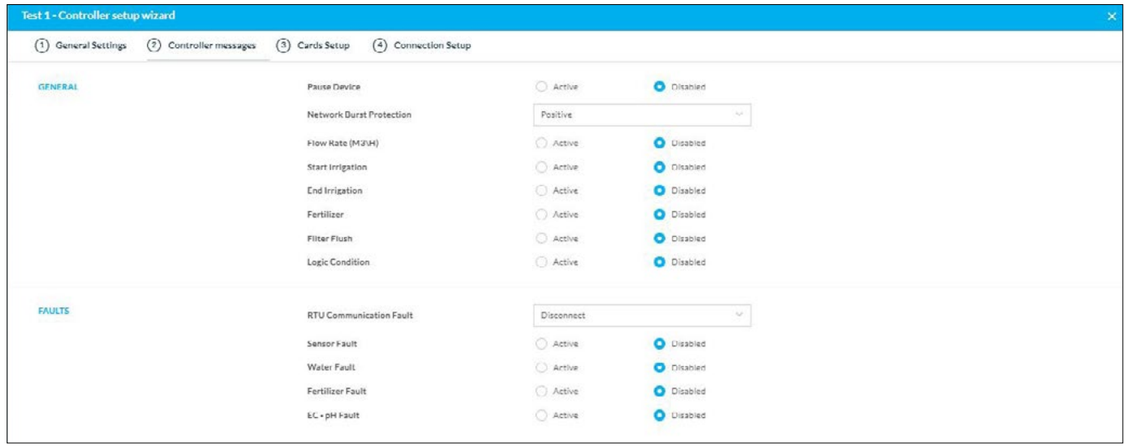
When needed, this section can be used to set a maximal irrigation amount (either in irrigation volume or in Irrigation time) for protecting the field from floods caused by a mistaken entry of water amount in the system's irrigation programs. The irrigation of a valve stopes when this parameter exceeds.

Additional Parameters:

- Irrigation - this parameter is used to protect against applying fertilizer to the wrong valve on the irrigation line when other valve on the same line is in fertigation mode. This parameter works only when all valves involved are set to proportional fertigation only. The options are:
  - Irrig. Forbidden During Other Prog. Fertilization - all other valves' irrigation will be paused while the irrigating valve is operational.
  - Enable Irrigation During Water Before Only - While the irrigating valve is still in "Water before" mode other valves on the line can be started.
  - Enable Irrigation During Water After Only - While the irrigating valve is in "Water after" mode other valves on the line can be started.
  - Enable Irrigation During Water Before or After - While the irrigating valve is in "Water before" or "Water after" modes other valves on the line can be started.
- Time Zone - Select the required time zone - this may affect irrigation programs who are set with geographical parameters.
- Latitude / Longitude parameters - set the geographical location of the controller. You may use the "Set Coordinates" button for opening a map and pointing to the controller's location.

Important - once the parameters of this screen are set, press the "Save & Continue to next step" button to save the parameters and to move to the next wizard's screen.

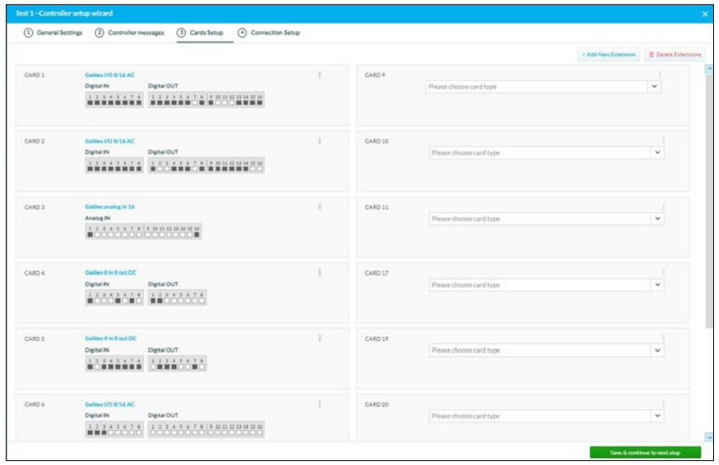
The second Wizard's Tab:



This tab enables the user to set the activation status of the controller's messages. This screen is divided into two sections, General messages and Fault messages. Each such message can be set to Active or Disabled mode (The default status of all the messages is Active). Once an Active message appears on the controller it will be also sent to the e-mail of the user who set this screen's parameters (each user has his own controller's messages screen).

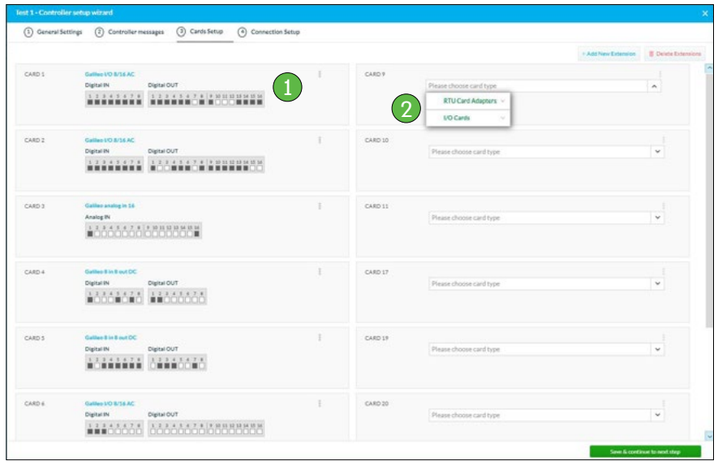
Important - once the parameters of this screen are set, press the "Save & Continue to next step" button to save the parameters and to move to the next wizard's screen.

The third Wizard's Tab:

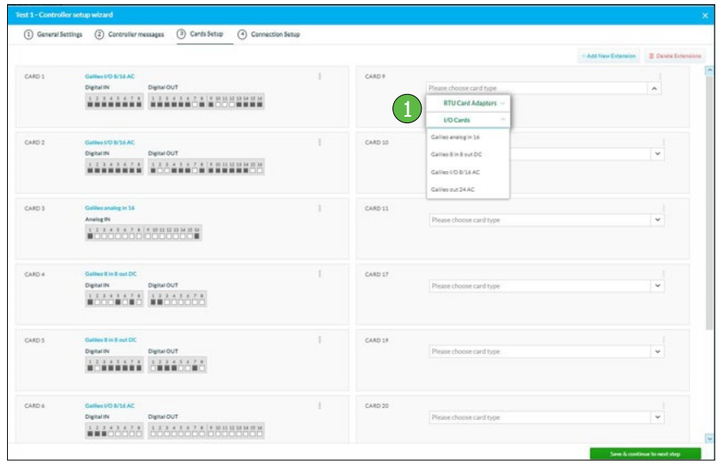


This tab is used for setting the controller's I/O and RTU Adapters cards.

- Set the required card slot to active, then press the "Please choose card type" list and select one of the options: "RTU Card Adapters" or "I/O card".



- For setting specific I/O card, open the dropdown list under the "I/O Cards" entry and select the required I/O card for this Controller's slot.

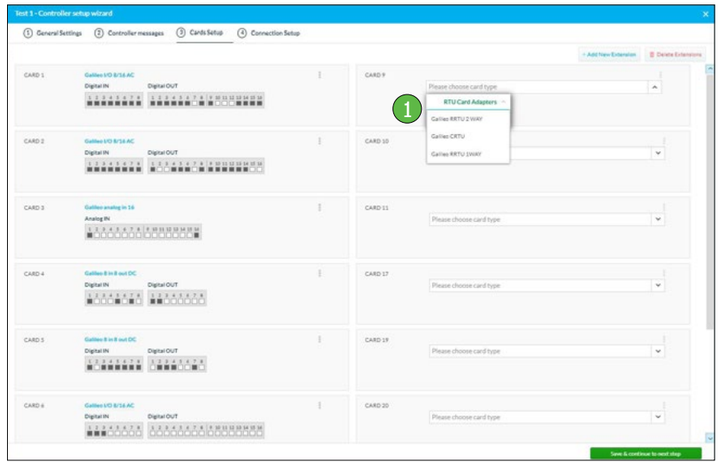


The optional I/O cards for the Open Field Galileo controller are:

1. Galileo analog in 16 - 16 analog inputs card
2. Galileo 8 in 8 out DC - 8 Inputs and 8 Outputs DC card
3. Galileo I/O 8/16 AC - 8 Inputs and 16 Outputs AC card
4. Galileo out 24 AC - 24 Outputs AC card

Important: Press the "Save and continue to next step" button if only I/O cards are selected. However, if RTU Adapter is selected (up to 2 per controller), it is necessary to add RTU's to this adapter.

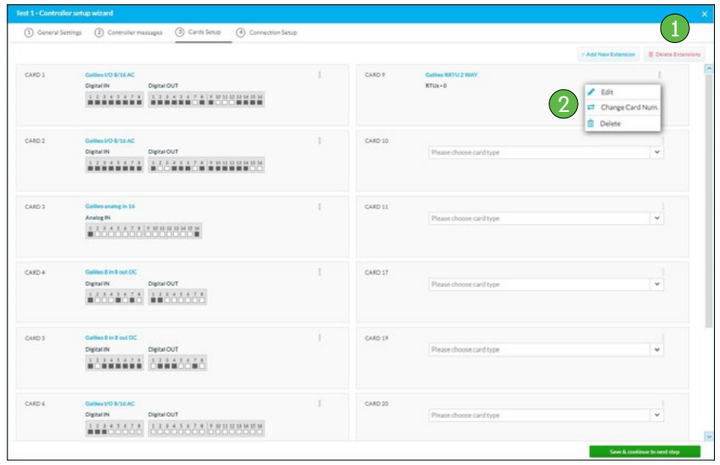
- For setting a RTU adapters, open the dropdown list under the "RTU Card Adapters" and select the required RTU card for this controller's slot.



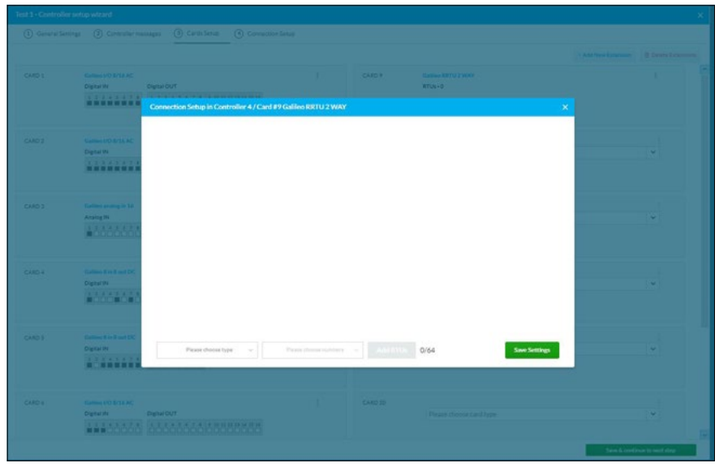
The optional RTU Adapter cards for the Open Field Galileo controller are:

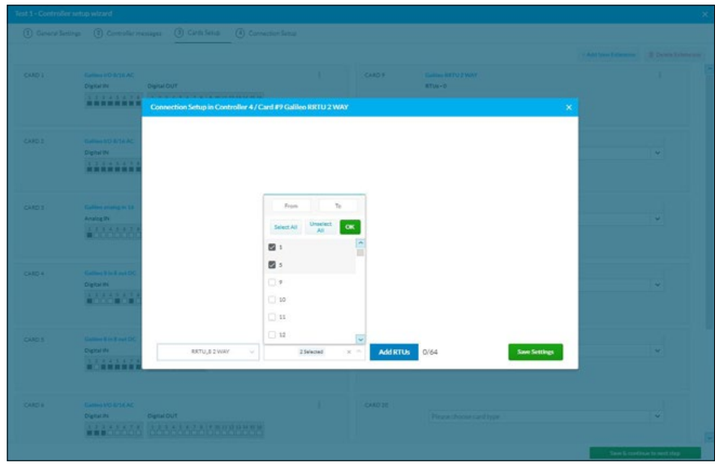
1. Galileo RRTU 2 Way - 2 Way Radio RTU that can control CRTU_2 DC or CRTU_4 DC cards.
2. Galileo RRTU 1 Way - 1 Way Radio RTU that can control RRTU_8 2 Way or RRTU_4 2 Way cards.
3. Galileo CRTU - Cable RTU that can control RRTU_2 1 Way or RRTU_4 1 Way cards.

- Adding RTUs to the selected adapter - Press the 3 vertical dotes at the right side of the RTU adapter name and select the Edit entry.

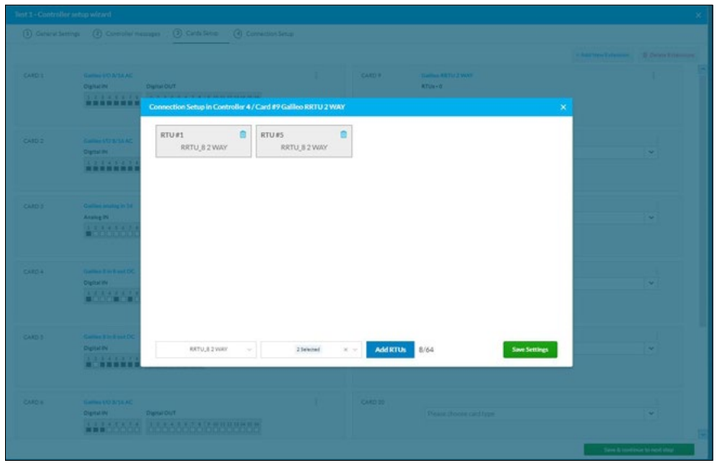


An adding RTUs window is opened for the selected adapter; select the required RTU type, set its communication ID (Galileo Number- up to 64) and press the "Add RTUs" button.





The system displays a window with the defined RTU adapters; this enables the user to select an RTU adapter and set its RTU cards and communication ID numbers (Galileo Number).

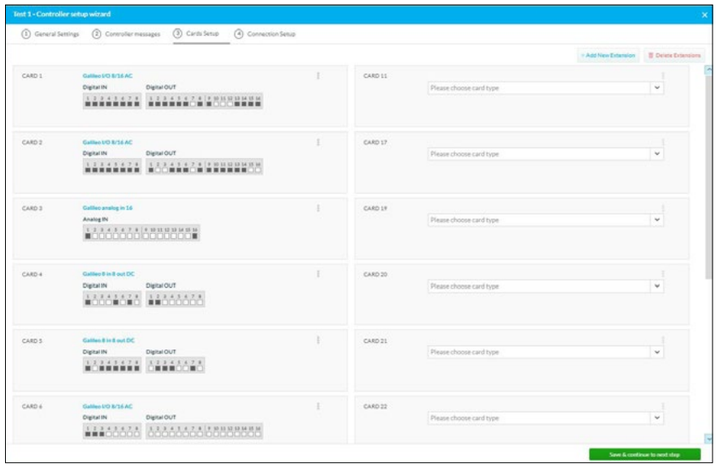


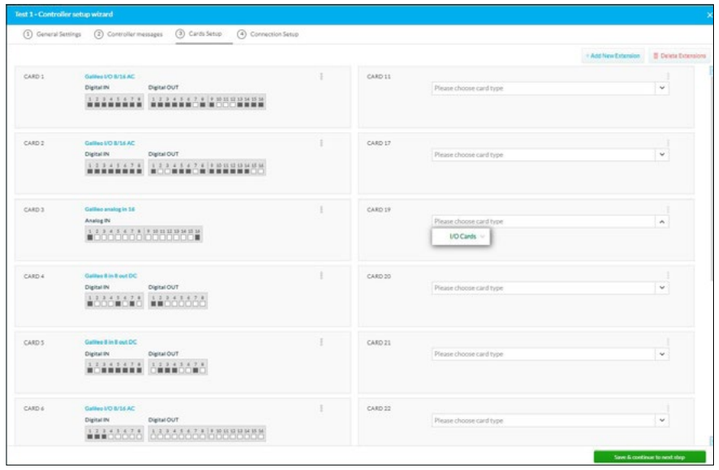
Important: Press the "Save settings" button to save the settings and then press the "Save and Continue to next step" button to save the cards settings and move to the next wizard's tab.

Adding and deleting Extensions:

The third wizard's tab enables the user to add extensions to the Galileo controller.

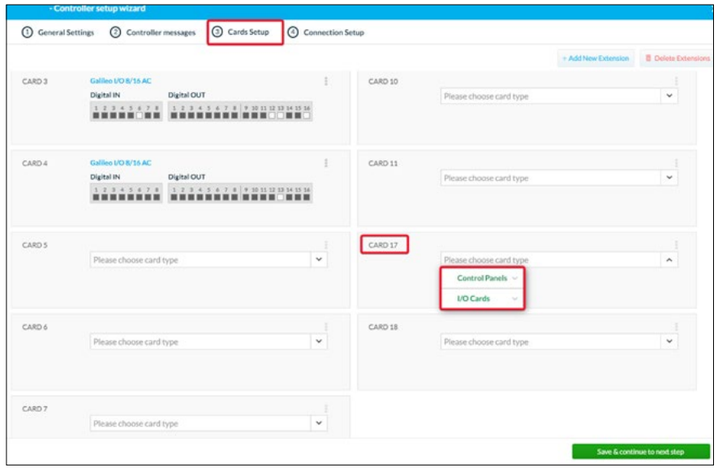
Press on the "+Add New Extension" button and the number of available cards will be increased accordingly.

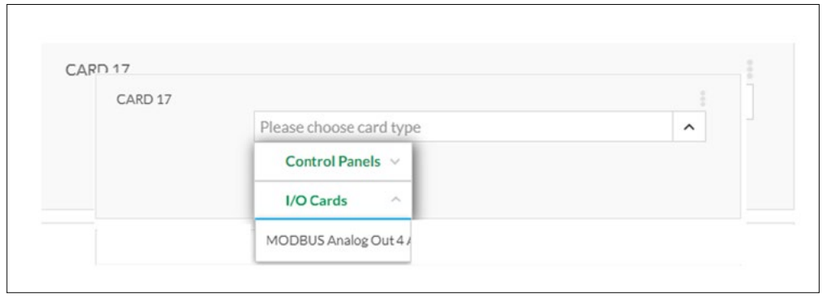




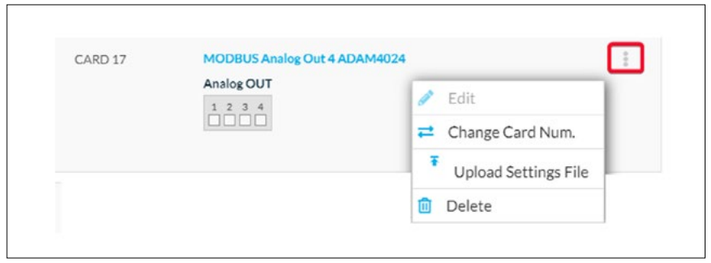
Adding a Control Panel:

A special type of extension is a control panel, it appears in the extensions list as card number 17. This card is a MODBUS remote hub, that can communicate with the server and the RTUs that are controlled by it. Therefore, it has to be added first before adding its RTUs.





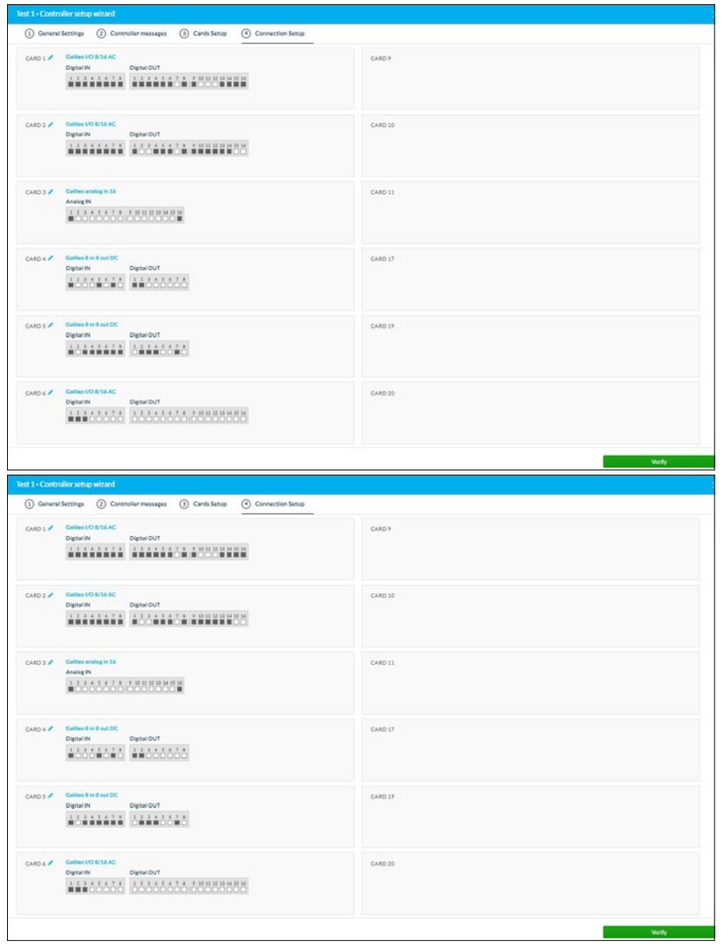
Once the new Control Panel is added and saved, click on the 3 dots at the right side of the control panel name, select Edit and add RTUs in the regular manner as described in the previous pages.



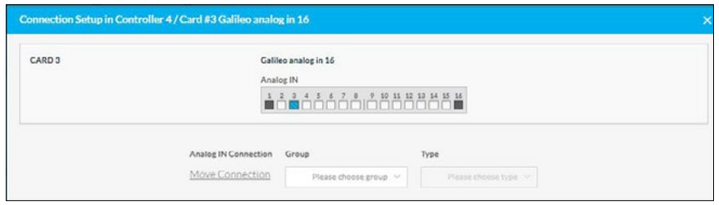
The fourth Wizard's Tab

This tab enables the user to select and set the inputs and outputs connected to each I/O card.

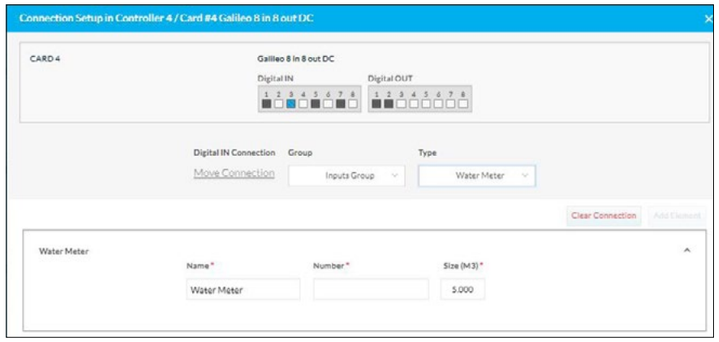
- For setting I/Os to a card, select the card on the fourth wizard's tab and click on the Pencil (edit) Icon.

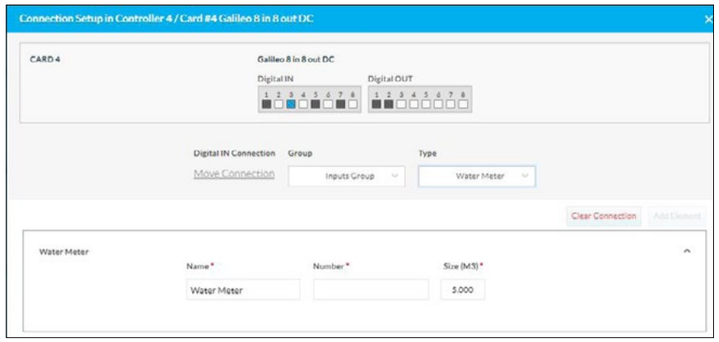


- The system opens the I/O connections window for the selected I/O card.

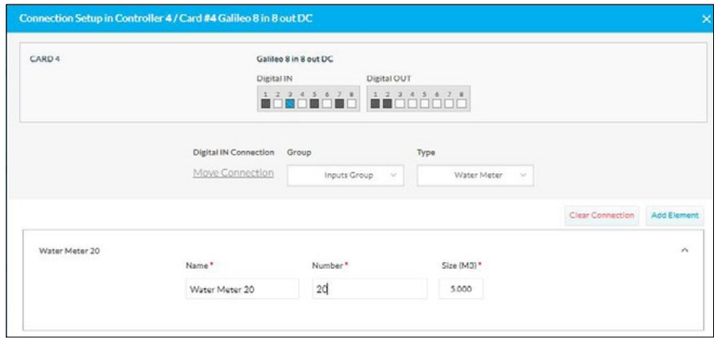


- Select the required I/O from the card I/O list, select a Group and Element type for this I/O (see table below)





- You may change the default name of the element to a meaningful name, select an available number for the element, complete the other parameters (if applicable) and press the "Save Settings" button.



Available Groups table:

Inputs:

Group	Element Name	Element Type	Counter	Maximal Quantity
Meteorology	Rain Meter	Digital Input	TRUE	1
Inputs Group	Sensor	Analog Input	FALSE	100
	Water Meter	Digital Input	TRUE	100
	General Counter	Digital Input	FALSE	10
	Condition Input	Digital Input	FALSE	50
	Fert. Pump Meter	Digital Input	TRUE	40
	Private Water Meter	Digital Input	TRUE	200
Water Mixing Junction	Fresh Water Fail Input	Digital Input	FALSE	4
	Saline Water Fail Input	Digital Input	FALSE	4
	Fresh Water Counter	Digital Input	TRUE	4
	Saline Water Count	Digital Input	TRUE	4

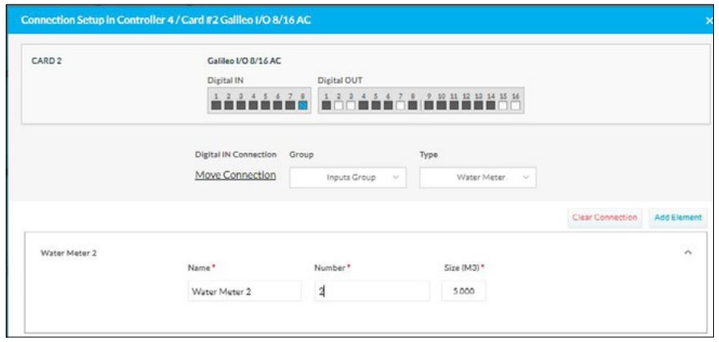
Outputs:

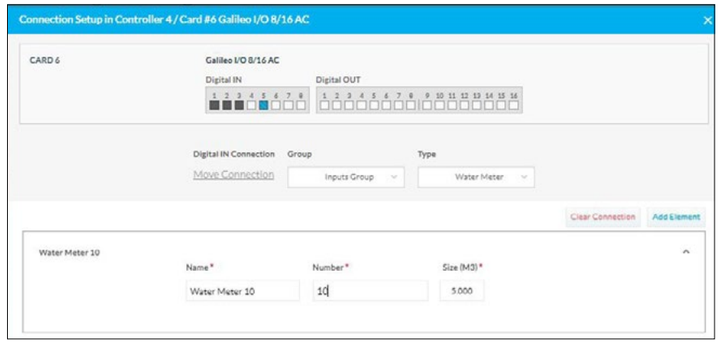
Group	Element Name	Element Type	Counter	Maximal Quantity
Water Mixing Junction	Open Fresh Water	Digital Output	FALSE	4
	Close Fresh Water	Digital Output	FALSE	4
	Main Fresh Water	Digital Output	FALSE	4
	Open Saline Water	Digital Output	FALSE	4
	Close Saline Water	Digital Output	FALSE	4
	Main Saline Water	Digital Output	FALSE	4
	Mixing Bypass	Digital Output	FALSE	4

Outputs Group	Master Valve	Digital Output	FALSE	50
	Pipe Local Filter Flush	Digital Output	FALSE	50
	Sustaining Valve	Digital Output	FALSE	10
	Filter Flush Unit	Digital Output	FALSE	40
	Alarm	Digital Output	FALSE	8
	Fertilizer Selector	Digital Output	FALSE	20
	Water Pump	Digital Output	FALSE	20
	Valve	Digital Output	FALSE	200
Auxiliary Output	Auxiliary Output	Digital Output	FALSE	20
Fertilizer Centre	Main Fertilizer Centre	Digital Output	FALSE	8
Fertilizer Pump	Open Fertilizer Pump	Digital Output	FALSE	40
	Close Fertilizer Pump	Digital Output	FALSE	40
	Main Fertilizer Pump	Digital Output	FALSE	40

Important points:

- It is possible to assign more than a single element to a digital Input connection.
- Only a single element of the type "Counter type" can be assigned to an Input connection.
- Deleting Elements is done by clicking on the "Clear Connection" button.



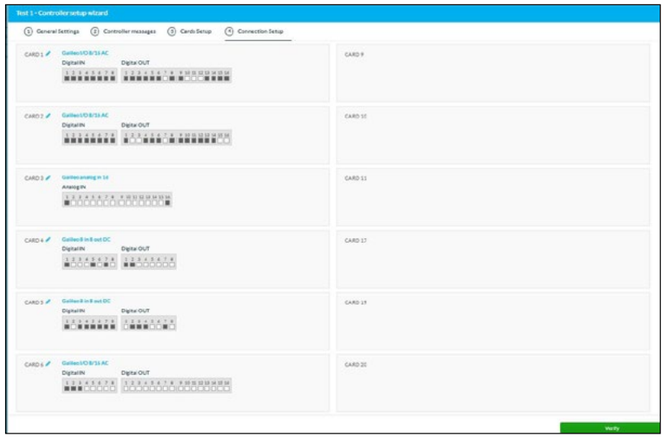


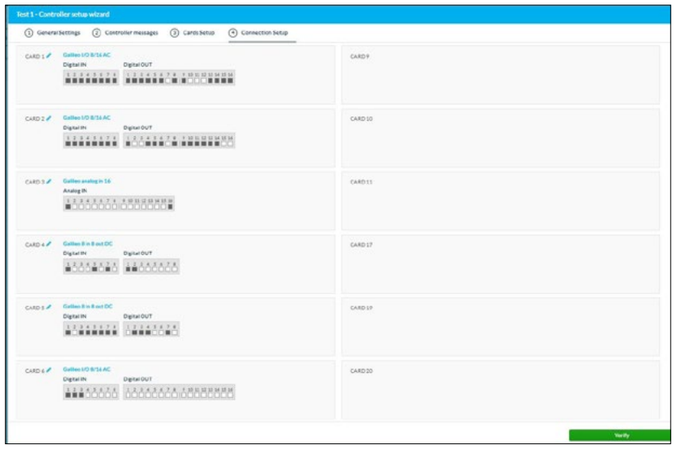
- In case of more than one element at a single connection it is possible to delete such element by clicking the "Delete Element" button.

Important: Press the "Save settings" button to save the settings and then return to the fourth wizard's screen.

A "Verify" button appears on the lower right corner of the screen; press this button to run a verification process on the defined elements.

Note: the verification process is for information only.





An error message will appear for elements with incomplete setup such as missing Open setup parameter for elements with Close parameter.

Save your settings and press the X on the wizard's screen upper right corner to exit.

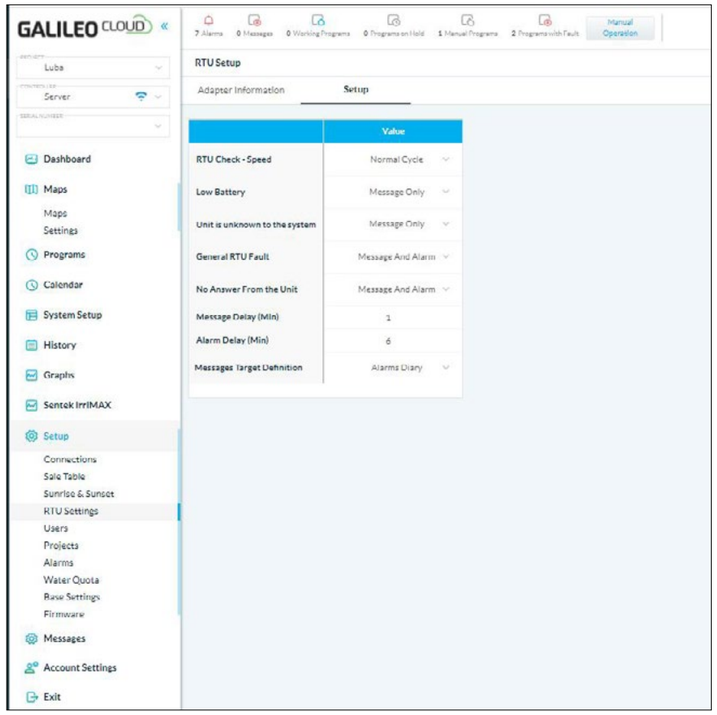
The following table displays the controller's elements to be checked by the "Verify" process.

Group	Element Name	Element Type	Counter	Maximal Quantity	Main Group
Water Mixing Junction	Open Fresh Water	Digital Output	FALSE	4	FALSE
	Close Fresh Water	Digital Output	FALSE	4	FALSE
	Main Fresh Water	Digital Output	FALSE	4	FALSE
	Open Saline Water	Digital Output	FALSE	4	FALSE
	Close Saline Water	Digital Output	FALSE	4	FALSE
	Main Saline Water	Digital Output	FALSE	4	FALSE
	Mixing Bypass	Digital Output	FALSE	4	FALSE
Fertilizer Pump	Open Fertilizer Pump	Digital Output	FALSE	40	FALSE
	Close Fertilizer Pump	Digital Output	FALSE	40	FALSE
	Main Fertilizer Pump	Digital Output	FALSE	40	FALSE

K.2. Defining RTUs

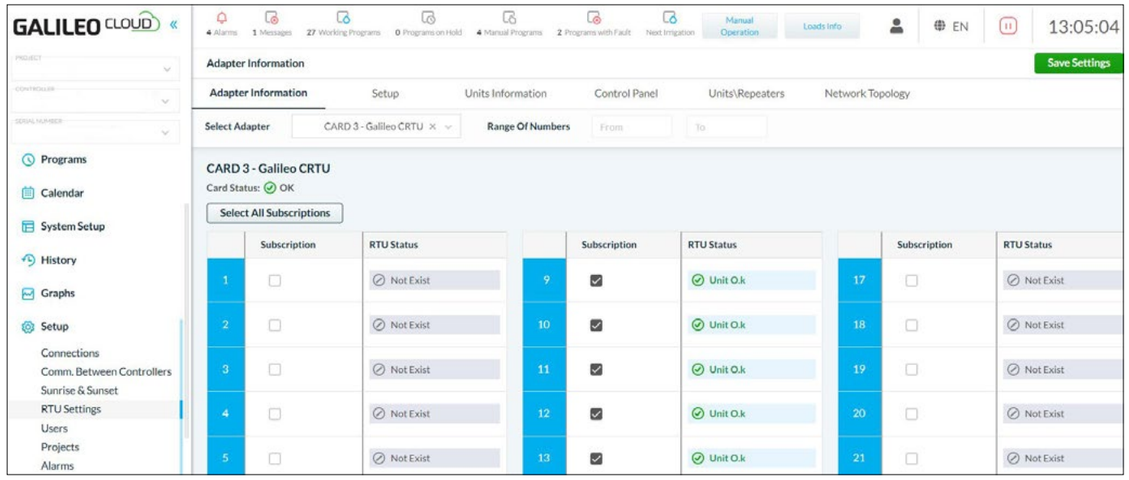
Entering the RTUs setup screen is done by clicking on the SETUPINSTALLATION -> RTU SETTINGS entry of the Galileo main menu; this screen has two tabs, Setup and Information.

The Setup Tab allows the user to set the following parameters:



- RTU Check -Speed - Set the communication polling of the RTU; Normal cycle or Fast Cycle. The default is Fast Cycle.
- Low Battery - Set the system's reaction to low battery indication; Ignore, Message only (send message to the Events log), Alarm Only (set a system alarm), Message and Alarm (set an alarm and log the event in the events and the alarms logs).
- Unit is unknown to the system - Set the system's reaction to a situation when an unknown RTU unit starts to communicate with the system; Ignore, Message only (send message to the Events log), Alarm Only (set a system alarm), Message and Alarm (set an alarm and log the event in the events and the alarms logs).
- No Answer from the unit - Set the system's reaction to a situation where a restarted RTU unit does not reply to a communication request; Ignore, Message only (send message to the Events log), Alarm Only (set a system alarm), Message and Alarm (set an alarm and log the event in the events and the alarms logs).
- Message Delay - Set the delay time between the fault appearance on the controller, and the system reaction. This parameter eliminates unnecessary reaction in case of a short and momentarily RTU fault.
- Alarm Delay - Set the delay time between the fault appearance on the controller, and the system reaction. This parameter prevents unnecessary reaction to and momentary RTU fault.
- Message Target Definition - Set the type of log for recording the message; Alarms Log or Events Log.

The Adapter Information displays the status of the RTUs:



- The user can select the required Adapter card whose RTUs appear on this screen by selecting the adapter from the list on the left side of the row above the table.
- The user can select the RTUs to be displayed by selecting them in the Subscription column.
- Another option for selecting the RYUs to be displayed is by the "Range Of Numbers" selection option on the upper line of the table.
- The optional statuses are: Not Exist, Main Comm. Error (communication failure), OK.

This screen is used to monitor the communication of the system to its RTU units.

- The upper line of this screen allows the user to filter the displayed RTUs according to their Control Panel.
- S/R –
- Gal No. – The Galileo Number of the unit.
- Name – The name assigned to the RTU unit/
- Average RSSI (dBm) – the average quality of the communication to the RTU.
- RSSI threshold –
- Last Update – The time of the last successful communication with the RTU.
- Battery [V] – The status of the RTU battery, the options are: OK,
- Parent Node – The name of this RTU parent node.
- Location – The geographical location of the RTU.
- Status – The current status of the RTU, the options are: OK, Warning

K.3. Condition Tab - Condition Inputs

Entering the Condition Inputs screen is done by clicking on the CONDITIONS -> CONDITION entry of the Galileo main menu. Please refer to the Control Philosophy chapter of this document for details on the usage of condition inputs.

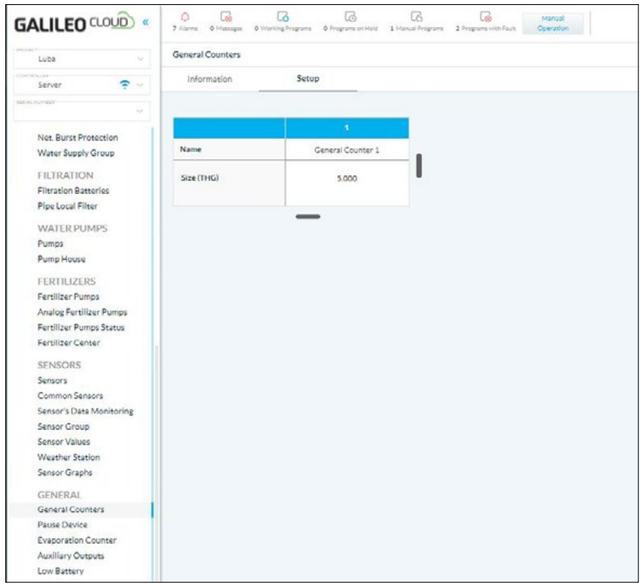
The Condition Inputs screen allows the user to set the following parameters:

- Name - Set a name for the selected condition input.
- Delay (Sec) - Set the delay (in seconds) between the appearance of the input's signal and the system reaction to it. This parameter prevents unnecessary system reaction to a short and momentary input signal.
- Status - This parameter displays the current status of the Condition Input, The options are: On or Off.

K.4. General Tab - General Counter

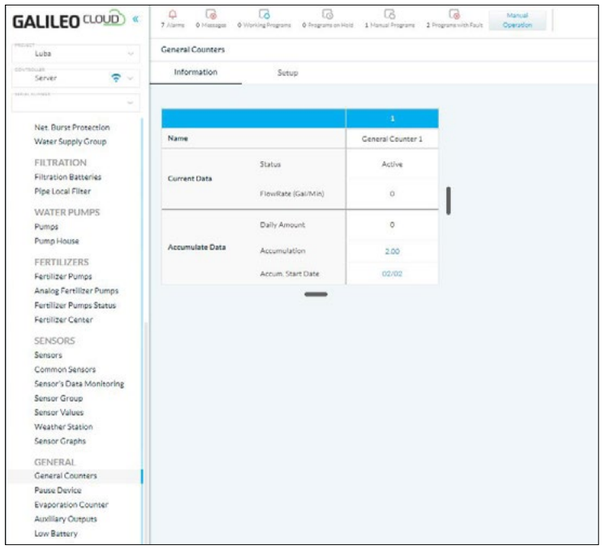
Entering the General Counter screen is done by clicking on the GENERAL -> GENERAL COUNTER entry of the Galileo main menu. Please refer to the Control Philosophy chapter of this document for details on the usage of general counters.

The General Counter Condition screen has two tabs; Setup and Information. The setup tab allows the user to set the following parameters:



- Name - Set a name for the selected General Counter.
- Size - Set a unit size for a single pulse of the general counter, e.g., in case of a counter such as water meter, the size may be something like 10 for meter with a volume of 10m³ per pulse.

The Information tab displays the following data:

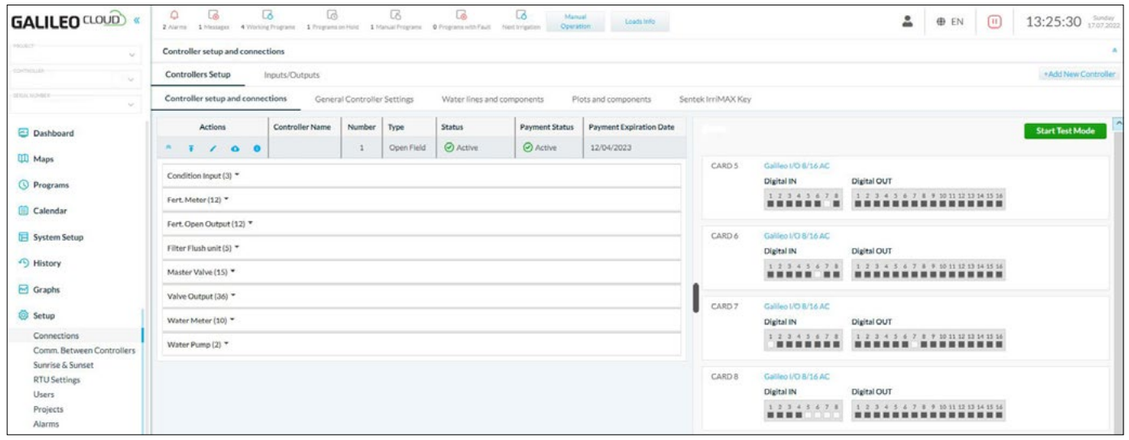


- Name - The name of the General Counter.
- Current Data - Status - Displays the current status of the general counter. The options are: N.Active. (not active), Active, Input Deff (error in the input definition), Pulse (error in the pulse volume definition), Running, Double (installation error, another input is already connected to this counter).
- Current Date - Flow Rate - Displays the number of units per hour registered by the general counter, e.g., for a meter with unit size of 10 that registered 3 pulses per hour this parameter shows the number 30.
- Accumulated Data - Daily Amount - Displays the number of units registered by the meter since the beginning of the current day.
- Accumulated Data - Accumulation - Displays the total number of units registered since the last start date parameter.
- Accumulated Data - Accum. Start Date - Displays the beginning date of the information registered in the Accumulation parameter.

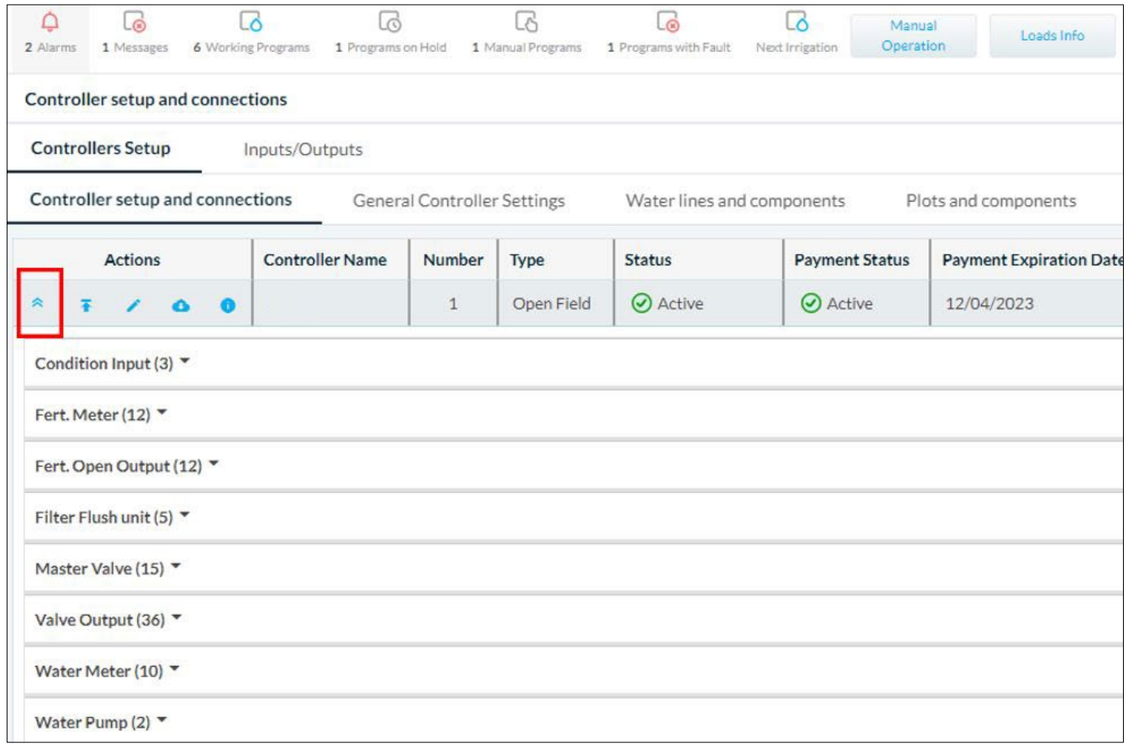
K.5. Connections Tab - Controllers Setup - Controller Setup and Connections

Entering the Controller Setup and Connections tab of the Setup entry of the Galileo system, is done by clicking on the SETUP -> CONNECTIONS -> CONTROLLER SETUP AND CONNECTIONS entry of the Galileo main menu.

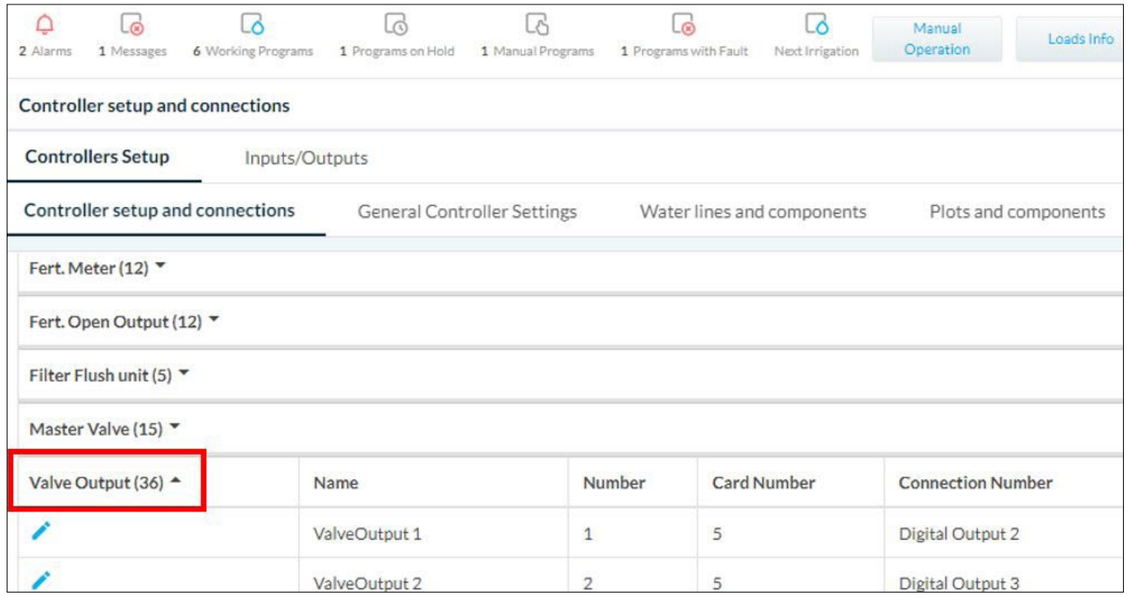
This screen displays a summary of the controllers' connections, and enables the user to see, install, define, check, and test the operation of the connections of the controllers installed at the project.



- Each line in this table contains information on a specific controller. Select the line of the required controller.
- Actions - Use the Down Arrow Icon of the Actions Column to open a summary list of the elements' types, that are configured for the selected controller. In the following picture the groups are: General Counter, Rain Meter, Sensors, Valve outputs, and Water Meter. Note that next to each such group appears the number of the configures elements in the group.



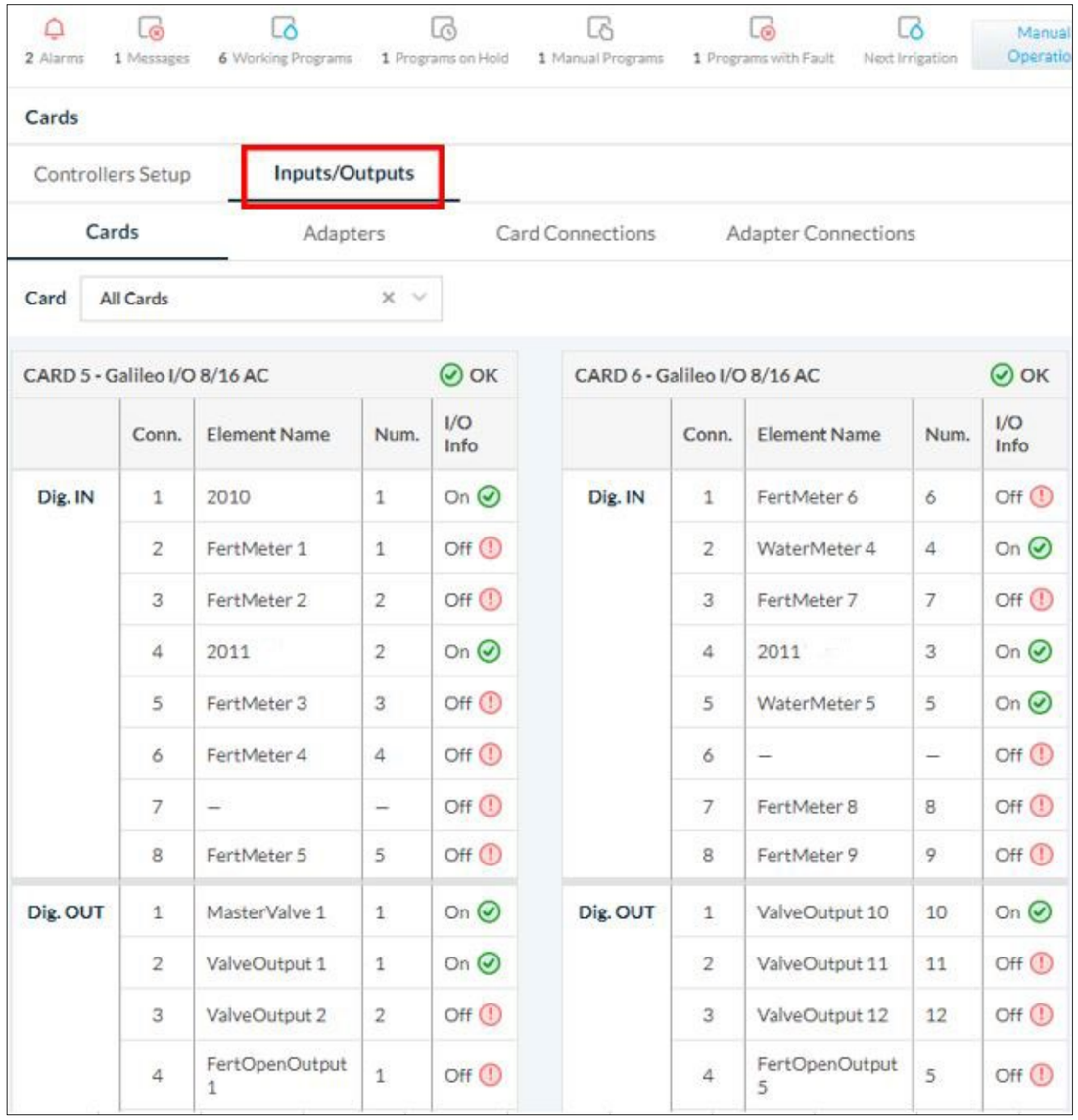
- Click on a group to display its configured elements; in the following picture the Valve Output is opened.



- To the right of the table the Status Section displays the controller's name, its connected cards together with their assigned I/Os, the card current status, and the status of each I/O. The options of the I/Os are: White - the I/O is not connected and it is closed, Dark Gray - the I/O is connected and it is closed, Green - the I/O is connected and it is opened. Note that for connected analog I/Os, this section displays also the current reading of the sensor

connected to the I/O.

- Once an element line on the left side table is selected, its designated I/O appears in the right section, with strips on its rectangle icon.
- The same information displaying method (color coded) is used at the Inputs/Outputs, Cards Screen, and the Adapters Screen.



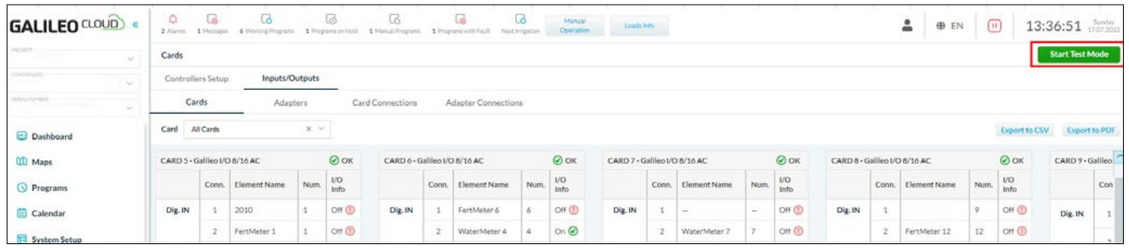
	Conn.	Element Name	Num.	I/O Info
Dig. IN	1	2010	1	On
	2	FertMeter 1	1	Off
	3	FertMeter 2	2	Off
	4	2011	2	On
	5	FertMeter 3	3	Off
	6	FertMeter 4	4	Off
	7	–	–	Off
	8	FertMeter 5	5	Off
Dig. OUT	1	MasterValve 1	1	On
	2	ValveOutput 1	1	On
	3	ValveOutput 2	2	Off
	4	FertOpenOutput 1	1	Off

	Conn.	Element Name	Num.	I/O Info
Dig. IN	1	FertMeter 6	6	Off
	2	WaterMeter 4	4	On
	3	FertMeter 7	7	Off
	4	2011	3	On
	5	WaterMeter 5	5	On
	6	–	–	Off
	7	FertMeter 8	8	Off
	8	FertMeter 9	9	Off
Dig. OUT	1	ValveOutput 10	10	On
	2	ValveOutput 11	11	Off
	3	ValveOutput 12	12	Off
	4	FertOpenOutput 5	5	Off

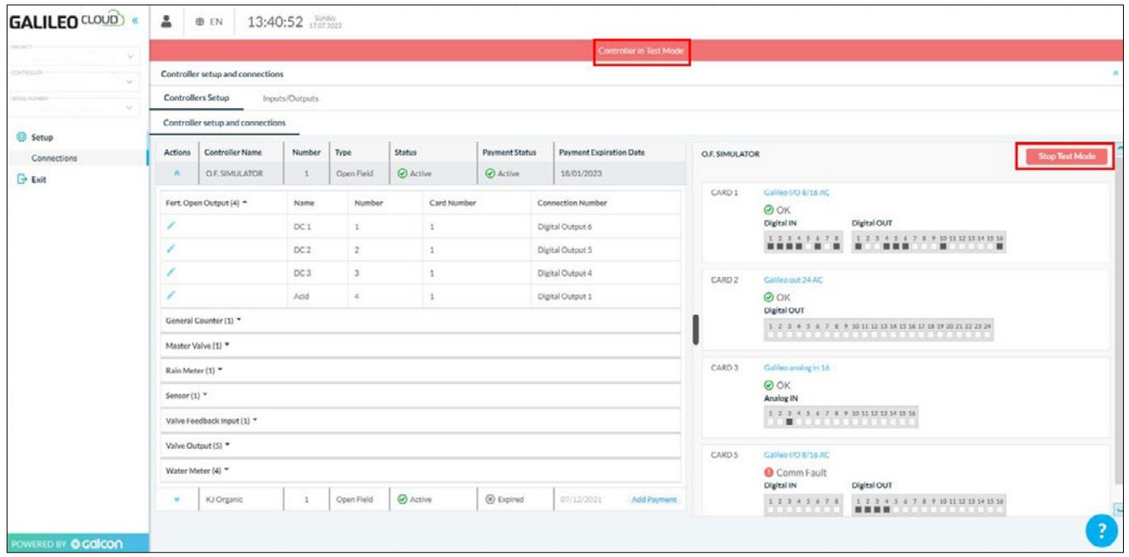
Connections Test Mode:

The Connections screen of the Galileo system enables the user to enter a special Test Mode for checking the operation of the system I/Os.

Entering the Test Mode is done by clicking on the green Start Test Mode Button on the upper right side of the following screen:



- Once the button is pressed and after the user acknowledges the operation in the popup window, the controller stopes its operation and all its elements close. Note that the closure process takes some time, wait until the following screen appears:



- The controller is in test mode and the Start Test Mode button changes to Stop Test Mode.
- During test mode the user can point on an I/O at the right side of the screen and click on the Open button - the output opens even if no element is configured to it. Click again to close the I/O. Note that if the user keeps the I/O opened it is automatically closing after 60 seconds.
- If the user keeps the controller in Test Mode without performing any test, the system returns to regular operation mode after 10 minutes.
- The same testing method is also used at the Cards, and the Adapters Screens.
- Note that while in Test Mode, the entries of the Galileo main menu are disabled:
- Other users who may enter to this controller while it is in Test Mode will not be able to perform any task on this controller.

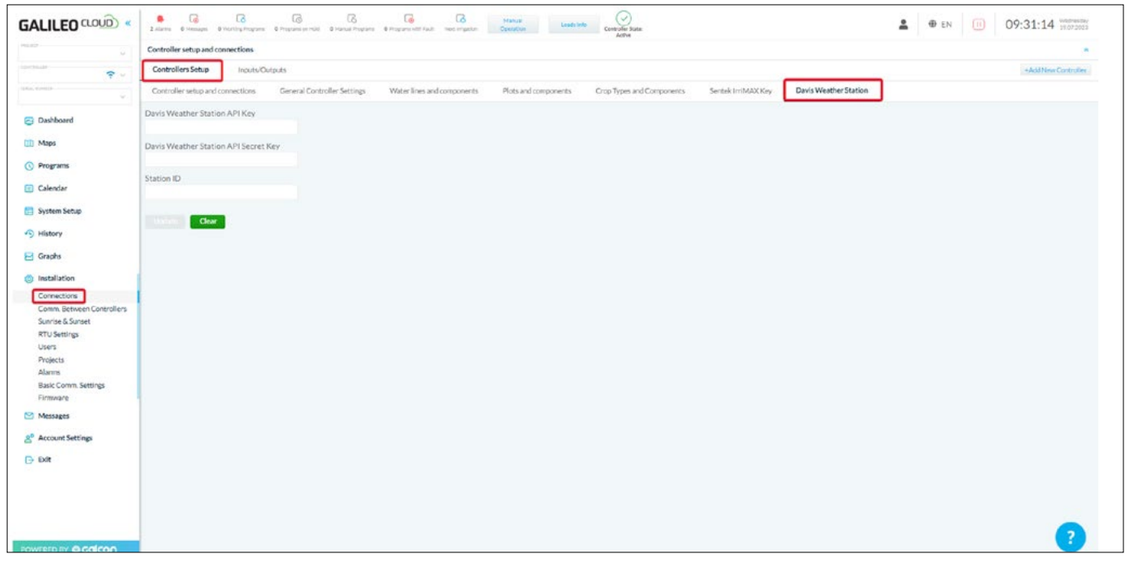
Connecting Davis weather station to Galileo system:

Working with Davis weather stations through API require a valid license from Davis and the following configuration at the Galileo system.

Very important notes:

- The Davis API can be obtained from the Davis web site.
- The operation instructions of the Davis weather station are found in the Davis IOM document, received from Davis upon purchasing their weather station.

Enter to the Installation --> Connections menu and select the Davis Weather Station tab:



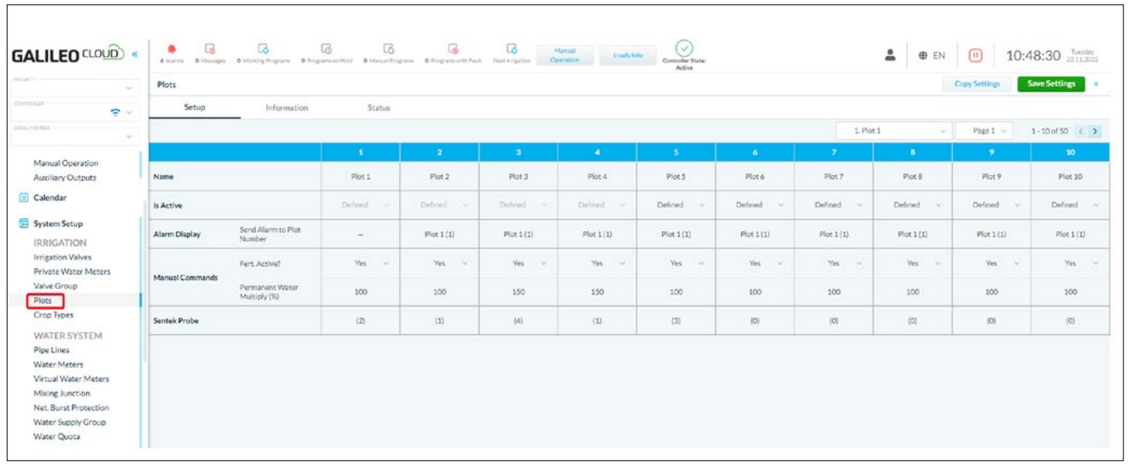
The data for the three parameters of this screen are obtained from the Davis web site after purchasing the station and completing the registration process with Davis at https://www.weatherlink.com/account

Click the following link to access detailed instructions on connecting a Davis Weather station to Galileo Cloud.

K.6. Irrigation Tab - Define Plots

Entering Define Plots Tab of the Irrigation screen is done by clicking on the SYSTEM SET UP entry of the Galileo main menu. Please refer to the Control Philosophy chapter of this document for details on the role of plots in the Galileo system.

The Plot screen has three tabs; Setup, Information, and Status. The setup tab allows the user to set the following parameters:



- Name - Set a name for the Plot.
- Is Active - Set the status of the Plot: Defined or Not Defined.
- Alarm Display - Send Alarm to Plot Number - Set the number of the parent plot of the current plot. This parameter is used in cases where a Plot contains some other plots in it. In such case, for the user's convenient, all the alarm messages of the plots are sent also to the parent plot.
- Manual Commands - Permanent Canceled Fert. - This parameter, once set to Cancel, prevents any fertigation on this plot.
- Manual Commands - Permanent Water Multiply - set the percentage to multiply the water amount set to the valves in this plot. This parameter is used for changing the water amount that are set to the irrigation valves of this plot in case it is necessary due to agrotechnical or weather conditions.
- Sentek Probe – In Galileo systems that are connected to Sentek system the user can specify in this table the number of the Sentek Probe per each one of the plots. Clicking on the Sentek parameter of a plot, opens a selection window with all the available Sentek probes; the user should select the designated probes for the current plot. Once selected the parameter displays the number of probes assigned to the plot.

The Information Tab of the Plot screen allows the user to set the following parameters:

- Plot Status - The current status of the plot, the options are: N.Active (not active), No Prg (no program; the plot has valves but without irrigation programs), Active, Pause, Irrigate. (Currently irrigating), Fertilz. (Currently fertilizing), Alarm.
- Faults - Fault at Plot Number - In case of a fault in one of the plots that are located inside this plot, the number of the faulty plot is displayed in this parameter.
- Faults - Fault Valve Number - In case of a fault in one of the plot's valves, the number of the faulty valve is displayed in this parameter.
- Faults - Fault Program Number - In case of a fault in one of the programs irrigating this plot, the number of the faulty program is displayed in this parameter.
- Faults - Fault Pipe Number - In case of a fault in one of the pipelines irrigating this plot, the number of the faulty line is displayed in this parameter.
- Faults - Fault Tensiometer Number - In case of a fault in one of the tensiometers connected to this plot, the number of the faulty tensiometer is displayed in this parameter.
- Faults - Fertilizing Fault - In case of a fault in one of the fertilizing programs servicing this plot, this parameter displays Fault, otherwise it displays Fert.OK.
- Manual Info - Today Water Multiply - in this parameter the user can set a multiplying percentage to change accordingly the current day water amounts, to be irrigated by the valves of this plot.
- Manual Info - Today Canceled Fert. - today's fert. canceling status; N.Active (not active), or No.Prg (not programmed).
- Limited Pause - in case a temporary pausing this plot's irrigation is required due to maintenance of other agrotechnical reasons, the irrigation of this plot will be paused for the time duration set in this parameter.
- Click for Permanent Pause - click on this parameter's Icon to pause all the irrigation of this plot.

The Status Tab of the Plot screen displays the following parameters:

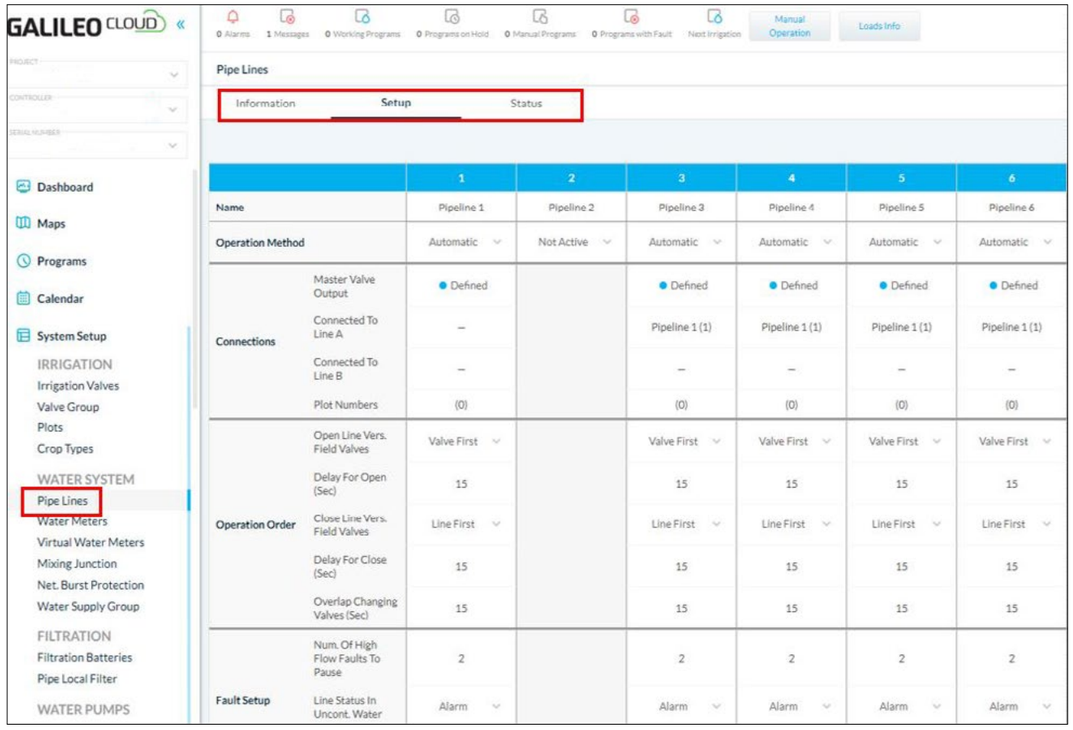
- The row above the table allows the user to select the range of plots to be displayed in the table.
- For each plot the table displays its status. Please refer to the list of possible statuses in the information tab description of this screen.

K.7. Water System Tab

Define Pipelines

Entering the Define pipelines tab of the Water System Tab screen is done by clicking on the WATER SYSTEM -> PIPELINE entry of the Galileo main menu. Please refer to the Control Philosophy chapter of this document for details on the role of Pipelines in the Galileo system.

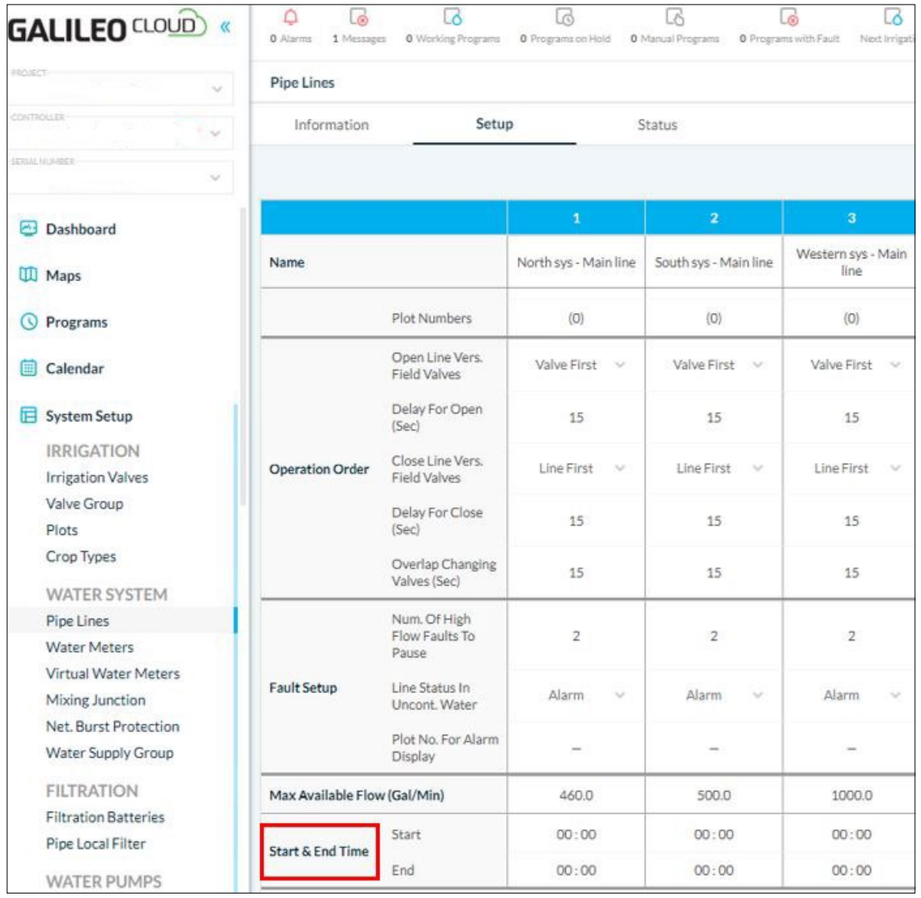
The Pipe Lines Constants screen has four tabs; Setup, Start by Time and Dated, Information, and Status. The setup tab allows the user to set the following parameters:



- Name - Set a name for the pipeline
- Operation Method - Set the required operation method of the pipeline, the options are: Not Active, Automatic (the system controls this pipeline automatically according to the irrigation programs), Close + Alarm (the pipeline is closed and an appropriate Alarm is displayed by the system), Open + Alarm (the pipeline is opened and an appropriate Alarm is displayed by the system), Pause, Open, and Open + Protect (the pipeline is opened but the system continues to protect it against too high flowrate and bursts).
- Master Valve Output - indicates whether a master valve is defined for this pipeline.
- Connected to line A - the pipeline can supply water to another pipeline. in such case, enter the number of the other pipeline here.
- Connected to line B - beside pipeline A, the pipeline can supply water to another pipeline. in such case, enter the number of the other pipeline here.
- Operation Order - Open Line Vers. Field Valves - This parameter defines the opening order of the master valve and the field valves, the options are: Parallel (the master valve opens together with the field valve), Line first (the master valve opens first and only then the field valve opens), Valve first (the field valve opens first and only then the master valve opens).
- Operation Order - Delay for open (Sec) - When the master valve and the field valve are not opening together, this parameter defines the delay between them.
- Operation Order - Close Line Vers. Field Valves - This parameter defines the closing order of the master valve and the field valves, the options are: Parallel (the master valve closes together with the field valve), Line first (the master valve closes first and only then the field valve closes), Valve first (the field valve closes first and only then the master valve closes).
- Operation Order - Delay for close (Sec) - When the master valve and the field valve are not closing together, this parameter defines the delay between them.
- Operation Order - Overlap Changing Valves (Sec) - When there is a hydraulic need to open the next irrigating valve while the finished irrigation valve is still opened, set the required overlap time in this parameter. once the irrigating valve finishes to irrigate its set water amount, it remains opened for the duration of the time set in this parameter.
- Fault Setup - High Flow Faults To Pause - This parameter set the allowed number of consecutive high flow faults in a pipeline, before the system enters the pipeline to pause mode.
- Fault Setup - Line Status In Uncont. Water - This parameter sets the system reaction to uncontrolled water fault. The options are: Idle (no response), Message (sent a message to the log), Alarm (set an alarm, and send messages to the events and alarm logs), Fault (enters the pipeline to fault, set an alarm, and send messages to the events and alarm logs).
- Fault Setup - Plot Numbers - Set the numbers of the plots served by this pipeline; mostly used for drawing the system's map correctly.
- Fault Setup - Plot No. For Alarm Display - Set the number of the plot in which a pipeline alarm will be displayed.
- Max Available Flow (M^3/H) - Set the maximal flow rate that this pipeline can supply, the system will not open additional irrigation program if its expected flowrate may exceed the pipeline maximal flow capacity.
- Start Time - When there is a need to open and close this pipe-line every day, in a manner that is not related to irrigation program, enter the required start time in this parameter.
- End Time - When there is a need to open and close this pipe-line every day, in a manner that is not related to irrigation program, enter the required end time in this parameter.

Start by Time

The Start by Time tab allows the user to set the following parameters:



This tab allows the user to set up to 10 programs for opening pipelines according to time and date parameters. It can be used for general purposes when a pipeline needs to be opened outside of an irrigation program.

- Status - the current status of the program: Off or On.
- Open Time - Start date - this parameter opens a calendar for selecting the required start date.
- Open Time - End date - this parameter opens a calendar for selecting the required end date.
- Open Time - Start Time - enter the required start time of the program.
- Open Time - End Time - enter the required end time of the program.
- Pipelines - Start Pipe Line Number - the user can set up to 3 different pipelines to controlled by this program. When this program starts, its pipelines are opened and controlled by the burst protection, when the program ends, its pipelines return to automatic operation mode.

Information

The Information tab allows the user to see the following parameters:

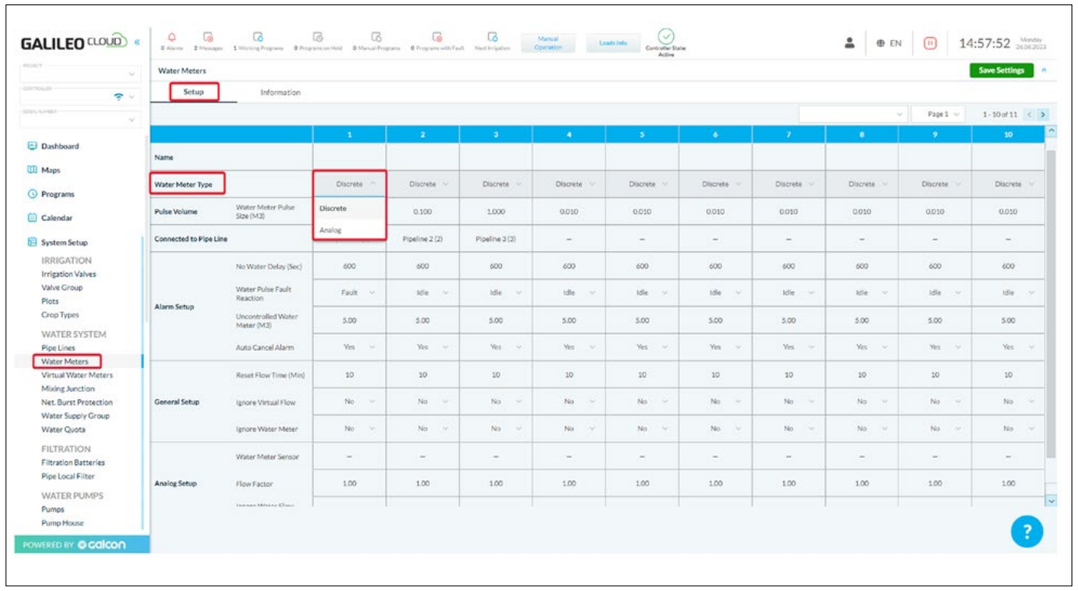
- Name - the name of the pipeline
- Status - the current status of the pipeline, the options are: N.Active (not active), Close, Fault, Paused, Paused + Alarm (the pipeline exceeded the number of consecutive faults and it is paused), Open, Irrig. + Alarm (irrigating + Alarm), Fertilizing, Fert. + Alarm (fertilizing + alarm).
- Required Flow Rate - the total of the nominal flow-rate of all the valves that are currently irrigating on this line.
- Operation Delay - Downstream Delay Sec - the delay between the master valve and the first irrigating valve fed by this pipeline.
- Operation Delay - Upstream Delay Sec - the delay between the master valve and other pipeline that is fed by this pipeline.
- Operation Delay - Parallel Open Time Sec - the overlapping opening delay for the valves on this pipeline. Once the irrigating valve finishes its water amount, it remains opened until this delay passes. This parameter is used when due to hydraulic requirements, the irrigating valve cannot be closed if the next valve is not opened yet.
- Pipe Conditions - Irrigation Request - the status of the irrigation request from this pipeline; On or Off.
- Pipe Conditions - Pause during Flush - the status of the pause the pipeline during flushing parameter; Off or Paused.
- Pipeline Conditions - Open request by a logic Condition - Off or Request
- Pipeline Conditions - Pause request by a logic Condition - Off or Request
- External Definitions - Manual Operation
- External Definitions - Manual Operation - The status of the pipeline as set at the Operation Method section of the Pipeline Setup Screen, the options are: Not Active, Automatic (the system controls this pipeline automatically according to the irrigation programs), Close + Alarm (the pipeline is closed and an appropriate Alarm is displayed by the system), Open + Alarm (the pipeline is opened and an appropriate Alarm is displayed by the system), Pause, Open, and Open + Protect (the pipeline is opened but the system continues to protect it against too high flowrate and bursts).
- External Definitions - Line Program
- External Definitions - Line Program - The status of the pipeline's Start by Time & Date program, the options are: Off or On.
- External Definitions - Permanent Open -
- Faults - High Flow Fault - The status of the High Flow Fault, the options are: OK (no fault), Alarm (the pipeline is in Alarm mode but it is still operational), Fault (the pipeline is in Fault mode and it is closed).
- Faults - Pipe Setup - Wrong definition of the pipeline setup, the options are: OK (no fault), Up Connection (Upper pipe not active - the pipeline is fed by another pipeline that is in fault mode), Connection Out (the pipeline is connected to a not-legal pipeline number), Self-Connection (the pipeline is connected to itself), Main Out (wrong pipe-out number - the pipeline is connected to a not-legal output pipe number).
- Faults - No Water Pulse - The pipeline should be opened, but no pulses are received from its designated water meter, the options are OK or Fault.
- Faults - Uncontrolled Water - The pipeline should be closed, but pulses are received from its designated water meter, the options are OK or Fault.
- Faults - Uncontrolled Fert. - The pipeline is not in fertigation, but pulses are received from its designated fertilizer pump, or by the end of the fertigation program the fertilizer pump has not stopped, the options are: OK or Fault.
- Faults - leak Protection -
- Faults - leak Protection - The status of the pipeline's burst protection feature, the options are: OK (no fault), Alarm (the pipeline is in Alarm mode but it is still operational), Fault (the pipeline is in Fault mode and it is closed).
- General Info. - Pause Device - The status of this pipeline's Pause Devices (pause device is a sensor or a condition-input that under certain conditions can set the pipeline to Pause status), the options are: OK (no fault), Alarm (the pipeline is in Alarm mode but it is still operational), Pause (the pipeline is Paused), and Fault (the pipeline is in Fault mode and it is closed).
- General Info. - Pump House Status -
- General Info. - Water Pump Status - The reaction of the pump house, servicing this pipeline, to pump's fault, the options are: OK (no fault), Alarm (the pipeline is in Alarm mode but it is still operational), Pause (the pipeline is Paused), and Fault (the pipeline is in Fault mode and it is closed).
- General Info. - Filter Flushing Status - The status of the filters servicing this pipeline, to filter fault, the options are: OK (no fault), Alarm (the pipeline is in Alarm mode but it is still operational), Pause (the pipeline is Paused), and Fault (the pipeline is in Fault mode and it is closed).
- General Info. - Over Flow Limit - The status of the Flow Limit assigned to this pipeline, the options are: OK or Alarm.

- General Info. - Water Source Open - Request from Water Source
- General Info. - Water Source Open - The status of the water source request to open this line, the options are: Off or Open.
- Using Programs - Very important: This screen displays only the first 5 irrigation programs that are currently irrigating. If more than 5 programs are currently active, only the first 5 are displayed on this screen. Each line of this screen group displays the number of the currently irrigating program.
- Cancel Alarm - Press this button to cancel this pipeline's active alarm together with all the alarms that are affected by this alarm or caused the alarm of this pipeline.

Water Meter

Entering the Water Meter section of the Water System Tab screen, is done by clicking on the WATER SYSTEM -> WATER METER entry of the Galileo main menu. Please refer to the Control Philosophy chapter of this document for details on the water meters components of the Galileo system.
The Galileo system supports two types of water meters: discreet and analog.

The Setup Tab:



Important Note: in this screen the system displays only water meters that are already connected and defined in the Galileo Controller (The hardware). Each such water meter has its own column in this screen.

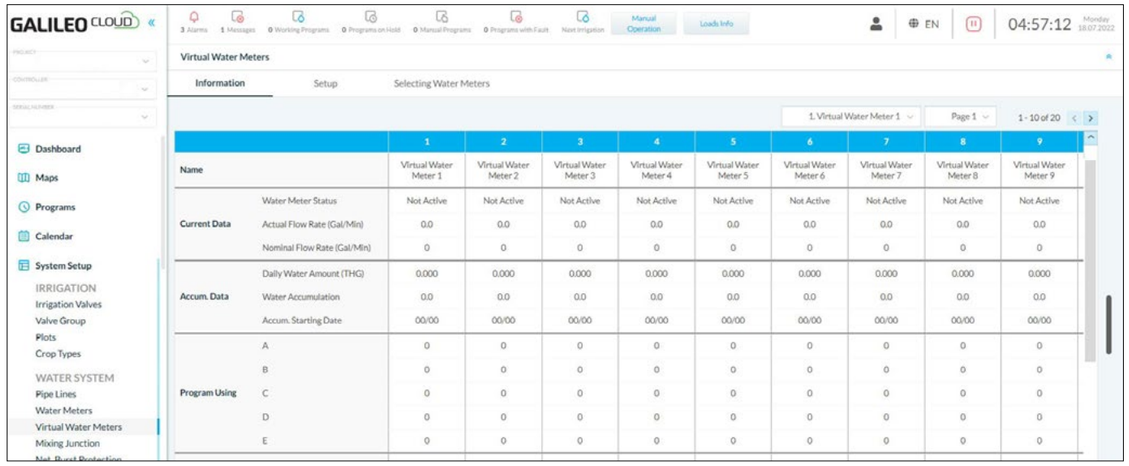
Discreet water meter

- Name - the name of the water meter; the user may enter a meaningful name for the water meter.
- Water Meter Type – the type of the water meter, for digital water meter please select Discreet.
- Pulse Volume - Size (M^3) - the volume of water that passes through the water meter per each electronic pulse sent from the meter to the Galileo Controller.
- Connection - Connect to Pipe Line - the pipe lines that are fed by this water meter. Clicking on this parameter opens a selection table with the names of all the already defined pipe-lines of the system, the user can select from the list the pipelines fed by this water meter.
- Alarm Setup - No Water Delay (Sec) - Set the delay time for the No Water alarm. When an active irrigation by volume program (that uses this water meter) is active, and no pulse is received from the water meter within the span of this parameter, the system enters to No Water fault.
- Alarm Setup - Uncontrolled Water (M^3) - Set the uncontrolled water volume that enters the system to Uncontrolled Water fault. When no irrigation program, that uses this water meter, is active, but water pulses are still received from the water meter, the system enters to Uncontrolled Water fault when the uncontrolled water volume exceeds this parameter.
- Alarm Setup - Auto Cancel Alarm - Set the Auto Cancel Alarm to Yes or No. The system's main alarms setup allows the user to set a time span for automatic alarms canceling. The Yes/No parameter set whether this water meter participates in the automatic alarm reset or not.
- Alarm Setup - Water pulse Fault Reaction - Set the reaction of the system when fault occurs in this water meter; the options are: Idle = do nothing, Alarm = issue an alarm message, Fault = issue an Alarm message and stop the operation.
- General Setup - Reset Flow Time (Min) - Set the maximal time between pulses that are still participate in the flow-rate calculation. If the time between two pulses exceeds this parameter the flow-rate is set to zero.
- General Setup - Ignore Virtual Flow - Set the virtual flow calculation to No (do not ignore) or Yes (ignore). When the flow rate of the water meter decreases, the time between every two pulses is getting longer and longer. The virtual flow-rate calculation displays the anticipated flow rate when the current time between two pulses is longer than the previous time between two pulses. Setting this parameter to "Ignore" stops the virtual flow-rate calculation and the system displays the last "real" flow-rate even though it is not valid anymore.
- General Setup - Ignore Water Counter - Set the No Water feature of this water meter to Yes or No. When set to No, the system continues to operate regularly even though no pulses are received from the water meter.

K.8. Irrigation Tab

Define Private Water Meter

Entering the Define Private Water Meter tab of the Irrigation Tab screen is done by clicking on the IRRIGATION -> PRIVATE WATER METER entry of the Galileo main menu. Please refer to the Control Philosophy chapter of this document for details on the role of private water meters in the Galileo system.



Important Notes: In this screen the system displays only water meters that are already connected, and defined as private water meters, in the Galileo Controller (The hardware) and are paired with an existing valve. Each such water meter has its own column in this screen.

The number of the private water meter is the same of the number of the valve it belongs to.

- Name - the name of the water meter; the user may enter a meaningful name for the water meter.
- Water Meter Pulse Size (M^3) - the volume of water that passes through the water meter per each electronic pulse sent from the meter to the Galileo Controller.
- No Water Delay (Sec) - Set the delay time for the No Water alarm. When an active irrigation by volume program (that uses this water meter) is active, and no pulse is received from the water meter within the span of this parameter, the system enters to No Water fault.

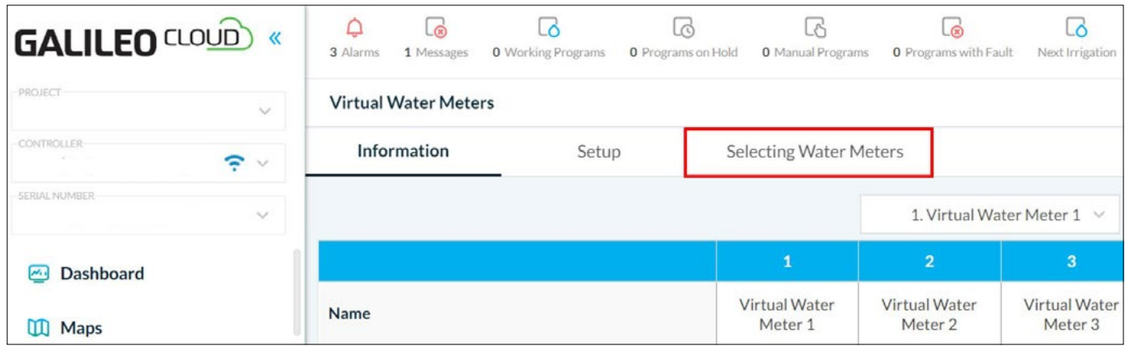
- Uncontrolled Water (M³) - Set the uncontrolled water volume that enters the system to Uncontrolled Water fault. When no irrigation program, that uses this water meter, is active, but water pulses are still received from the water meter, the system enters to Uncontrolled Water fault when the uncontrolled water volume exceeds this parameter.
- Reset Flow Time (Min) - Set the maximal time between pulses that are still participate in the flow-rate calculation. If the time between two pulses exceeds this parameter the flow-rate is set to zero.
- Water pulse Fault Reaction - Set the No Water feature of this water meter to Yes or No. When set to No, the system continues to operate regularly even though no pulses are received from the water meter.
- Ignore Virtual Flow - Set the virtual flow calculation to No (do not ignore) or Yes (ignore). When the flow rate of the water meter decreases, the time between every two pulses is getting longer and longer. The virtual flow-rate calculation displays the anticipated flow rate when the current time between two pulses is longer than the previous time between two pulses. Setting this parameter to "Ignore" stops the virtual flow-rate calculation and the system displays the last "real" flow-rate even though it is not valid anymore.

K.9. Water System Tab

Define Virtual Water Meter

Entering the Define Virtual Water Meter tab of the Water System Tab screen is done by clicking on the WATER SYSTEM -> VIRTUAL WATER METER entry of the Galileo main menu. Please refer to the Control Philosophy chapter of this document for details on the role of virtual water meters in the Galileo system.

The Selecting Water Meters Tab:



Setting a virtual water meter is a two-stage process; first define the physical water meters that construct the virtual meter and then use the setup screen to set the operation parameters of the virtual meter.

The system has up to 20 virtual meters where each such meter can be constructed by up to 30 physical meters.

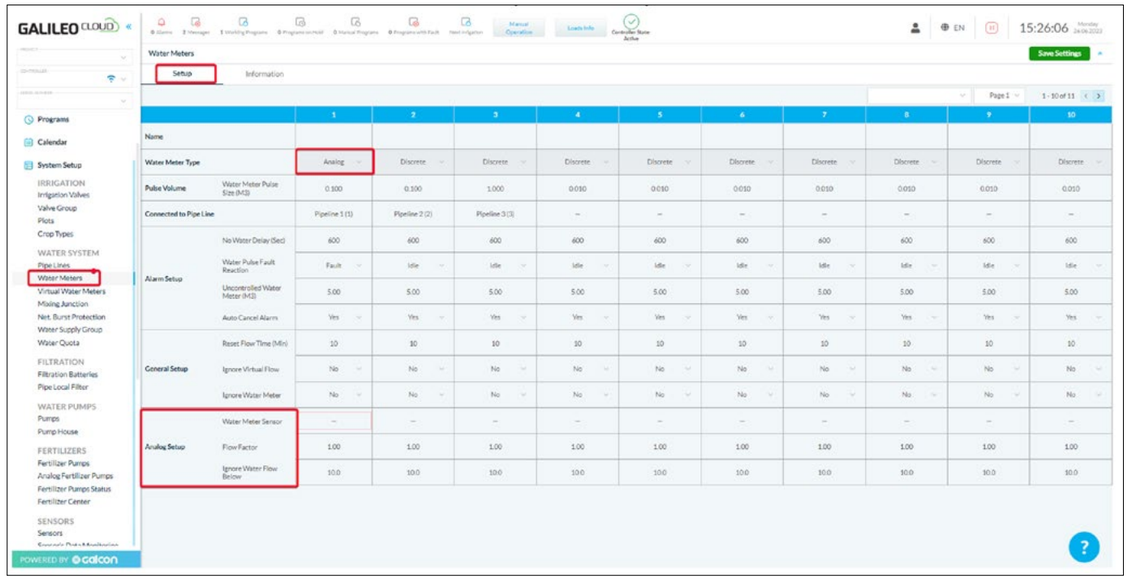
In the column of the virtual water meter select the numbers of the physical water meters that construct it, for each meter select Inlet Water (+) or Outlet Water (-).

The Setup Tab:

Once defined, save the table and move to the Setup tab.

- Name - the name of the virtual water meter.
- Volume - Water Meter Pulse Size (M³) - the volume of water that passes through the water meter per each electronic pulse sent from the meter to the Galileo Controller.
- Connection - Connect to Pipe Line - the pipe lines that are fed by this water meter. Clicking on this parameter opens a selection table with the names of all the already defined pipe-lines of the system, the user can select from the list the pipelines fed by this water meter.
- Alarm Setup - No Water Delay (Sec) - Set the delay time for the No Water alarm. When an active irrigation by volume program (that uses this water meter) is active, and no pulse is received from the water meter within the span of this parameter, the system enters to No Water fault.
- Alarm Setup - Uncontrolled Water (M³) - Set the uncontrolled water volume that enters the system to Uncontrolled Water fault. When no irrigation program, that uses this water meter, is active, but water pulses are still received from the water meter, the system enters to Uncontrolled Water fault when the uncontrolled water volume exceeds this parameter.
- Alarm Setup - Auto Cancel Alarm - Set the Auto Cancel Alarm to Yes or No. The system's main alarms setup allows the user to set a time span for automatic alarms canceling. The Yes/No parameter set whether this water meter participates in the automatic alarm reset or not.
- Alarm Setup - Water pulse Fault Reaction - Set the reaction of the system when fault occurs in this water meter; the options are: Idle = do nothing, Alarm = issue an alarm message, Fault = issue an Alarm message and stop the operation.
- General Setup - Reset Flow Time (Min) - Set the maximal time between pulses that are still participate in the flow-rate calculation. If the time between two pulses exceeds this parameter the flow-rate is set to zero.
- General Setup - Ignore Virtual Flow - Set the virtual flow calculation to No (do not ignore) or Yes (ignore). When the flow rate of the water meter decreases, the time between every two pulses is getting longer and longer. The virtual flow-rate calculation displays the anticipated flow rate when the current time between two pulses is longer than the previous time between two pulses. Setting this parameter to "Ignore" stops the virtual flow-rate calculation and the system displays the last "real" flow-rate even though it is not valid anymore.
- General Setup - Ignore Water Counter - Set the No Water feature of this water meter to Yes or No. When set to No, the system continues to operate regularly even though no pulses are received from the water meter.

Analog Water Meter



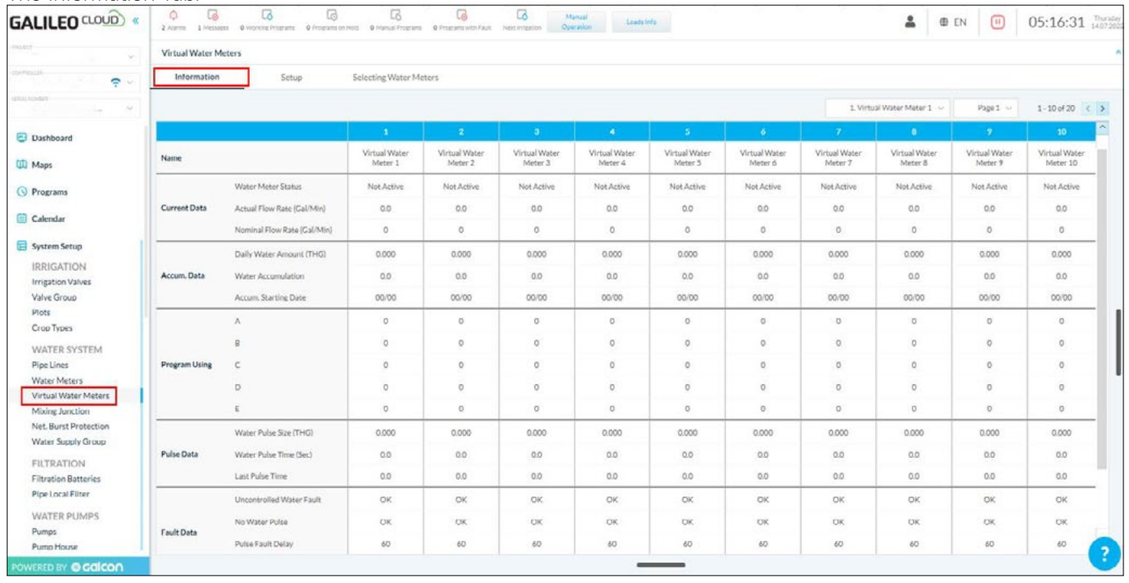
When the water meter is defined as an Analog Meter, the relevant rows of the table become editable:

- Analog Setup – Water Meter Sensor – select the Analog sensor input that to which the analog water meter is connected.
- Analog Setup – Flow Factor – in some cases, in order to adjust the reading of the physical water meter device's display with the reading of the Galileo system, there is a need to multiply the reading by a certain factor, so both of the displays present exactly the same numbers.
- Analog Setup – Ignore Water Flow Below –in cases where there is a flow reading above zero when the sensor's reading is 4 milliamps, there is a need to ignore this reading by setting it in this parameter, this eliminates error messages such as uncontrolled water when the meter sends a reading that is not zero where the sensor's reading is 4 milliamps.

Please note that in case where only an Analog water meter exists in the system, it should be defined first as a

discreet water meter, and then its type should be changed to Analog.

The Information Tab:



The Information tab allows the user to see the following parameters:

- Name – the name of the virtual water meter.
- Current Data – Water Meter Status – the current status of the water meter. The options are: Active – the water meter is correctly defined but currently it is not operational, Running – water passes through the water meter according to the irrigation program, Fault – the water meter is faulty, Paused – the water meter is paused, No Pulse – an irrigation program using this water meter has started but the controller dose not receive pulses from the water meter, Uncontrolled Water – water passes through the water meter when no irrigation program is active (the meter entered to uncontrolled water fault). לבדוק את נכונות כל הסטטוסים האפשריים
- Current Data – Actual Flow Rate (Unit/Min) – the current real time flow rate of the water meter (the units depend on the controller's basic units' configuration).
- Current Data – Nominal Flow Rate (Unit/Min) – the expected flow rate of the water meter, as calculated by the nominal flow rate of the valves that currently using this water meter (the units depend on the controller's basic units' configuration).
- Accumulation Data – Daily Water Amount (Unit) – the accumulated water volume that passed through this water meter since the beginning of the current day (the unit depends on the controller's basic units' configuration).
- Accumulation Data – Water Accumulation – the total accumulated water volume that passed through this water meter since the date written in the Accum.
- Accumulation Data – Accum. Starting Date – the date from which the water accumulation of this water meter has started.
- Program Using – Program Using A – the number of the first irrigation program that currently using this water meter.
- Program Using - program using B/C/D/E - the number of the first irrigation program that currently using this water meter.
- Please note that in case that more than 5 irrigation programs currently using this water meter, the screen displays only the first five of them.
- Pulse Data – Water Meter Pulse Size (Unit) – the volume of water that passes through this water meter per each pulse being send to the controller (the unit depends on the controller's basic units' configuration).
- Pulse Data – Last Pulse Time (Sec) – The time in seconds that passed since the last pulse sent by the water meter.
- Fault Data – Uncontrolled Water Fault – the status of the uncontrolled water control feature of this water meter (for details please see the description of the water meter setup tab).
- Fault Data – No Water pulse – the status of the No Water Pulse fault of this water meter.
- Fault Data – Pulse Fault Delay – the countdown of the delay time for the No Water alarm (for details please see the description of the water meter setup tab).
- Fault Data – Uncontrolled Water (Unit) – the volume of water that passes through this water meter in uncontrolled manner. Once this volume exceeds the parameter set in the water meter setup tab the meter enters to uncontrolled water fault.
- Cancel Alarm – click to cancel the water meter alarm (if exists).
- Water Meter Total Reset – click to reset the water meter settings and accumulation.

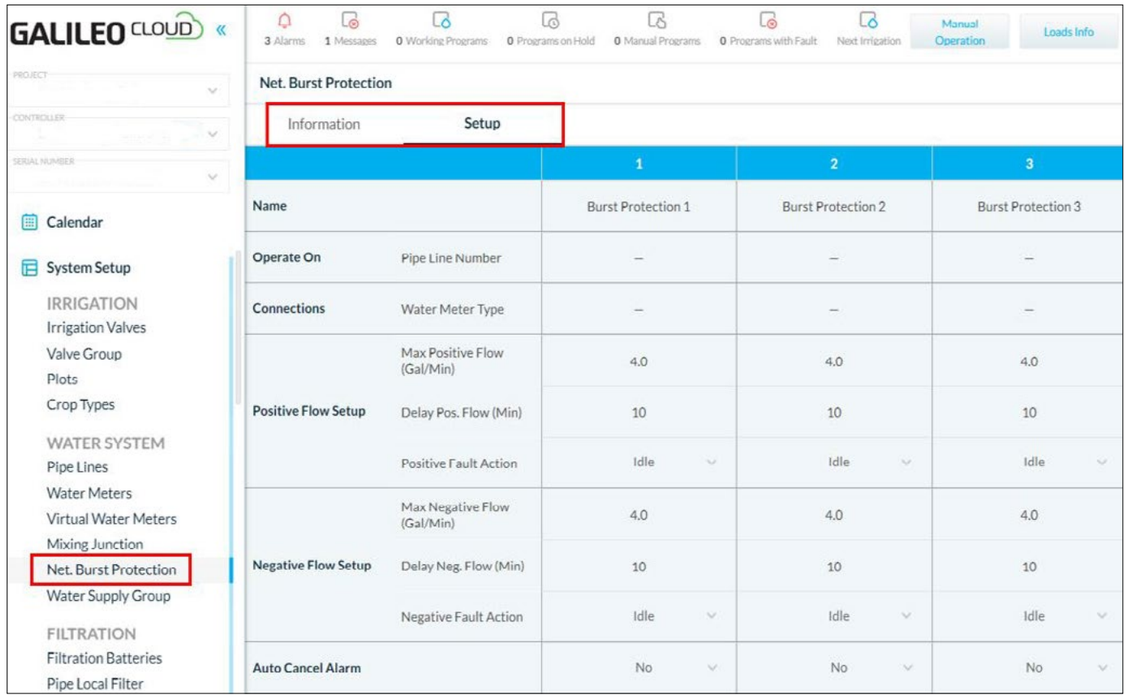
Define Network Burst Protection

Entering the Define Virtual Network Protection tab of the Water System Tab screen is done by clicking on the WATER SYSTEM -> NETWORK PROTECTION entry of the Galileo main menu.

Important Note: The network protection feature of the Galileo system is designed to protect large water networks against burst pipes and faulty water meters. Such networks have multiple inlets and outlets water meters, that may be controlled even by more than a single Galileo controller. The system performs a water balance calculation by summing the flow of all the inlet water meters (Physical and Virtual meters) and subtracting the flow of all the outlet meters. In case where the inlet flow is higher than the outlet flow (pipe burst) or when the outlet flow is higher than the inlet flow (faulty water meters) the system reacts by rising an alarm and stopping the operation. The Galileo system can protect up to 5 such networks.

Please do not confuse the Network Protection feature with the Uncontrolled Water or the Over Flow features of the system.

The Network Protection feature has two screen tabs: Setup and Information:



- Name - the name of the water network to be protected (1-5).

- Operate On - Pipe Line Number - click and select from the selection window the name of the pipe line that should react when a situation of network protection is detected.
- Connection - Water Meter Type - click and select the type of the water meter from the selection window; mostly this is a virtual meter.
- Connection - Flow from other controllers - select Yes or No. Once Yes is selected, a group of up to ten (A-J) entries appears under the Other Controllers' Water Meters group.
- Other Controllers' Water Meters - Clicking on one of the A-J entries opens a selection window that displays a list of water meters connected to other Galileo Controllers. **Very Important Note:** The selection window displays only water meters from other controllers that are already set as "Shared" water meters. Please refer to the Data Exchange Table under the Galileo Setup Menu for sharing elements between controllers. The upper part of the selection window enables the user to set the Other Controllers' Water Meters for all the ten options (A-J) from the same window. Note: water meters from other controllers should be only of "outlet" type.
- Positive Flow Setup - Max. Positive Flow (M^3) - Set the positive flow that above it the system responds; positive flow is when the inlet water flow is higher than the outlet flow (indicating burst pipe).
- Positive Flow Setup - Delay Pos. Flow (Min) - Set the delay time before the system reacts to too high positive flow; eliminates momentarily high flow readings.
- Positive Flow Setup - Positive Fault Action - Set the system reaction to a too high positive flow. The options are: Idle = do nothing, Alarm = issue an alarm message, Fault = issue an Alarm message and stop the operation.
- Negative Flow Setup - Max. Negative Flow (M^3) - Set the negative flow that above it the system responds; negative flow is when the inlet water flow is lower than the outlet flow (indicating faulty water meter).
- Negative Flow Setup - Delay Neg. Flow (Min) - Set the delay time before the system reacts to too high negative flow; eliminates momentarily high flow readings.
- Negative Flow Setup - Negative e Fault Action - Set the system reaction to a too high negative flow. The options are: Idle = do nothing, Alarm = issue an alarm message, Fault = issue an Alarm message and stop the operation.
- Auto Cancel Alarm - Set whether the network protection faults participate in the automatic timer that cancel alarms in a predefined interval; the default is NO.

The Information Tab:

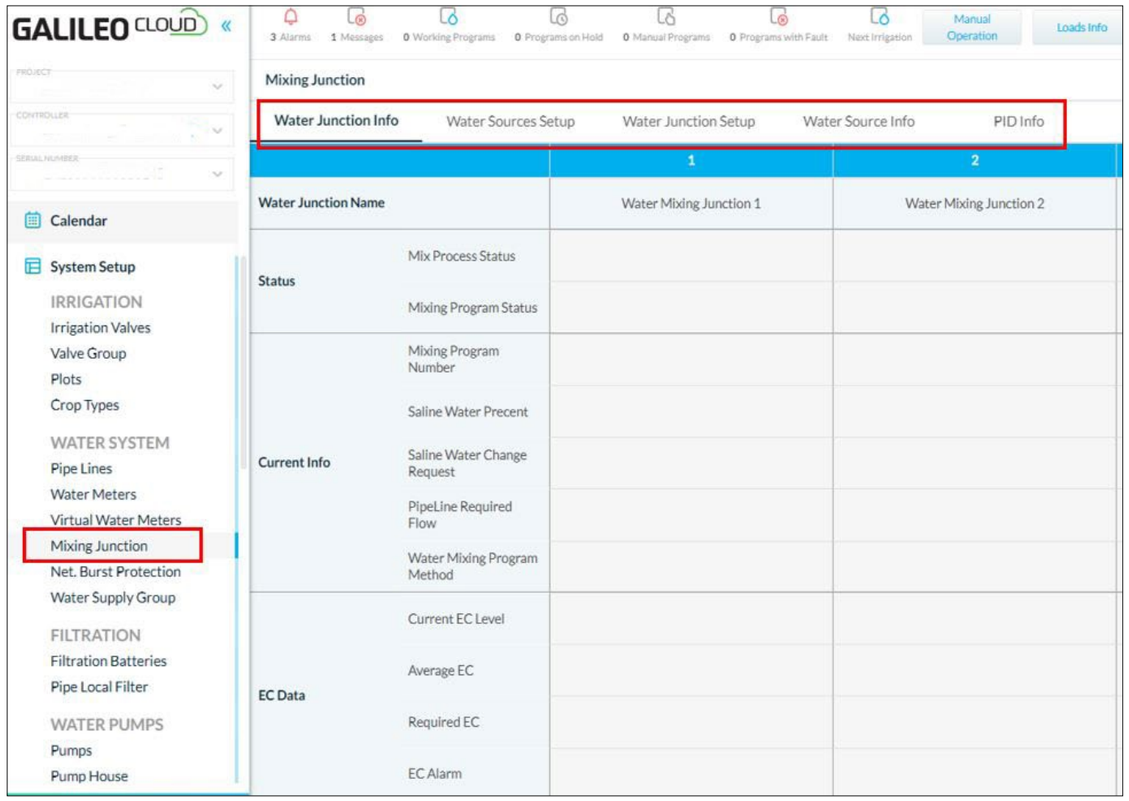
- Name - the name of the water network to be protected (1-5).
- Status - Burst Protection status - the status of this network protection feature. The options are: Not Active - the system is OK, Invalid Water Meter - one of the water meters definition is not valid, Faulty water meter - one of the water meters is in fault, Invalid Remote water meter - one of the water meters, connected to a remote Galileo controller, definition is not valid, Faulty Pipe line - the pipe line setup is faulty, Idle - the reaction to fault is not defined, Active - The network is protected, Alarm - the network protection raised the Alarm, Fault - the pipeline closed due to network protection fault.
- Status - Current Flow Rate - the current flow of the network protection feature (inlets minus outlets).
- Faults - Positive Protection - the status of the positive protection - Ok or Fault
- Faults - Negative Protection - the status of the Negative protection - Ok or Fault
- Faults - Cancel Fault Yes/No - Press this entry for an option to cancel faults.

Define Water Mixing Junction

Entering the Mixing Junction tab of the Water System Tab screen is done by clicking on the WATER SYSTEM -> WATER MIXING JUNCTION entry of the Galileo main menu. Please refer to the Control Philosophy chapter of this document for details on the role of the mixing junctions in the Galileo system.

The Mixing Junction feature has four screen tabs: Water Source Setup, Setup, Water Junction Info, and Water Source Information:

The Water Source Setup Tab:



- Water Source Name - enter a name for the water source of each one of the 4 available mixing junctions.
- Note: each mixing junction includes two water sources: Fresh water source and Saline water source.
- Fed by Line Number - clicking on this parameter opens a section window showing the already defined system's pipelines. In case where the water sources for this junction are pipelines (other than pumps or reservoirs), select the feeding pipelines for the fresh and the saline lines.
- Operation Variables - Full Opening Time (sec.) - set the time in seconds it takes the fresh and the saline valve to fully open.
- Operation Variables - Number of stages - divide the opening time of the valves to stages, the maximum number of stages is 100 but the recommended number is 50.
- Operation Variables - Maximum Water Flow (m^3/h) - set the maximal flow that each one of the fresh and the saline sources can supply.
- Fault Setup - No Water Pulse Delay (Sec.) - In case the water source flow-rate is measured by a water meter, and no pulses are received from this meter, the system will enter to fault status after the number of seconds set in this parameter.
- Fault Setup - Number of Uncontrolled Pulses for Fault - if water pulses are received from the water meter when the valve should be closed (uncontrolled pulses) the system will enter to fault status after the number of pulses set in this parameter.
- Fault Setup - System Reaction to fault - select the required system reaction when one of the above-mentioned faults occurs. The options are: Open Fresh (or Open Saline) - close the faulty valve and open its pair, e.g., in case of a fault in the saline line the system closes it and opens the fresh water source, Close the junction - the mixing junction closes and the irrigation programs fed from this mixing junction are paused.
- Default Stages - Opening Stage While Mix. OFF - set the water source valve to the opening stage set in this parameter when the mixing junction is off. This parameter keeps the valve open near its required opening stage, so once the irrigation starts the valve will reach its required operation state faster.

- Default Stages - Opening Stage While Irrig. OFF - set the water source valve to the opening stage set in this parameter when the irrigation is off. This parameter keeps the valve open near its required opening stage, so once the irrigation starts the valve will reach its required operation state faster.
- Connections - Valve's Open Command - this parameter displays whether an Open Command Output is set for this valve in the controller's hardware setup, the options are Defined or Not Defined.
- Connections - Valve's Close Command - this parameter displays whether a Close Command Output is set for this valve in the controller's hardware setup, the options are Defined or Not Defined.
- Connections - Main/Pump Command - this parameter displays whether an Output Command is set for the mixing junction main valve (or Pump) in the controller's hardware setup, the options are Defined or Not Defined.
- Connections - Water Meter - this parameter displays whether a water meter is set for this water source in the hardware setup, the options are Defined or Not Defined.
- Connections - Water Source Pulse Volume (Liter) - the volume in liters of each single pulse sent by the water meter to the controller.
- Connections - Water Fault Input - this parameter displays whether a Fault Input is set for this water source meter in the hardware setup, the options are Defined or Not Defined.
- By Pass - this parameter displays whether a Bypass feature is set for this mixing junction in the hardware setup, the options are Defined or Not Defined.

The Mixing Junction Setup Tab:

- Water Junction Name - enter names for the 4 available mixing junctions.
- Is active - set the operation status of the Mixing Junction, the options are: Active or Not Active.
- Setup - Supply's to Line Number - clicking on this parameter opens a selection window that displays all the system's pipelines. Select the pipeline (only one) that is fed by this mixing Junction.
- Setup - Mixing Junction - EC Sensor - clicking on this parameter opens a selection window that displays all the system's sensors. Select the EC sensor (only an EC sensor and only a single sensor) that is used to control this mixing Junction.
- Setup - Precision level - the precision level of the mixing junction control, the options are Low, Medium and High. This parameter controls the reaction of the system to minor changes of the control sensor real time readings.
- Setup - EC threshold Alarm (+-) - when the EC reading is Higher or Lower from the required EC level by the number entered in this parameter, the system enters to Alarm mode.
- Setup - EC alarm Delay (Sec.) - Set the delay for the EC alarm, this parameter prevents unnecessary alarms due to momentary high or low EC reading.
- Setup - Default Mixing Program - the dropdown list displays all the system's mixing programs, if no mixing program is set in the fertilizer center, then this parameter defines the default mixing program to be operated in such case. Please Note: the mixing junction operation is controlled by a fertilizer center that is selected by the irrigation program. Therefore, the fertilizer center should be assigned with a mixing program. in case such program was not entered, the mixing junction will operate the default program set in this parameter.
- Note that one of the options is By Pass, when bypass is selected, the mixing junction will close and the water supply will be diverted to the mixing junction bypass.
- Note that one of the options is Off, in such case the mixing junction remains close.
- Setup - BYPASS During Junction Fault - select the bypass operation (Yes or No) when the mixing junction is in fault.
- PID Setup - Please Note: the PID parameters control the mixing Junction operation, if you are not familiar with the PIC Control Loop System do not change the default settings. In any case when required it is possible to return to the default settings by using the "Return to Default" option at the last row of this table.
- PID Setup - Automation Cycle Time (Sec.) - the default setting is 20
- PID Setup - Proportional Coefficient - the default setting is 0.15
- PID Setup - Integral Coefficient - the default setting is 0.05
- PID setup - Derivative Coefficient - the default setting is 1.00

- PID setup - Return to PID Defaults - use this option to set the PID parameter to their factory default settings.

The Water Junction Info Tab:

- Water Junction Name - enter names for the 4 available mixing junctions.
- Status - Mix Process Status - The current status of the mixing junction, the options are: Not Active (not configured), Active - the settings are correct but the junction is currently not supplying water, Mixing - the junction is currently supplying water, Alarm - the junction is in fault mode, Bypass - the junction is closed and the irrigation is done via the bypass.
- Status - Mixing Programs Status - The current status of the all the mixing programs, the options are: OK or Definition Error.
- Current Info - Mixing Program Number - the number of the currently operating mixing program.
- Current Info - Saline Water Precent - the opening percentage of the saline water source.
- Current Info -Saline Water Change Request - the current demand for changing the saline water source ratio, the options are: OK - no need to change ratio, Decrease - there is a need to decrease the saline water ratio, Increase - there is a need to increase the saline water ratio.
- Current Info - Pipe-line Required Flow- the required flow-rate of the pipeline fed by the mixing junction.
- Current Info - Water Mixing Program Method - the type of the mixing method required by the irrigating program, the options are: Not Active - no irrigation, Manual, EC - by EC sensor, Percent - by percentage.
- EC Data - Current EC level - the current reading of the EC sensor.
- EC Data - Average EC - the average of the EC readings, calculated from the last ended irrigation program.
- EC Data - Required EC - the currently required EC level.
- EC Data - EC Alarm - the status of the EC alarm, the options are: OK or Alarm.
- Miscellanies - Water Source Alarm - the status of the water source alarm, the options are: OK or Alarm.
- Miscellanies - Water Mix Available - the availability status of the mixing junction's water sources, the options are: Available or Not Available.
- Miscellanies - Water Junction Setup - the status of the water junction, the options are: Not Active - not configured, Active - configured correctly, Invalid Pipe Number - the pipeline number for the junction setup is not correct, Pipe Definition Error - the pipeline number is valid but the pipe setup is faulty, Source Definition Error - the setup of one of the water sources is faulty, Default Program Error - the number of the default mixing program for this junction is invalid, No Mixing Program - no mixing program is defined for this junction, Invalid Water Meter - the water meter is already in use in another part of the system.
- Operated by Fertilizer Center Number - the numbers of the fertilizer centers that operate this mixing junction. Out of all the system's fertilizer centers only up to 5 centers can use this mixing junction, this parameter displays the names of these fertilizer centers.
- Cancel Alarm - use this button to cancel mixing junction faults.

The Water Source Info Tab:

- Status - Water Source Status - The current status of the water source, the options are: Not Active - not configured, Closed - this water source is currently closed, Opened - currently opened, Opening - this water source is in its opening process, Closing - this water source is in its closing process.
- Current Activity - Current Stage - The current opening stage of the water source valve.
- Current Activity - Required Stage - The stage to which the valve should be opened (or closed).
- Current Activity - Current Source Flow (m^3/h) - The current flow-rate of this water source.
- Water Done - Daily Water (m^3) - The volume of water that passed through this water source since the beginning of the current day.
- Water Done - Accumulate Water (m^3) - The volume of water that passed through this water source since the last time this parameter was reset (the beginning of the current season).
- Failure Data - Water Counter Failure - The status of this water source water meter, the options are: YES (in fault), NO (no fault).

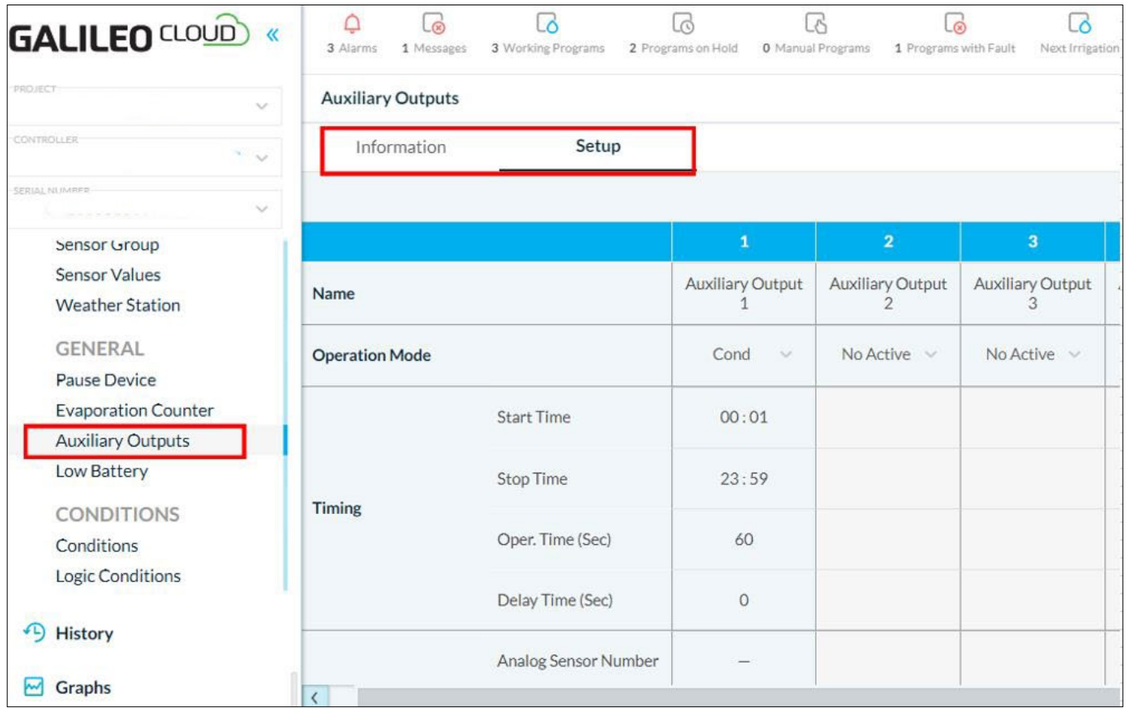
- Failure Data - Uncontrolled Water - When this water source enters to uncontrolled water state, this parameter shows YES, otherwise it shows NO.
- Failure Data - Uncontrolled Water Pulse - The number of the uncontrolled water pulses that the system receives.
- Failure Data - Upstream Line Not Available - The line that feeds this water source is not defined or in fault, the options are Yes or No.
- Failure Data - Setup Error - In case of an error in the water source setup data, this parameter displays the type of the error, the options are: Not Active - not configured, OK - no setup error, Invalid Open Output - incorrect hardware configuration for this water source opening output, Invalid Close Output - incorrect hardware configuration for this water source closing output, Invalid Main Output - incorrect hardware configuration for this water source main valve output, Operation Time Error - the opening time from fully closed to fully opened of the valve is incorrect, Operation Stages Error - the number of opening stages of the valve is incorrect, Invalid Water Meter Number - the number of the water meter of this water source is invalid, Invalid Pulse Size - the volume definition of the water meter pulses in incorrect, Maximal flow Error - the definition of the maximal flow for this water source is missing or invalid.
- Initializing - Restart Source Accum. - reset the water accumulation of the water source back to zero, the options are: Yes and No.
- Initializing - Water Valve Calibration - Bring the water valve to its Home Position in order to calibrate the opening/closing stages with the operation controller software, the options are: Yes and No.

Define Auxiliary Output Group

Entering the Auxiliary tab of the General System Tab screen is done by clicking on the GENERAL -> AUXILIARY OUTPUT entry of the Galileo main menu. Auxiliary Outputs are general outputs that can be used for any general-purpose task that is not covered by the regular irrigation programs.

The Auxiliary Output has two screen tabs: Setup and Information:

The Auxiliary Output Setup Tab:



- Name - enter names for the 20 available Auxiliary Outputs.
- Operation Mode - Set the required operation mode for the auxiliary output, the options are: Not active - not configured or not active, Time - operation within a time frame, Conditions - operation according to a predefined logical condition.
- Timing - Start Time - The daily start time of the time-frame in which the auxiliary output is operational.
- Timing - Stop Time - The daily stop time of the time-frame in which the auxiliary output is operational.
- Timing - Oper. Time (sec) - In case the auxiliary output should operate in intervals within its operation time-frame, this parameter set the operation time of each such interval.
- Timing - Delay Time (sec) - In case the auxiliary output should operate in intervals within its operation time-frame, this parameter set the delay time between the operation intervals.
- Note: in case the Delay Time is zero, the system ignores the Oper.Time parameter, but if the Delay Time is greater than zero, the user must set time for the Operation Time parameter.
- Operation According to Sensor - Important note: the operation of the auxiliary output according to a sensor reading can take place only if the general operation mode of the auxiliary output is set to CONDITION. In such case if a daily time-frame is entered the auxiliary output works according to the sensor readings only within the daily time-frame.
- Operation by Sensor - Analog Sensor Number - Set the number of the analog sensor according to which the auxiliary output operates.
- Operation by Sensor - Start Set Point - Below - set the reading of the sensor that below it the auxiliary output opens.
- Operation by Sensor - Start Set Point - Above - set the reading of the sensor that above it the auxiliary output opens.
- Operation by Sensor - Deferential to Stop - set the threshold for stopping the auxiliary output operation when the sensor reading is greater or smaller than the operation setpoint.
- Operation by Condition - Important note: There are two types of conditions that can operate the auxiliary output: Condition Inputs and Logic Conditions. Note the different parameters accordingly.
- Operation by Condition - Condition Input to Start - select the number of the condition input according to which the auxiliary output operates.
- Operation by Condition - Condition Input to pause - select the number of the condition input according to which the auxiliary output operation is paused. Please note that the condition input that pauses the auxiliary input operation, pauses the output even when it is outside of the auxiliary output operation time-frame.
- Operation by Logic Condition - Important Note: the behavior parameters of the logic conditions are defined in the logic conditions setup table of the Galileo system. In the Auxiliary outputs' setup screen, the user can select the required logic condition only (up to two logic conditions per single auxiliary output); the actual effect of the condition on the auxiliary output will be as set on the condition definition table.
- Operation Condition - Logic Condition A - select the number of the first logic condition according to which the auxiliary output operates.
- Operation Condition - Logic Condition B - select the number of the second logic condition according to which the auxiliary output operates.
- Simultaneously Operation - due to pressure or flow-rate restriction it is possible to limit the number of the auxiliary outputs that can be opened together. For each one of the auxiliary outputs, the user can define if this output is included in the Simultaneously Operation restriction, the options are: Yes or No. The number of the maximal simultaneously operating outputs is defined in the Max. Outputs Together parameter found below the setup table.
- Manual Operation (Sec) - if needed the user can manually open the auxiliary output by entering the required open time (in seconds) in this parameter. the output opens immediately, the display shows the entered time counted down till the end of the manual operation.

The Auxiliary Output Information Tab:

- Name - the names for the 20 available Auxiliary Outputs.
- Status - The current status of the auxiliary output, the options are: Idle - Not configured, Out Def. Error - incorrect or missing output definition, Time Def. Err. - the operation time is incorrect or missing, Time Frame Err. - the time frame for the auxiliary output operation is incorrect, Oper. Mode Def. - incorrect operation mode definition, Active

- the output is correctly defined, Out of Time Frame - the output is currently not within its operation time frame, Pause - the output is currently paused, Run - the output is currently opened, Manually - the output is manually opened, Fault - the output is in fault due to a logic condition.
- Time Info - End of Pulse (Sec.) - When the auxiliary output works in pulses, this parameter displays the time left for the current pulse operation.
- Time Info - Time to Next Pulse (Sec.) - When the auxiliary output works in pulses, this parameter displays the time left till the beginning of the next pulse operation.
- Time Info - Operation by Time - The status of the Operation by Time mode of the auxiliary output, the options are: Idle - not defined, OFF - the Operation by Time is defined but the output is currently closed, ON - the Operation by Time is defined and the output is currently opened.
- Time Info - Time Frame Status - The status of the auxiliary output time frame operation, the options are: Idle - not defined, OFF - the auxiliary output is currently out of its time frame operation, ON - the auxiliary output is currently within its time frame operation, N.A. - The operation by time frame is not relevant in this case (for instance, the auxiliary output works according to a sensor reading), Definition failure - the time definition is not correct.
- Sensor Info - Current Reading - The current reading of the sensor that controls the auxiliary output.
- Sensor Info - Operation by low value - When the auxiliary output is defined to open when the reading of the sensor is below the setpoint value, this parameter displays the status of this setting, the options are: Idle - the auxiliary output is not defined to operate according to a low value reading, OFF - the auxiliary output is defined to operate according to a low value but currently it is closed, ON - the auxiliary output is defined to operate according to a low value and currently it is opened.
- Sensor Info - Operation by high value - When the auxiliary output is defined to open when the reading of the sensor is above the setpoint value, this parameter displays the status of this setting, the options are: Idle - the auxiliary output is not defined to operate according to a high value reading, OFF - the auxiliary output is defined to operate according to a high value but currently it is closed, ON - the auxiliary output is defined to operate according to a high value and currently it is opened.
- Conditions Info - Start Cond. Input - When the auxiliary output is defined to open according to a Condition Input, this parameter displays the status of this setting, the options are: Idle - the auxiliary output is not defined to operate according to a Condition Input, OFF - the auxiliary output is defined to operate according to a Condition Input but currently it is closed, ON - the auxiliary output is defined to operate according to a Condition Input and currently it is opened.
- Conditions Info - Pause Cond. Input - When the auxiliary output is defined to open according to a Pause Condition Input, this parameter displays the status of this setting, the options are: Idle - the auxiliary output is not defined to operate according to a Pause Condition Input, OFF - the auxiliary output is defined to operate according to a Pause Condition Input but currently it is closed, ON - the auxiliary output is defined to operate according to a Pause Condition Input and currently it is opened.
- Conditions Info - Start Logic Cond. - When the auxiliary output is defined to open according to a Logic Condition, this parameter displays the status of this setting, the options are: Idle - the auxiliary output is not defined to operate according to a Logic Condition, OFF - the auxiliary output is defined to operate according to a Logic Condition but currently it is closed, ON - the auxiliary output is defined to operate according to a Logic Condition and currently it is opened.
- Conditions Info - Pause Logic Cond. - When the auxiliary output is defined to open according to a Pause Logic Condition, this parameter displays the status of this setting, the options are: Idle - the auxiliary output is not defined to operate according to a Pause Logic Condition, OFF - the auxiliary output is defined to operate according to a Pause Logic Condition but currently it is closed, ON - the auxiliary output is defined to operate according to a Pause Logic Condition and currently it is opened.
- Conditions Info - Fault Logic Cond. - When the auxiliary output is defined to open according to a Fault Logic Condition (a logic condition that enters the auxiliary output into fault mode), this parameter displays the status of this setting, the options are: Idle - the auxiliary output is not defined to operate according to a Fault Logic Condition, OFF - the auxiliary output is defined to operate according to a Fault Logic Condition but currently it is closed, ON - the auxiliary output is defined to operate according to a Fault Logic Condition and currently it is opened. Note: When the auxiliary input is entered to fault it will not return to regular operation unless the user clears the fault.
- Daily Info - Cycles Today - When the auxiliary output is defined to open in pulses within its daily time frame, this parameter displays the number of pulse cycles performed since the beginning of the current day.
- Daily Info - Operation Time Today (Min.) - The accumulated operation time performed since the beginning of the current day.
- Cancel Faults - Press this button to cancel faults.

K.10. Sensors Tab

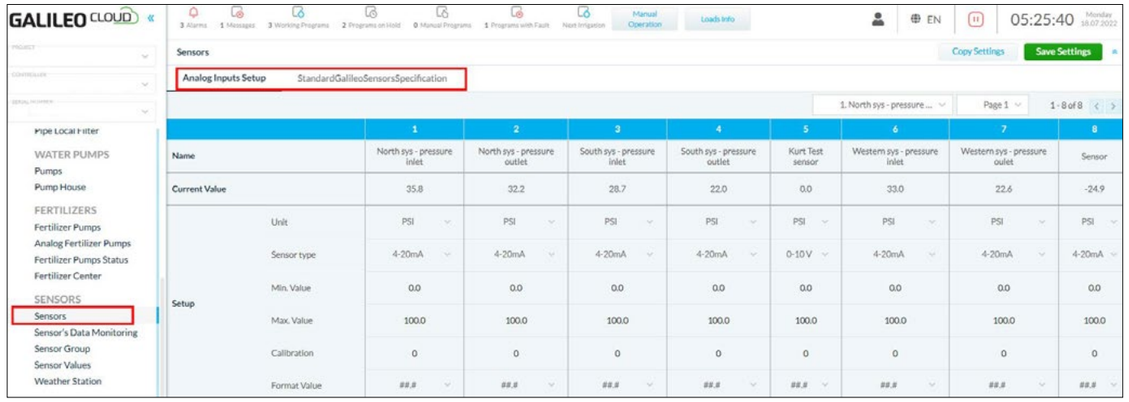
Define Sensor

Entering the Sensor tab of the Sensors System Tab, is done by clicking on the SENSORS -> SENSOR entry of the Galileo main menu.

Very Important Notes:

1. If no sensor is defined in the Galileo Controller Hardware, this screen doesn't appear in Galileo web screens. When sensors are defined, each one of them has a single column on the screen.
2. The Galileo system can read sensors in two different ways; regular and fast. The fast sensor reading is used when the changes in the sensor reading are very fast (such as in some fertigation systems or in poultry weighing scales); fast reading may overload the controller's operation and therefore it is important to use it only when it is absolutely necessary.
3. Galileo system can read two types of relative humidity sensors; single sensor - a sensor that uses a single analog input and transfers the 4-20mA reading of the relative humidity to the controller, and a calculated sensor; the calculated relative humidity level is calculated by the system from two readings of temperature sensors, one reads the air temperature (Dry sensor) and the other reads the temperature through a wet clothe that covers it and kept wet (Wet sensor). When using the Wet method, it is important to set the Dry temperature sensor to one of the hardware analog-inputs, and the Wet temperature sensor must be connected to the consecutive analog input (the next input number); failing do so will not produce humidity reading. Note that is this configuration, the readings of the wet temperature sensor are displayed on screen, as relative humidity percentage.

The Sensor Definition Tab:



- Name - Set a name for the sensor.
- Current Value - The current reading of the sensor.
- Setup - Unit - Select the engineering unit of the sensor (°C, %, Kg, Bar, cBar, mBar, etc.).
- Setup - Sensor type - Clicking on this parameter opens a selection list that displays all the sensors types that can be connected to the Galileo system. Select the required type. Please read the Important Notes section in the beginning of this chapter for explanations on the types and connection methods of the analog sensors. The list displays the following sensor types: Not defined, 4-20mA, Wet. 4-20mA, Fast 4-20, 0-10V, Temp, Wet. Temp, Fast Temp.
- Setup - Min. Value - Since the sensors are linear sensors, set the engineering value for the minimal reading value

of the sensor, e.g., in case of a 4-20mA sensor, this should be the engineering value for the 4mA hardware reading.

- Setup - Max. Value - Since the sensors are linear sensors, set the engineering value for the minimal reading value of the sensor, e.g., in case of a 4-20mA sensor, this should be the engineering value for the 20mA hardware reading.
- Setup - Calibration - In case the reading as appears on screen deviates from the reading as measured by an external standard sensor, the user can set an appropriate +/- calibration value.
- Setup - Format value - Set the number of digits after the decimal point for the sensor. Very Important Note: for temperature and humidity sensors the format should be a single digit after the decimal point (##.#). For EC and pH sensors the format should be two digits after the decimal point (#.##). For other sensors' types please refer to Standard Galileo Sensors Specification table in next tab of this screen for details.

Define Sensor Group

Entering the Sensor Group tab of the Sensors System Tab, is done by clicking on the SENSORS -> SENSOR GROUP entry of the Galileo main menu.

Very Important Notes:

1. A group of sensors can contain up to four sensors that are already set and configured in the Galileo system.
2. When configuring a sensor group, all participating sensors should be of the same type and have the same decimal points format.

The Sensor Group tab:

- Name - Set a name for the sensor group.
- Group Type - Select the required group type from the dropdown list, the options are: Not Active - this group is not defined yet, Average - the system calculates the average reading of the participating sensors, Lowest - the system uses the currently lowest reading of the participating sensors, (for example: turning on the heater according to the coldest area of a greenhouse), Highest - the system uses the currently highest reading of the participating sensors, (for example turning on the fans according to the hottest area of a greenhouse), Highest (-) Lowest - the system calculates the difference between the highest and the lowest readings, (for example turning on the fans when the temperature difference between areas of a greenhouse is too high), A (-) B - the system calculates the difference between the readings of sensor A and sensor B, (for example when fertigating according to EC reading it may be important to track and monitor the difference between the upstream and downstream EC levels), Sensors Sum - the system sums up the reading of the participating sensors, (for example when a line flow is divided into two branches that their flow-rate is measured by two separated meters before rejoining the flows back to the main line.
- Current Reading - The real time result of the calculation as set in the Group Type
- Status - The current status of the group, the options are: Not defined - this group is not defined yet, Active - the group is correctly defined, Invalid Sensor Number - the number of a sensor participating in this group is not valid, Sensor Error - a sensor participating in this group is in error, Group Type Error - there is an error in the group type definition, Too high Difference - the difference between the sensors readings exceeds the maximum allowed deference parameter.
- Sensors - Sensor A, B, C, D, - Select the participating sensors in this sensors group. Please note the very important notes at the beginning of this chapter.
- Max Allowed Difference Between Sensors - Enter the maximal difference between the sensor's readings, this is used for issuing an alarm in case the readings difference it too high.

Data collection Sensor Group

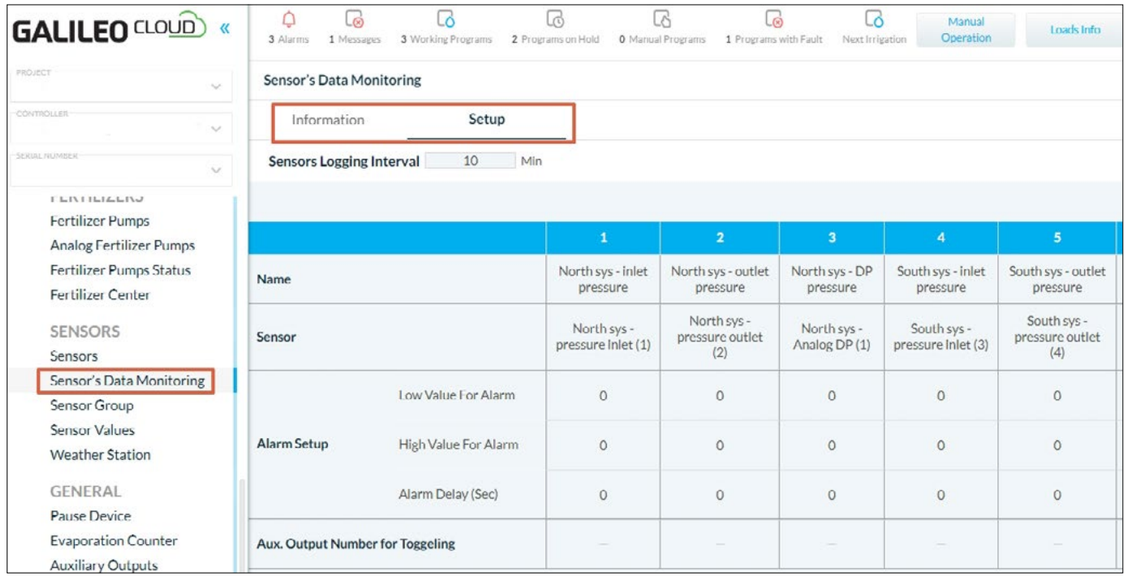
Entering the Data Collection Sensor Group tab of the Sensors System Tab, is done by clicking on the SENSORS -> DATA COLLECTION SENSOR GROUP entry of the Galileo main menu.

This screen has two tabs: Setup and Information:

Very Important Notes:

This feature of the Galileo system is used for selecting important sensors to be closely monitored; the parameters of this screen are not used for control; they are used for monitoring and for issuing alarms accordingly.

The Setup tab:



- Name - Set a name for the sensor to be monitored.
- Sensor - Select the sensor to be monitored from the list.
- Alarm Setup - Low Value For Alarm - Set the reading value that below it the system issues an alarm.
- Alarm Setup - High Value For Alarm - Set the reading value that above it the system issues an alarm.
- Alarm Setup - Alarm Delay (Sec.) - Set a delay time for issuing an Alarm, this prevents unnecessary alarm in case of momentarily faulty reading.
- Auxiliary Output for Sensor Toggling - This parameter is used for conserving energy in the Galileo Line RTUs. Select the auxiliary output that toggles the Sensor Reading. Note that the interval of the auxiliary output is defined in the Auxiliary Outputs definition screen.

The Info tab:

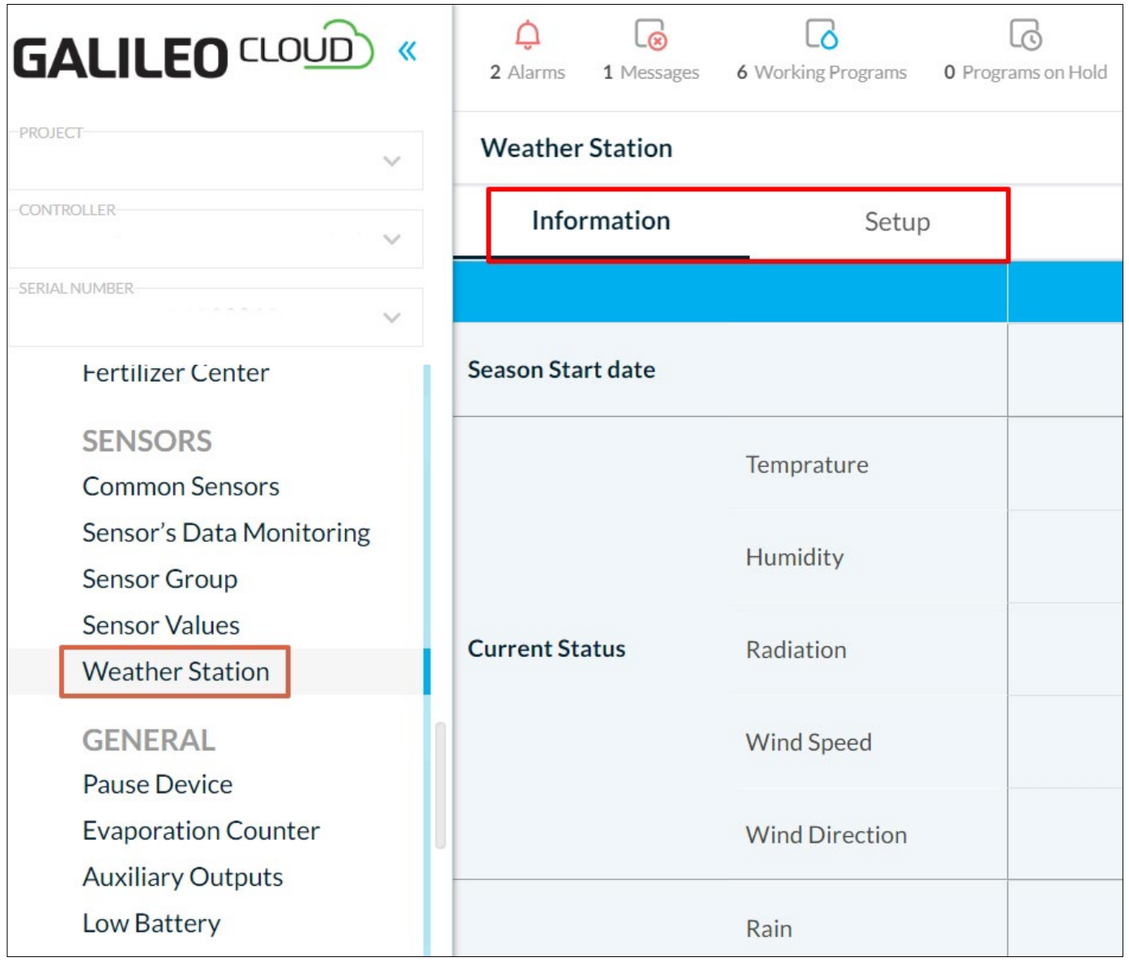
- Name - The name of the monitored sensor.
- Status - The current status of the monitored sensor, the options are: Not Def. - this monitored sensor is not defined, Active - the monitoring process of the sensor is active, Toggled OFF - the auxiliary output is closed and the sensor is not active, Toggled ON - The auxiliary output is on and the sensor is active, Invalid Sensor No. - the selected sensor member is invalid, Invalid Aux. Output - the selected auxiliary output number is invalid, Aux. Out Err. - the selected auxiliary output is in error. Alarm Low - the sensor is in Alarm due to a low reading, Alarm High - the sensor is in Alarm due to a high reading.
- Current Reading - the current reading of the monitored sensor.
- Daily Statistics - Minimum today - the minimal reading value recorded since the beginning of the current day.
- Daily Statistics - Average today - the average of all the readings recorded since the beginning of the current day.
- Daily Statistics - Maximum today - the maximal reading value recorded since the beginning of the current day.
- Initiate Data - restart the monitoring process for this sensor; the current reading value will be entered to the minimum, maximum, and average parameters; the system continues to monitor the sensor from this point and on.
- Initiate all sensors data (upper left corner of the screen) - restart the monitoring for all the monitored sensors as described in the previous bullet.

Meteorology

Entering the Meteorology tab of the Sensors System Tab, is done by clicking on the SENSORS -> METEOROLOGY entry of the Galileo main menu.

This screen has two tabs: Setup and Information:

The Setup tab:



- Name - The name of the meteorology station.
- Sensor Connections - External Temp. - Sensor Number - Select the required sensor number from the list.
- Sensor Connections - External Humidity - Sensor Number - Select the required sensor number from the list.
- Sensor Connections - Radiation - Sensor Number - Select the required sensor number from the list.
- Sensor Connections - Wind Speed- Sensor Number - Select the required sensor number from the list.
- Sensor Connections - Wind Direction - Sensor Number - Select the required sensor number from the list.
- Rain Setup - Rain Meter - Input Number - Select the required sensor number from the list.
- Rain Setup - Rain volume per pulse (m/l) - Set the volume for a single pulse of the rain meter in milliliter.
- Reset (Initiate Data) - restart the monitoring process for the sensors; the current reading value will be entered to the table; the system continues to monitor the sensors from this point and on.

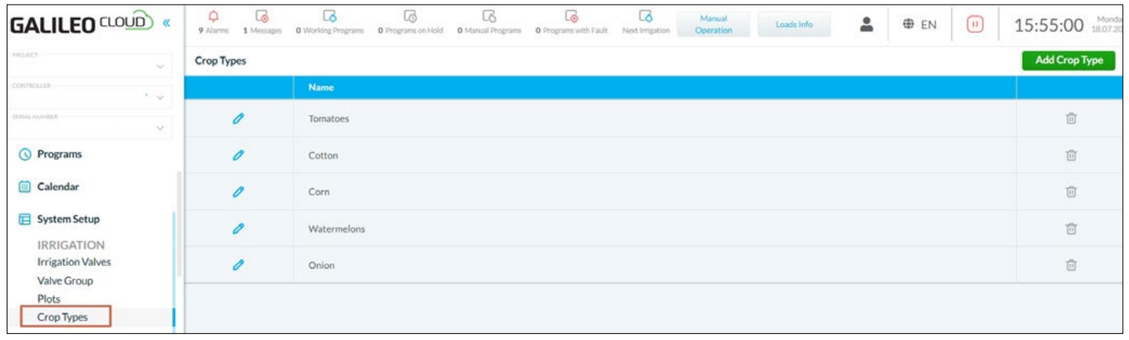
The Information tab:

- Current Status - Temperature - the temperature current reading.
- Current Status - Humidity - the humidity current reading.
- Current Status - Radiation - the radiation current reading.
- Current Status - Wind Speed - the current reading of the wind speed.
- Current Status - Wind Direction - the current wind direction.
- Daily Statistic - Rain - The accumulated rainfall from the beginning of the current day.
- Daily Statistic - Evaporate Yesterday - The accumulated evaporation of the previous day.
- Daily Statistic - Evaporate Today - The accumulated evaporation from the beginning of the current day.
- Maximum Wind Speed Km/h - The maximal wind speed that registered from the beginning of the current day.
- Maximum Wind Speed Time - The time (Hour : Minute) when the maximal wind speed occurred.
- Maximum Wind Speed Direction - The direction of the wind when the maximal wind speed occurred.
- Rain Seasonal - The accumulated rainfall from the beginning of the season.
- Seasonal maximum wind speed data - Speed - The maximal wind speed that registered from the beginning of the season.
- Seasonal maximum wind speed data - Time - The time (Hour : Minute) when the maximal wind speed occurred.
- Seasonal maximum wind speed data - Date - The Date when the maximal wind speed occurred.
- Seasonal maximum wind speed data - Direction - The direction of the wind when the maximal wind speed occurred.
- Start Season Date - The date of the last time the Initiate Data button was pressed.
- Reset (Initiate Data) - restart the monitoring process for the sensors and reset the Start Season Date to the current date; the system continues to monitor the sensors from this point and on.

K.11. Irrigation Tab

Define Crop Type

Entering the Crop Type tab of the System's Irrigation Tab, is done by clicking on the IRRIGATION -> CROP TYPE entry of the Galileo main menu.



Press the Add Crop Type button on the upper right side of the screen to add a name of a crop to be used by the Galileo system.

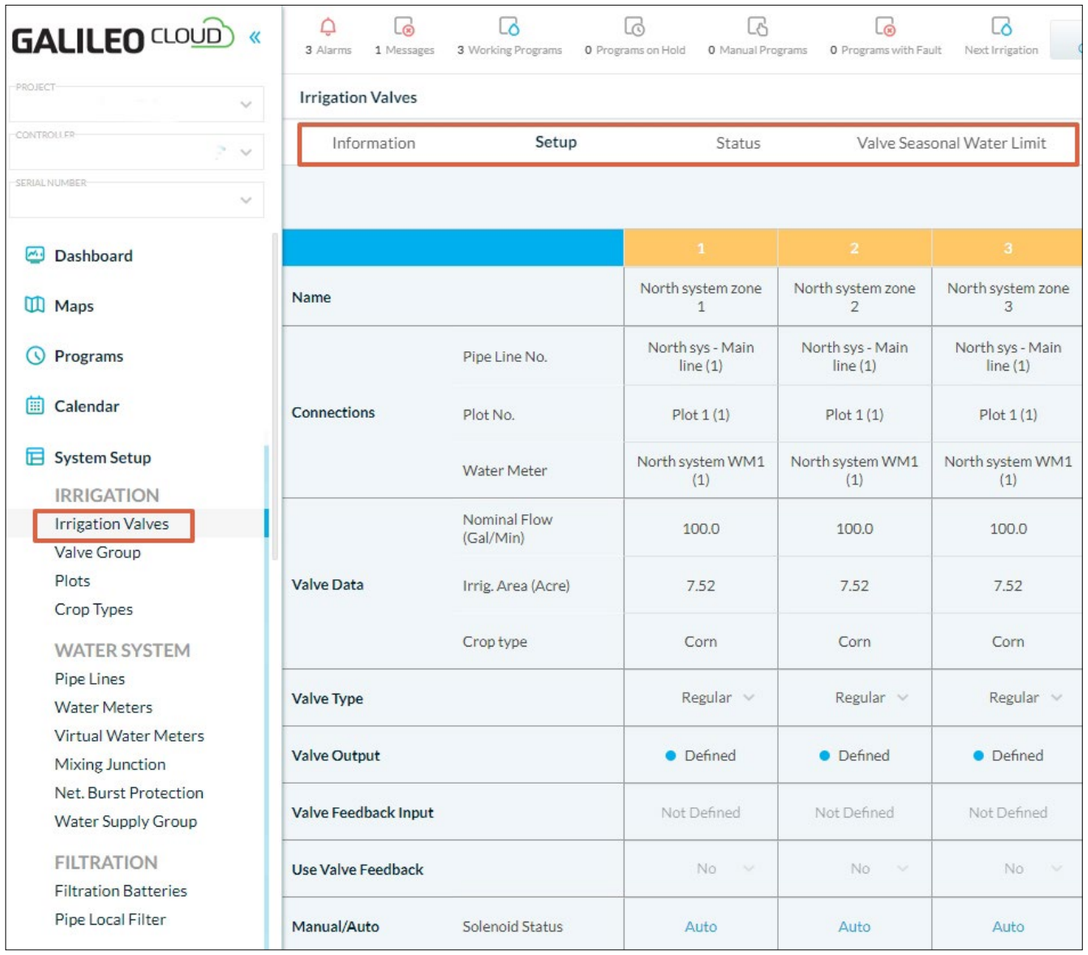
Very Important Note: In addition to the Crop Types the Galileo system Manages also up to 50 Plots. When installing a new Galileo controller these plots are active; so, there is no need to set them up during the system basic configuration process, however the user can change their parameters through the Plot entry of the Galileo main menu Irrigation tab.

Define Irrigation Valve

Entering the Irrigation Valve tab of the System's Irrigation Tab, is done by clicking on the IRRIGATION -> IRRIGATION VALVE entry of the Galileo main menu.

This screen has four tabs: Setup, Information, Status, and Valve Seasonal Water Limit:

The Setup tab:



- Name - Set a name for the valve.
  Valve Type - Set the Valve Type, the options are: Regular - a regular irrigation valve, or Co-valve - a valve that cannot serve as full irrigation valve and in order to use it, it should be connected to an irrigation valve or another system element.
- Connections - Pipe Line - Select the Pipe Line that serves this valve.
- Connections - Plot Number - Select the plot number that is served by this valve.
- Connections - Water Meter Number - Set the number and type of the water Meter that serves this Irrigation Valve. Clicking on this parameter opens a selection window that enables the user to select the water meter type (Water Meter, Virtual Water Meter, or Private Water Meter), and number. Please note that when selectin a private water meter its number should be the same as the valve's number.
- Valve Data - Nominal Flow (M^3/h) - Set the Nominal flow-rate of the valve (the expected flow of the valve according to its pipeline engineering data).
- Valve Data - Irrigation Area (Dunam) - Set the area that is irrigated by this valve.

- Valve Data - Crop type - Select the crop name that is irrigated by this valve.
- Manual/Auto - Solenoid Status - Set the status of the valve's solenoid, the options are: Auto - the solenoid is in automatic mode, Open Man. - the solenoid is manually opened (a system alarm appears accordingly), Close Man. - the solenoid is manually closed.

The Information tab:

- Name - The name of the valve.
- Information - Valve Status - The current status of the valve, the options are: Not Active - Not defined, Active - the valve's configuration is correctly set, Irrigating - the valve is currently irrigating, Opened by Cond. - the valve is opened due to a system condition, Closed by Cond. - the valve is closed due to a system condition, Opened Manually - the valve is manually opened, Closed Manually - the valve is manually closed, Valve Fault - the valve is in fault, Invalid Output No. - the number of the output for this valve is invalid, Invalid Pipe Line No. - the line number for this valve is invalid, Negative Flow Def. - the nominal flow defined for this valve is negative, Invalid Plot No. - the number of plot defined for this valve is invalid, Invalid Wtr. Mtr. No. - the number of the water meter defined for this valve is invalid, Wtr. Mtr. Def. Err. - the definition of the water meter of this valve in incorrect, Missing Water Meter - no water meter is set for this valve, Limit exceeded Alarm - the valve exceeded its seasonal mater quota so the system issues an alarm, Limit Exceeded Pause - the valve exceeded its seasonal mater quota and the valve's operation is ceased, Limit + Open - although the valve exceeded its seasonal mater quota it is temporary opened, Fault + Open - although the is in fault it is temporary opened.
- Information - Current Flow-rate M^3/h - The current flow of the valve.
- Information - Is Conditioned - This parameter displays whether this valve is set to be controlled by any system Logic Condition, the options are: Idle - no Logic Condition is set to control this valve, Conditioned - there is a system Logic Condition set to control this valve, Opened by Condition - the valve is currently opened by a Logic Condition, Paused by Condition - the valve is currently paused by a Logic Condition, Ended by Condition - the valve is currently closed by a Logic Condition.
- Activated by - Irrigating at program No. - the valve is currently irrigating; this parameter displays the number of the irrigation program that opened it.
- Activate by - Programed in Prog. No. - The number of the first irrigation program that controls this valve.
- Activate by - Programed in Prog. No. - The number of the second irrigation program that controls this valve.
- Important Note: the valve may be controlled by more than two irrigation programs; however, this screen shows the first two programs only.
- Last Cycle Data - Water Delivered (m^3) - This parameter displays the water amount that was delivered by this valve at its last irrigation cycle. Note that if the valve is currently irrigating, this parameter displays, in real time, the progress of the amount of water delivered.
- Last Cycle Data - Duration (Min.) - the duration of the last irrigation cycle. Note that if the valve is currently irrigating, this parameter displays, in real time, the progress of the irrigation duration.
- Last Cycle Data - Flow Rate (m^3/h) - The last recorded flow-rate of this valve. Note that if the valve is currently irrigating, this parameter displays, in real time, the current flow-rate of the valve.
- Last Cycle data - Irrigation Date - The date of the last irrigation cycle of this wave.
- Alarms - No Water Pulse - This parameter displays whether the valve is in No Water Pulse Alarm (the valve was opened but no pulses are received from its designated water meter), the options are: OK - no alarm, Alarm - the valve is in No Water Pulse state and the system issued an Alarm message, Fault - the valve is in No Water Pulse state and the system stopped it and issued a Fault message.
- Alarms - Uncontrolled Water - This parameter displays whether the valve is in Uncontrolled Water Alarm (the valve should be closed but pulses are received from its designated water meter), the options are: OK - no alarm, Fault - the valve is in Uncontrolled Water Fault and the system stopped it.
- Alarms - Reset Alarms - press this button to reset the alarms of this valve.
- Daily Data - Water Delivered Today (m^3) - The amount of water irrigated by this valve from the beginning of the current day.
- Daily Data - Irrigation Duration Today (min.) - The accumulated duration of today's irrigation.
- Daily Data - Fert. "A" - the number of the first fertilizer pump of this valve, and the amount of fertilizer applied by it from the beginning of the current day.
- Daily Data - Fert. "B" - "G" - same as at Fert. "A" above.

- Accumulation Data - Accumulation Start Date - The date from which the accumulated data for this valve has started.
- Accumulation Data - Accumulated Water (m^3) - The amount of water delivered by this valve since the Accumulation Start Date.
- Accumulation Data - Accumulated Time (Hours:Minutes) - The accumulated time of irrigation by this valve since the Accumulation Start Date.
- Accumulation Data - Fert. "A" Accumulation (liter) - The accumulated fertilizer applied by fertilizer pump "A" since the Accumulation Start Date.
- Accumulation Data - Fert. "B" - "G" Accumulation - same as at Fert. "A" above.
- Accumulation Data - Too many Fert. Pumps for Accumulation - Important: the system can accumulate delivered fertilizers of up to 8 fertilizers pumps; the more than 8 fertilizer pumps can feed this valve, but only the first 8 pumps will be accumulated. The options are: OK - no additional fertilizer pump above the first 8 pumps is present, Too Many Fert. Pumps for Accumulation - more than 8 pumps are configured for this valve. Upon changing the fertilizer pump for this valve, the user can reset the accumulation of the old pump in order for the new one to be accumulated.
- Accumulation Data - Reset Accumulation - Press this button to reset the accumulated data for this valve, and for setting the Accumulation Start Date to the current date.
- Manual /Auto - Solenoid Status - Set the status of the valve's solenoid, the options are: Auto - the solenoid is in automatic mode, Open Man. - the solenoid is manually opened (a system alarm appears accordingly), Close Man. - the solenoid is manually closed.

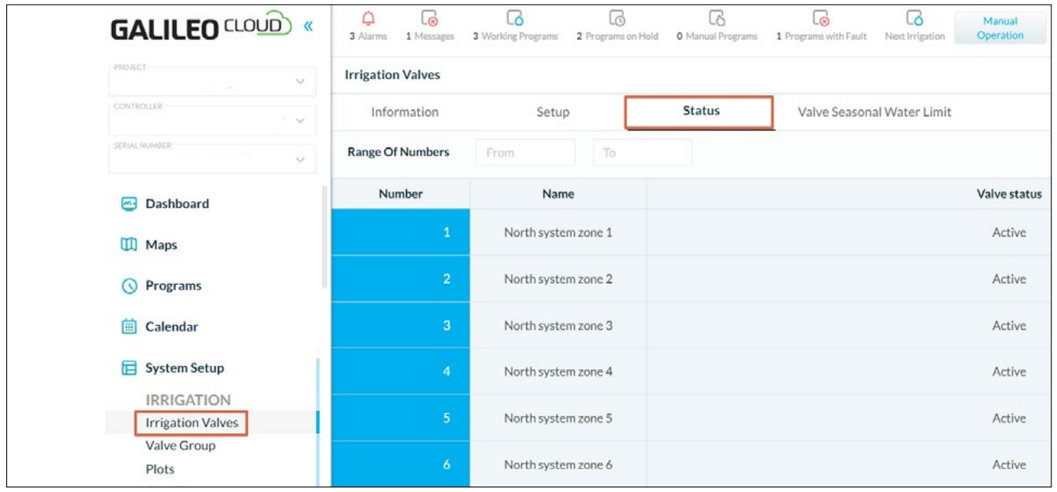
Very Important Note - the user can change the data presented in this screen; however, it is not advisable since it can cause inconsistent or incorrect data.

The Status tab:

This screen displays the status of all the valves that are configured in the system's hardware.

- For each valve the screen displays its number, name and status.
- The status options are: Not Active - Not defined, Active - the valve's configuration is correctly set, Irrigating - the valve is currently irrigating, Opened by Cond. - the valve is opened due to a system condition, Closed by Cond. - the valve is closed due to a system condition, Opened Manually - the valve is manually opened, Closed Manually - the valve is manually closed, Valve Fault - the valve is in fault, Invalid Output No. - the number of the output for this valve is invalid, Invalid Pipe Line No. - the line number for this valve is invalid, Negative Flow Def. - the nominal flow defined for this valve is negative, Invalid Plot No. - the number of plot defined for this valve is invalid, Invalid Wtr. Mtr. No. - the number of the water meter defined for this valve is invalid, Wtr. Mtr. Def. Err. - the definition of the water meter of this valve in incorrect, Missing Water Meter - no water meter is set for this valve, Limit exceeded Alarm - the valve exceeded its seasonal mater quota so the system issues an alarm, Limit Exceeded Pause - the valve exceeded its seasonal mater quota and the valve's operation is ceased, Limit + Open - although the valve exceeded its seasonal mater quota it is temporary opened, Fault + Open - although the is in fault it is temporary opened.

Valve seasonal water Quota:



This screen is used for setting and controlling the usage of a seasonal water quota for each system's valve. it is usually used by regional water supply authorities or by the managers of large irrigation projects.

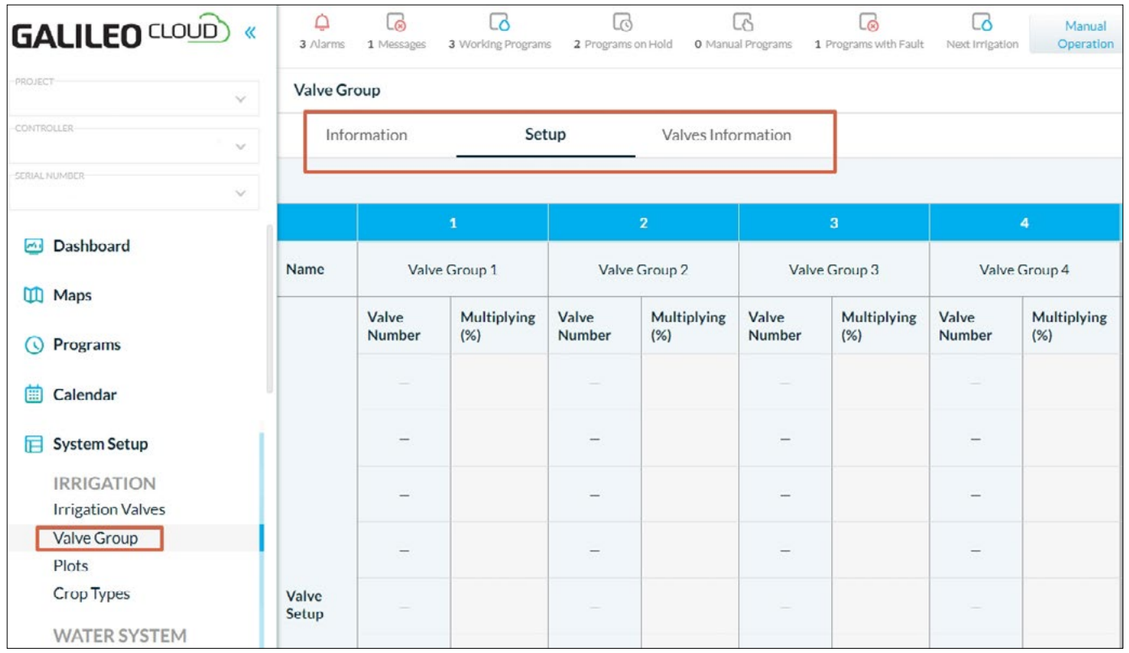
- Valve Number - The number of the valve.
- Quota (m^3) - Set the water quota for this valve.
- This screen has two control parameters:
- Reaction to Over Quota - Set the required system reaction to a situation where the valve exceeds its seasonal quota, the options are: Idle - no reaction to over quota status, Alarm - the system issues an Alarm only, Pause Valve - the system issues an Alarm and pauses the valve operation.
- Percentage of quota for Alarm (%) - This parameter is used for notifying the user that the seasonal water quota is about to be completed. Set the percentage of the quota for issuing an alarm, e.g., issue an alarm when 70% of the quota is used. Note that it is possible to set an above 100% number. In case where the system reaction is set to pause the valve, the valve will not reach more than 100% of the usage anyway, therefore a number greater than 100% is not relevant in this case. In case where the system reaction is set to alarm only, the system issues first alarm at 100% of the quota, and a second alarm when the usage exceeds the greater than the greater than 100% settings.
- Range of members - use this selection feature to display a required range of valves.

Define Valve Group

Entering the Valve Group tab of the System's Irrigation Tab, is done by clicking on the IRRIGATION -> VALVE GROUP entry of the Galileo main menu.

This screen has three tabs: Setup, Information, and Valves Information:

The Setup tab:



- Name - The name of the Group. A group is sort of a virtual valve that includes up to 10 real valves that can irrigate together once the group is set in one of the system's irrigation programs.
- Valve Setup - Valve number - Select the desired valves to participate in this group. A group may contain up to 10 valves.
- Multiplying (%) - This is an option to multiply the defined water amount of any valve in the group by a certain percentage (10% - 200%), according to the set percentage the system calculates the desired water amount per each valve and sums the water amounts of all the group's valves. The result is the water amount to be irrigated once this group's irrigation starts by one of the system's irrigation programs.
  Please note that the system includes a parameter that defines whether to end all the valves together by the end of the irrigation, or to continue each valve until it completes its water amount.

The Information tab:

Name - The name of the Group

- Status - The status of the group, the options are: Not Active - the group is not defined (it is not containing valves), Active - the group is correctly defined but it currently is not irrigating, Valve Def. Error - a valve that is included in this group is in definition error (the group cannot irrigate), Irrigating - the group is currently irrigating.
- Flow - Actual flow (m^3/h) - The current flow-rate of the group.
- Flow - Nominal Flow (m^3/h) - Sum of all the group's valves set flow-rate. The user can compare the Nominal and the Actual flow-rates for monitoring the system.
- Activated by - Irrigating in Program No. - When the group is irrigating this parameter displays the number of the irrigation program that activated the group.
- Activated by - Define in prog. - The number of the irrigation program that can open this group irrigation. Please note that if more than a single irrigation program is defined to open this group, only the program with the lowest number will appear here.

The Valves Information tab:

- Select valves group - select the range of valve groups to be displayed in this screen
- Name and number of the group - the name of the group together with its number.
- Valve No. - the numbers of the valves in the group
- Status - Not Active - no valve is defined to participate in this slot of the group, OK - the valve is correctly defined and it is not in fault, Error - this valve is in error (the group cannot irrigate, irrigating - the valve is currently irrigating.
- Irrigation Plan - the calculated water amount to be irrigated by the valve.
- Irrigation remains - the amount of water that remains until the end of the current irrigation of the valve.

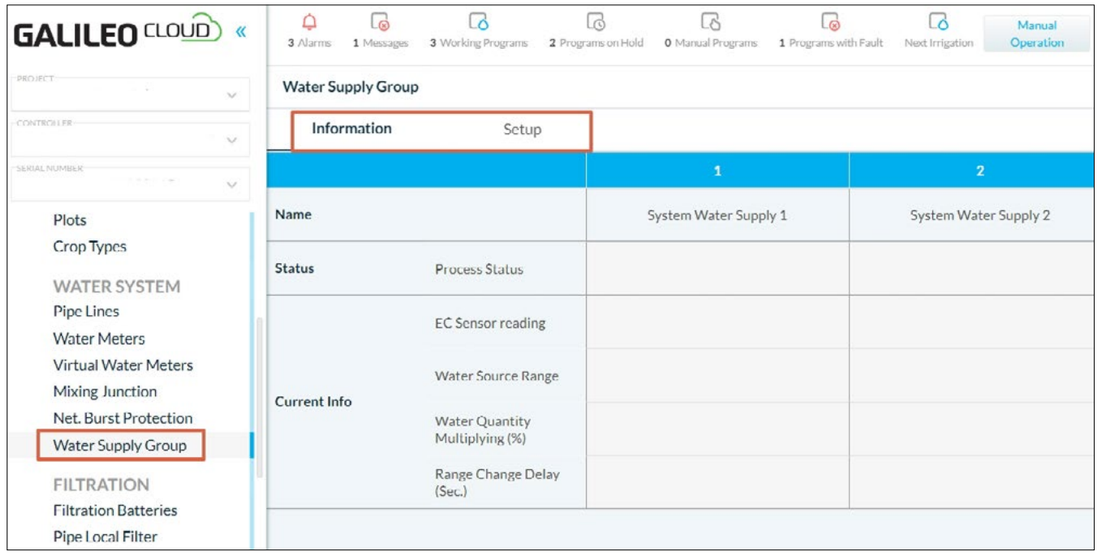
K.12. Water System Tab

Define System Water Supply

Entering the Define System Water Supply tab of the Water System Tab, is done by clicking on the WATER SYSTEM -> SYSTEM WATER SUPPLY entry of the Galileo main menu.

VALVE GROUP entry of the Galileo main menu.

This screen has two tabs: Setup and Information:



The Setup tab:

- Name - The name of the water supply - The Galileo system can control up to 4 different water supply systems (water sources).
  Important Note: The usage of each water supply is defined by the fertilizer centers since the quality of the water from each water supply (source) effects the fertigation programs of the fertilizer center.
- Definition - Operation Method Definition - The control method according to which this water supply operates, the options are: Not active - this water supply is not active. By EC - the water source operates according to an EC reading, By time - the water supply is controlled by time frame.
- Definition - Supplying to Pipe Line Number - The number of the pipe line that receives water from this water supply source.
- Definition - EC Sensor Number - The number of the EC sensor that this water supply reads.
- Definition - EC Measurement delay (Sec.) - The delay time in seconds that prevents unnecessary system reaction due to momentary change in the EC reading.
- Definition - Minimum time in range (Sec.) - Once the water supply enters to a range, it must stay in this range at

least for a minimal time as defined in this parameter.

- Operation Range A - Start Time for Operation by Time - when the operation method of the water supply is by time, this parameter defines the start time of the operation.
- Operation Range A - Stop Time for Operation by Time - when the operation method of the water supply is by time, this parameter defines the stop time of the operation.
  Note: in case of a mix between the operation timing of the ranges, the system will remain in the first started range.
- Operation Range C – highest EC level for this range – this is the highest EC reading available for this range.
- Operation Range C – lowest EC level for this range – this is the lowest EC reading available for this range.
- Operation Range C – Multiplying Water Quantity (%) - multiply the irrigation water quantity by this parameter percentage when the water source is in range.
- Stop Fert. when – EC lower than range A – stop the fertigation if the EC reading is below the range A definition, the options are: Idle – do not stop the fertigation due to this parameter, Stop – stop the fertigation according to this parameter.
- Stop Fert. when – EC higher than range C - stop the fertigation if the EC reading is above the range C definition, the options are: Idle – do not stop the fertigation due to this parameter, Stop – stop the fertigation according to this parameter.

The Information tab:

- Name - The name of the water supply.
- Status - Process status - The current status of the water supply (source), the options are: Not Active - the water supply is defined correctly but currently it is not irrigating, Active - the water supply is defined correctly, it is irrigating, but no fertigation range has changed by it yet, Irrigating - the water supply is irrigating.
- Current Info - EC Sensor Reading - the current reading of the EC sensor of this water supply.
- Current Info - Water Source Range - the current range of the water source, the options are: Not defined - the water supply is not defined, Range "A" - the water supply is in range A, Range "B" - the water supply is in range B, Range "C" - the water supply is in range C, Below range A - the water supply is below range A, Above Range C - the water supply is above range C, Checking - The system checking if there is a need to change the current operation range.
- Current Info - Water Quantity Multiplying (%) - The current multiply percentage of the water quantity (10% - 200%).
- Current Info - Range Change Delay (Sec.) - The system is about to change range, and for preventing unnecessary change due to temporary EC change, it is counting down the delay.

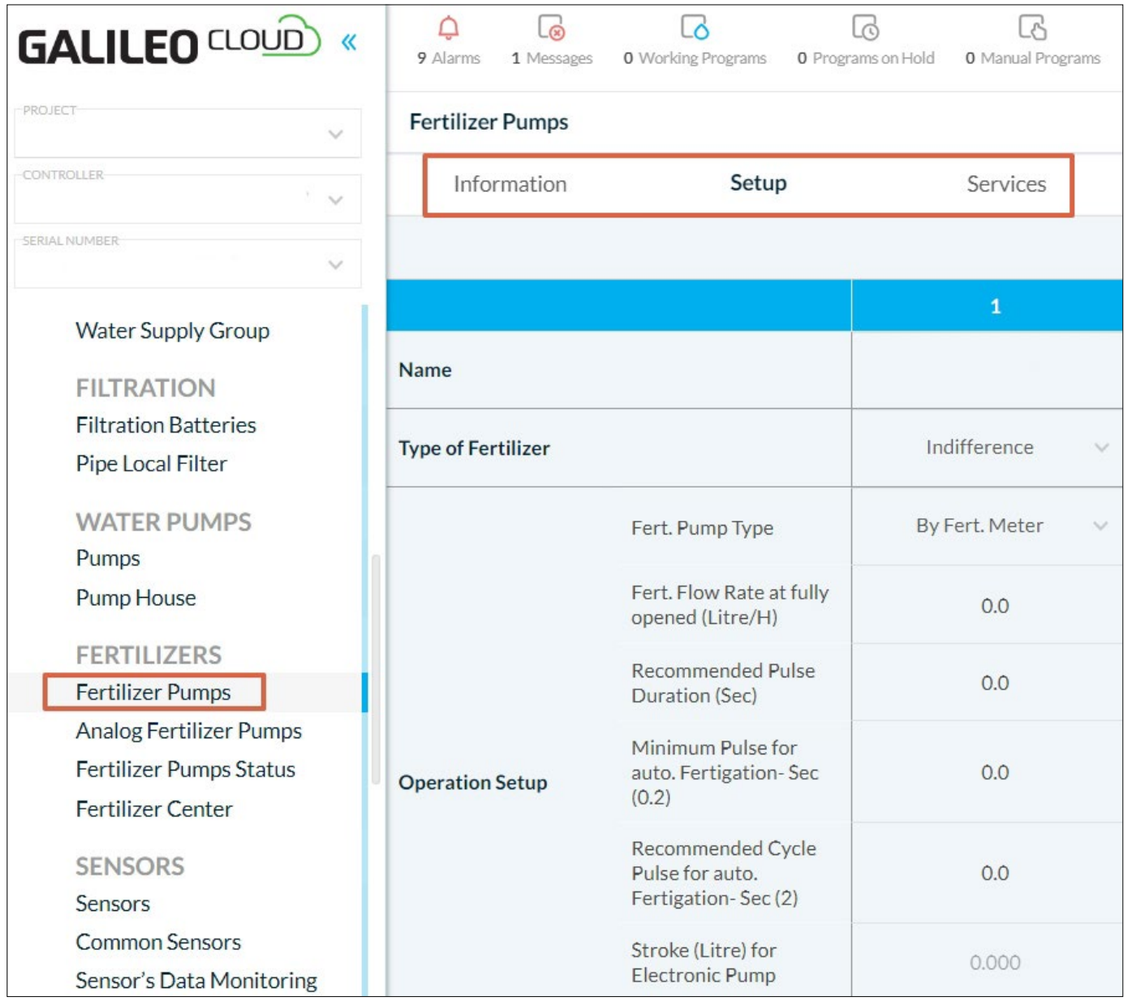
K.13. Fertilizers Tab

Define Fertilizer Pumps

Entering the Fertilizer Pumps tab of the Fertilizers Tab, is done by clicking on the FERTILIZERS -> FERTILIZER PUMPS entry of the Galileo main menu.

This screen has 2 tabs: Setup and Information: **Important,** for analog fertilizer pumps there are additional Setup and information screens under the FERTILIZING -> ANALOG FERTILIZER PUMP entry of the Galileo main menu.

The Fertilizer Pump Setup tab:



Very Important Note: Galileo system distinguishes between two main type of fertigation methods: Automatic Fertigation and Regular Fertigation.

Automatic Fertigation is caried out by fertilizers centers in order to control the irrigation water quality; the system takes into account the parameters of the water quality in the water source (such as EC and pH **Note:** currently only the EC level is measured), and physical definition parameters of the various types of the system fertilizer pumps. During operation and according to the user fertigation requirements, the system calculates the fertilizer concentration in the water, the injection rate, the fertilizer accumulation and other parameters in order to adjust the operation plans for the best possible performance, even when no fertilizer meters are connected to the specific fertigation center.

In Regular Fertigation the system operates fertilizer pumps that are directly connected to the irrigation valve, in this case the water quality is not taken into account and the system injects fertilizer according to the water and the fertilizer pulses received from the fertilizer pump, fertilizer meter and water meter.

In addition to the hardware outputs and inputs of the fertilizer pumps, the system can add special outputs to the pumps, for main fertilizer valve, booster valve, and other such tasks; regularly these outputs are used to control the outlet valve of the fertilizer tanks.

Please Note that:

1. Most of the setup parameters on this screen are used for the Automatic Fertigation method.
2. At the upper line of the setup screen the selection dropdown box allows the user to select and see out of the 40 possible fertilizer pumps, only pumps that are defined in the Galileo hardware. The numbers at the top row of the table are the actual numbers of the hardware-defined fertilizer pumps.
3. The Galileo system can control two distinguished types of fertilizer pumps; district pumps and analog pumps. When setting a fertilizer pump that is not of an analog type, the 2 tabs under the Fertilizer Pump tab are in use (Setup, and Information), however when the fertilizer pump is of an analog type, the user is required to setup additional parameters for this type of pump, parameters that appear under the Analog Fertilizer Pump tab entry of the Galileo main menu (Setup, General Setup, According Fertilizing Type, and Information).
4. Fertilizer Injection Flow-rate calculation - The Galileo system uses the flow-rate of the fertilizers injection for controlling the various fertigation control processes, for calculating the applied fertilizers amounts and for issuing alarms and faults. The system has three distinguished types of fertilizer flow- rate calculation:
   - 4.1. Fertilizer pumps that have a dedicated fertilizer meter - in this case the injection flow-rate, the fertilizer accumulation and the fertilizer fault/alarms are based on the fertilizer meter readings.
   - 4.2. Fertilizer pumps that have no fertilizer meter - in this case the injection flow-rate, the fertilizer accumulation and the fertilizer fault/alarms are based on mathematical calculation that are based on the type of the pump (Venturi, Electrical, Electronic, etc.), its full pulse volume, its stroke size, and other such parameters.
   - 4.3. Fertilizer pumps that have a dedicated fertilizer meter, but for achieving the most accurate control, the system mathematically calculates their injection rate, but uses the fertilizer meter's readings for the accumulation recording and for the fault/alarm control and messaging.

The following is a description of the non-analog Fertilizer pump Setup screen:

- Name - Set a name for the fertilizer pump.
- Type of Fertilizer - Select the type of the fertilizer that is injected by this pump, the options are: Indifference - this fertilizer type is not affecting the quality of the irrigation water, EC - this fertilizer type, when applied in automatic fertigation affects the EC level of the irrigation water, pH - this fertilizer type, when applied in automatic fertigation affects the pH level of the irrigation water, OH - this fertilizer type (bicarbonate) is used in automatic fertigation to compensate for un-ordinary pH level of the irrigation water. Note that the actual fertigation programs, take into account the type of the injected fertilizer, for correctly calculating their operation regime.
- Operation Setup - Fert. Pump Type - Set the type of the fertilizer pump, the options are: Not Active - this pump is not defined, Electronic - the pump type is electronic (its stroke size is used by the system when controlling an automatic fertigation), Electric - the pump type is electric (the pump's flow rate and its recommended pulse duration are used by the system when controlling an automatic fertigation), Venturi - the pump type is venturi (the pump's flow rate and its recommended pulse duration are used by the system when controlling an automatic fertigation), By Fertilizer Meter - the pump's has a pulse-meter (for automatically operate the pump, and for calculating its flow-rate), Analog - the pump is an analog pump and it requires additional setup parameters for correctly operating (see the Analog Fertilizer Pump setup screen for details).
- Operation Setup - Fert. Flow-rate at fully opened (L/H) - Set the maximal injection rate of the pump in liters per hour.
- Operation Setup - Recommended Pulse Duration (Sec.) - the recommended duration of the controller's injection pulses applied to this pump. This parameter is used for pumps that has no fertilizer flow-meter (section 4.2 above), or pumps that have a fertilizer meter but the system mathematically calculates their injection flow-rate (section 4.3 above). In such case enter the recommended pulse duration in seconds. Important note: Since the value of this parameter depends on the pump's type (Venturi, Electrical, Electronic, etc.), you are requested to consult with Galileo Technicians for the correct recommended value for your specific pump type.
- Operation Setup - Minimum Pulse (Sec.) (0.2) for Automatic Fertigation - in automatic fertigation that is carryout by electric or venturi pumps, the system controls the length of the pulse (shorter or longer) in order to reach the desired EC or pH of the irrigation water. The minimal pulse length protects the system against too short pulses that are not conveying the fertilizer correctly. The Minimum Pulse length varies according to the pump type, however for venturi pumps the recommended minimal pulse length is 0.2 seconds.
- Operation Setup - Recommended Cycle (Sec.) (2.0) for Automatic Fertigation - This parameter is used for pumps that has no fertilizer flow-meter (section 4.2 above), or pumps that have a fertilizer meter but the system mathematically calculates their injection flow-rate (section 4.3 above). In cases where the pump's pulse size is fixed, the control of the automatic fertigation is done by changing the time between pulses, in such case enter the recommended cycle (the On time + the Off time) for this pump, in seconds. Important note: Since the value of this parameter depends on the pump's type (Venturi, Electrical, Electronic, etc.), you are requested to consult with Galileo Technicians for the correct recommended value for your specific pump type.
- Operation Setup - Electronic Stroke (Liter) - for electronic pumps in automatic fertigation, set the pump's stroke size in liters (this is similar to a pulse volume of a fertilizer meter). Please note: when setting a pump as an electronic pump type, the user must set also the stroke volume size for the pump, otherwise the setup screen cannot be saved.
- Operation Setup - Water/Fert. Distribution method - the method of distributing the fertilizer pulses between the water pulses, the options are continuous operation and divided operation. For example: If the system needs to apply 3 pulses of fertilizer per every water pulse, then in continuous operation the system will apply the 3 fertilizer pulses immediately after receiving the water pulse. In divided operation the system will divide the 3 fertilizer pulses in between two water pulses.
- Fault Setup - No Fert. Pulse (Sec.) - This parameter is valid for fertilizer pumps that are connected to a fertilizer meter. When such pump is in fertilizing mode, and no fertilizer pulse is received from its designated fertilizer meter during the time in seconds set in this parameter, the pump's operation stops and the system issues an alarm.
- Fault Setup - Uncontrolled Fert. (liter) - This parameter is valid for fertilizer pumps that are connected to a fertilizer meter. When the pump is not in fertilizing mode, and fertilizer pulses are received from its designated meter, the system enters to an uncontrolled fertilizer fault and issues an alarm when the volume of uncontrolled fertilizer pulses exceeds the number of liters set in this parameter. Please note that in cases where the fertilizer pulses are divided between the water pulses, and the fertilizer pulse count between two water pulses exceeds the required number, the system compensates by reducing the number of fertilizer pulses between the next two water pulses accordingly, (such case may happen when the reaction of the fertilizer pump to the controller's commands is slow). However, if the volume of the extra fertilizer pulses between two water pulses exceeds the volume set in this parameter the system enters to uncontrolled fertilizer fault.
- Fault Setup - Auto cancel No Fert. Alarm - Set whether this fertilizer pump participates in the system feature of automatically resetting alarms after a predefined time period, the options are: Yes and No. **Very important note:** The system will never automatically reset an Uncontrolled Fertilizer alarm, it can automatically reset only the "No Fert. pulses Alarm". In case of uncontrolled fertilizer alarm, the user must manually check and fix the problem before manually resetting the alarm.
- Connections - Fert. Main Output - This parameter displays whether a main output is defined in the hardware configuration for this pump, such output may be used as a main valve the opens the outlet of the fertilizer tank or as a fertilizer booster pump, etc. The options are: Defined or Not Defined. Whenever the pump has to start fertilizing, this output will be opened few seconds before the pump's start command.
- Connections - Fert. Open Output - This parameter displays whether a hardware output is defined in the hardware configuration for this pump. If such output is not defined the pump is not operational and it is not displayed in the screen.
- Connections - Fert. Close Output - This parameter displays whether a second hardware output is defined in the hardware configuration for closing this pump operation, the options are Defined or Not Defined. Such output is used in pumps that use two outputs; one for increasing the injection rate and the other for decreasing the injection rate. For analog pumps these two outputs must be configured in the controller's hardware, otherwise they will be in Definition Error mode.
- Connections - Fert. Flow Element Type - The type of the system's fertilizer flow calculation, the options are: None - no measurement device is connected to this pump, Discrete - for a pump with a digital fertilizer meter (pulse), or Analog - for pumps that have a sensor connected to a hardware analog input, that transmits the actual fertilizer flow-rate to the controller.
- Connections - Fertilizer Meter - This parameter displays whether a fertilizer meter input is defined in the hardware configuration for this pump, the options are: Defined or Not Defined.
- Connections - Pulse Volume (Liters) - For pump with a discrete water meter, set the volume of fertilizer (in liters)

that is injected per a single pulse received from the meter. Note that a defining a fertilizer meter without defining its Pulse Volume causes a fault alarm.

- Connections - Analog Sensor Number - For pumps with analog flow element type, select the number of the sensor that transmits this pump's flow-rate to the controller.
- Additional Connections - Water Meter Number - For a regular fertilizer pump (that is not operated by a fertilizer center), set the number of the water meter that is used by the system for calculating the fertigation Water/Fert. Ratio. Note that a pump that doesn't have a water meter can operate only for fertigation by minutes, liters, liter per dunam, and other such quantity fertigation parameters.
- Additional Connections - Connected to Pipeline Number - For a regular fertilizer pump (that is not operated by a fertilizer center), set the number of the Pipe Line that this pump injects fertilizer to. Note that fertigation cannot take place if a Pipe Line is not selected in this parameter.
- Additional Connection - Pipe Line Fill Delay for Fert. (Sec) - Set the pipeline fill delay for making sure that the fertigation of a regular fertilizer pump (that is not operated by a fertilizer center), is taking place only after the pipeline, to which it injects fertilizer, reaches its stabilized pressure.

The Fertilizer Pump Information tab:

Important - this screen is the Information tab of the fertilizer pumps, however for analog fertilizer pumps please refer to the additional information tab for analog fertilizer pumps that can be found under the Analog Fertilizer Pumps Entry of the Galileo Main Menu.

Please Note that:

At the upper line of the Information screen the selection dropdown box allows the user to select and see out of the 40 possible fertilizer pumps, only pumps that are defined in the Galileo hardware. The numbers at the top row of the table are the actual numbers of the hardware-defined fertilizer pumps.

- Name - The name for the fertilizer pump.
- Current Status - Fertilizer Pump Status - The current status of the fertilizer pump, the options are: Not Active - the pump is not defined, Active - the pump is correctly defined but currently it is not fertilizing, Fertilizing - the pump is currently fertilizing, Fault- the pump is in fault, Type Error- the pump type definition is incorrect, Output Def. Error - one of the pumps outputs is incorrectly defined, Pipeline Def. Error - the pump's pipeline definition is incorrect, Fert. Meter Def. error - the definition of the pump's fertilizer meter is incorrect, Pulse size Error - the pulse size of the pump's meter is incorrect, Flow Def. Error - the definition of the pump's flow-rate is incorrect, Pulse Time Def. Error - the pump's pulse type is incorrect, Double Fert. Center - the pump is defined in more than a single fertilizing center, Water Meter Number Error - the water meter number of this pump is incorrect, Water Meter Def. Error - the definition of the pump's water meter is incorrect, Full Opening Time Error - for analog pump its full opening time definition is incorrect, Sensor Number Error, the flow sensor number of this pump is incorrect, Sensor Def. Error - the definition of the flow sensor is incorrect.
- Current Status - Fert. Unit - The fertilizing unit of the pump, the options are: Liter, MM.SS, L/dunam, L/M^3, Calc. Ratio (calculated ration- the fertilizer is applied evenly along the irrigated water).
- Current Status - Pump Flow Rate (L/H) - The current flow rate of this pump.
- Current Status - Programmed Fert. - The planed required fertilizer, as appears in the fertilization program of this pump.
- Current Status - Adjusted Fert. - The current actual fertilizing operation of the pump.
- Current Status - Adjusted by Sensor - For fertigation by EC or pH this parameter displays, the options are: N/A - not applicable - the fertigation is not controlled by water quality sensors, EC - Controlled by EC sensor, pH - Controlled by pH sensor, oH - controlled by oH sensor.
- Additional Connections - Water Meter Type - The type of the water that consoles the fertigation of this pump, the options are: Private water meter, virtual water meter, Water meter.
- Additional Connections - Water Meter No. - The number of the water meter that controls this pump.
- Additional Connections - Pipe Line No. - The number of the pipe line that is fertilized by this pump.
- Additional Connections - Fert. Center No. - The number of the fertilizer center that controls this pump (0 = not controlled by a fertilizer center).

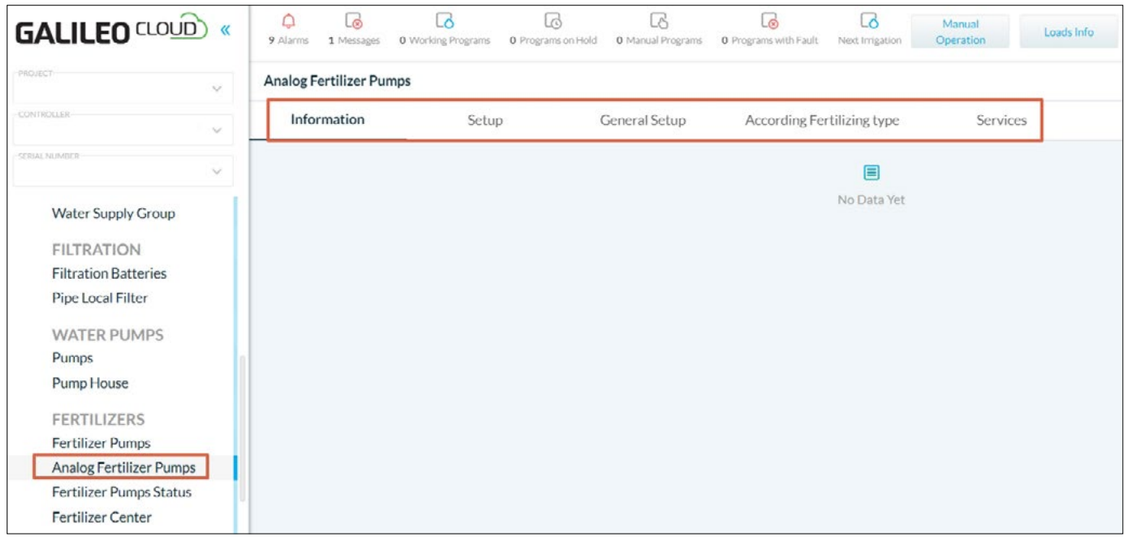
- Used by program - The number of the first irrigation program that uses this fertilizer pump.
- Important Note: the pump can be controlled by up to 5 irrigation programs at the same time; this screen displays the numbers of the irrigation programs that currently using this pump.
- Accumulation Data - Daily Fert. (Liter) - The amount of fertilizer applied by this pump since the beginning of the current day.
- Accumulation Data - Seasonal Accum. (L) - The total amount of fertilizer applied by this pump since the beginning of the season.
- Accumulation Data - Accum. Start Date - The beginning date of the current season.
- Restart Accumulation - Reset the fertilizers accumulations and set the Accumulation Start Date to the current date.
- Uncont. Fert. (liter) - The current count of the uncontrolled fertilizer pulses in liters. Once this parameter reaches the number of liters defined in the Uncontrolled Fertilizer Fault setup, the system enters to fault mode.
- Faults - Uncontrolled Fert. - Displays whether the pump is in Uncontrolled Fertilizer alarm, the options are: OK or Alarm.
- Faults - No Fert. Pulse - Displays whether the pump is in No Fertilizer Pulse alarm, the options are: OK or Alarm.
- Faults - Flow Rate Fault - Displays whether the pump is in Flow- Rate alarm, the options are: OK, Fert. flow too high, Fert. Flow too low.
- Cancel Alarm - Press this button to reset this pump's alarms.
- Output Test - 15 sec. Pulse - This button is used for checking the operation of the pump's hardware output. Once the button is pressed, the output opens for 15 seconds and the button label changes From Start to Stop. If the user doesn't press Stop the output is automatically close after 15 seconds and the system returns to regular operation.

Define Analog Fertilizer Pumps

Entering the Analog Fertilizer Pumps tab of the Fertilizers Tab, is done by clicking on the FERTILIZERS -> ANALOG FERTILIZER PUMPS entry of the Galileo main menu.

Important - this screen has the Setup, General Setup and Information tabs of the analog fertilizer pumps, please make sure to set the basic parameters of the analog pumps in the regular fertilizer pumps setup screen before setting the additional parameter required in this screen.

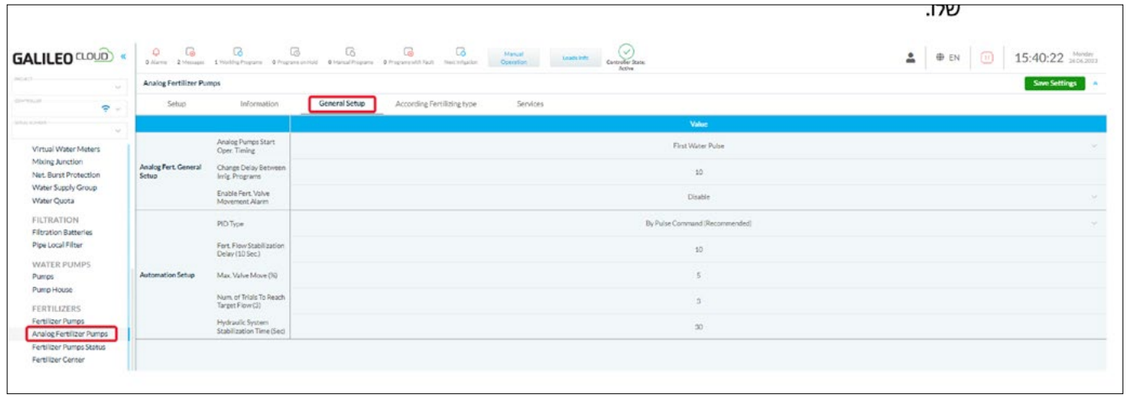
The Analog Fertilizer Pump setup tab:



- Name - Set a name for the analog fertilizer pump.

- Analog Fertilizer Pump Setup - Fert. Flow-rate at fully opened (L/H) - Set the maximal injection rate of the pump in liters per hour.
- Analog Fertilizer Pump Setup - Valve full movement time (Sec.) - Enter the time in seconds that take for the pump's valve to move from fully closed to fully opened status.
- Analog Fertilizer Pump Setup - First open step on start fertigation (0-20%) - Set the required position of the pump's opening percentage at the beginning of a new irrigation cycle (between 0-20%).
- Analog Fertilizer Pump Setup - Minimum Auto Pulse (Sec.) (0.2) for Automatic Fertigation - in automatic fertigation that is carryout by an analog pump, the system controls the length of the pulse (shorter or longer) in order to reach the desired EC or pH of the irrigation water. The minimal Auto Pulse is the shortest allowed pump's movement command length and it protects the system against too short pulses that are not conveying the fertilizer correctly. The recommended minimal pulse length is 0.2 seconds.
- Analog Fertilizer Pump Setup - Ignore Fert. Flow - Below (L/H) - This parameter is used for analog fertilizer pumps, that their meters measure the flow correctly only when the flow is higher than a certain minimal flow. For such meters, set the flow rate that below it the meter readings should be ignored.
- Fert. Flow PID Setup - Proportion Coefficient - Kp (0.15) - This is the setup of the P portion of the pump's PID operation. Important: do not change this parameter if you are not familiar with PID control.
- Fert. Flow PID Setup - Integral Coefficient - Kp (0.15) - This is the setup of the I portion of the pump's PID operation. Important: do not change this parameter if you are not familiar with PID control.
- Fert. Flow PID Setup - Derivative Coefficient - Kp (0.15) - This is the setup of the D portion of the pump's PID operation. Important: do not change this parameter if you are not familiar with PID control.
- Fert. Flow PID Setup - Max. Valve Move -Sec. (5) - Set the maximal movement time of the pump's valve while the pump's movement control is operated by PID control.

The Analog Fertilizer Pump General Setup tab:



This screen defines General parameters that are applicable for all the system's analog fertilizer pumps.

- Analog Fert. General Setup - Analog Pumps Start Operation Timing - Set the required start operation timing of the system's analog fertilizer pumps, the options are: Irrigation Start - start the fertilizer pumps operation immediately upon the start of the irrigation process, First Water Pulse - start the fertilizer pumps operation upon receiving the first water pulse of the irrigation process, Water Flow Above Zero - start the fertilizer pumps operation only upon beginning receiving the water flow rate reading. Important note: In case where the irrigation program includes Water Before Fert. setting, the Start Operation Timing parameter is not applicable.
- Analog Fert. General Setup - Change Delay Between Irrigation Programs - when one of the irrigation programs, that uses analog fertilizer pump, ends, and another irrigation program that uses the same fertilizer pump starts, the pump's required flow rate will not be changed by the system during the transition between these two irrigation programs, until the delay parameter time ends.
- Analog Fert. General Setup - Enable Fert. Valve Movement Alarm - Enable or disable the option of issuing an alarm when the fertilizer flow doesn't reach the required level within the time in minutes, set in an internal software parameter, even though the pump's opening level changed.

- Automation Setup - PID Type - The type of the system's PID, the options are: By percentage or By Pulse Command (recommended).
- Automation Setup - Fert. Flow Stabilization delay (10 Sec) - Set the PID stabilization delay for the analog pumps' operation (this is the time between two cycles of fertilizer flow adjustment by the PID process). The default is 10 seconds.
- Automation Setup - Max. Valve Movement (%) - For PID By Percentage type, set the maximal allowed movement of the pump's valve in a single adjustment cycle.
- Automation Setup - Number of Trials to Reach the Target flow (3) - When controlling the water quality by analog fertilizer pumps, set the maximal trials to reach the required flow target. If the system cannot reach the target within the set number, the system calculates the required flow again according to the current water quality reading.

The Analog Fertilizer Pump According to fertilizer Type tab:

This tab set controls the analog pumps according to their set fertilizer type.

There are 3 types of fertilizers for the analog pumps: EC fertilizer type, pH fertilizer type, and General fertilizer type.

- Maximal Auto percentage increase (Decrease) - between 0-100% - The maximal pump's movement command step, in %, when the flow rate of the pump should be increased or decreased.
- Max. Auto percentage decrease - between 1-100% - The maximal pump flow change step in % when the flow rate of the pump should be decreased.
- Target Threshold band - between 1-5% -The reached level above and below the required target that is still considered as target reached.
- Significant Flow Change - % (10%) - Set the flow change (in percentage) that is considered as significant change by the PID process.
- Derivative Flow Domain % (30%) - Set the

The Analog Fertilizer Pump Information tab:

- Name - The name of the analog fertilizer pump.
- Current Fert. Info - Fertilizer Pump Status - The current status of the fertilizer pump, the options are: Not Active - the pump is not defined, Active - the pump is correctly defined but currently it is not fertilizing, Fertilizing - the pump is currently fertilizing, Fault- the pump is in fault, Type Error- the pump type definition is incorrect, Output Def. Error - one of the pumps outputs is incorrectly defined, Pipeline Def. Error - the pump's pipeline definition is incorrect, Fert. Meter Def. error - the definition of the pump's fertilizer meter is incorrect, Pulse size Error - the pulse size of the pump's meter is incorrect, Flow Def. Error - the definition of the pump's flow-rate is incorrect, Pulse Time Def. Error - the pump's pulse type is incorrect, Double Fert. Center - the pump is defined in more than a single fertilizing center, Water Meter Number Error - the water meter number of this pump is incorrect, Water Meter Def. Error - the definition of the pump's water meter is incorrect, Full Opening Time Error - for analog pump its full opening time definition is incorrect, Sensor Number Error, the flow sensor number of this pump is incorrect, Sensor Def. Error - the definition of the flow sensor is incorrect.
- Current Fert. Info - Fert. Valve Status - The current status of the pump's valve, the options are: Closed, Opening, Closing, Fertigating.
- Current Fert. Info - Required Fert. flow (Liter/m^3) - This is the required flow rate as set in the fertigation program.
- Fert. Flow Control Info. - Required Fert. (liter/m^3) - The currently required fertilizing program of the analog fertilizer pump, as calculated by the system's automation process.
- Fert. Flow Control Info. - Current Fert. Flow (liter/Hour) - The current flow-rate of the analog fertilizer pump.
- Fert. Flow Control Info. - Required Fert. Valve Location % - The required opening position of the analog pump valve, as calculated by the system's automation process.
- Fert. Flow Control Info. - Current Fert. Valve opening position % - The current opening position of the analog pump valve.
- Fert. Flow Control Info. - PID Stabilization Delay Sec. - Displays the stabilization delay countdown.
- Accumulation Data - Daily Fert. (Liter) - The amount of fertilizer applied by this pump since the beginning of the current day.

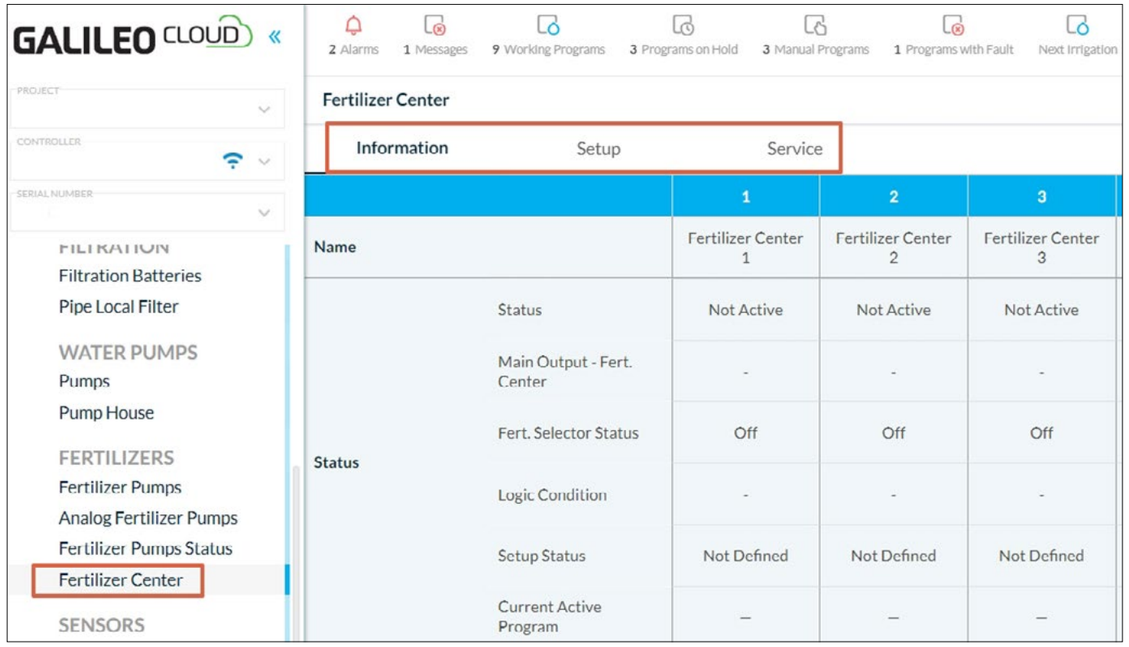
- Accumulation Data - Seasonal Accum. (L) - The total amount of fertilizer applied by this pump since the beginning of the season.
- Accumulation Data - Accum. Start Date - The beginning date of the current season.
- Restart Accumulation - Reset the fertilizers accumulations and set the Accumulation Start Date to the current date.
- Alarms and Faults - Uncont. Fert. (liter) - The current count of the uncontrolled fertilizer pulses in liters. Once this parameter reaches the number of liters defined in the Uncontrolled Fertilizer Fault setup, the system enters to fault mode.
- Alarms and Faults - Uncontrolled Fert. - Displays whether the pump is in Uncontrolled Fertilizer alarm, the options are: OK or Alarm.
- Alarms and Faults - No Fert. Pulse - Displays whether the pump is in No Fertilizer Pulse alarm, the options are: OK or Alarm.
- Alarms and Faults - Flow Rate Fault - Displays whether the pump is in Flow- Rate alarm, the options are: OK, Fert. flow too high, Fert. Flow too low.
- Cancel Alarm - Press this button to reset this pump's alarms.
- Restart Fert. Pump - Press this button to stop the pump and restart its operation (the system re-calculates all the pump's operation parameters.

Define Fertilizer Center

Entering the Fertilizer Center tab of the Fertilizers Tab, is done by clicking on the FERTILIZERS -> FERTILIZER CENTER entry of the Galileo main menu.

The Galileo system has up to 8 fertilizer centers, and their setup process is described in the following paragraphs.

The Fertilizer Center setup tab:



- Name - Set a name for the Fertilizer Center.
- Setup - Fert. Pump A - Select the first fertilizer pump that is controlled by this fertilizer Center.
- Setup - Fert. Pump B - Select the second fertilizer pump that is controlled by this fertilizer Center.
- Setup - Fert. Pump F - Select the sixth fertilizer pump that is controlled by this fertilizer Center.
- Setup - Main Output - Fert. Center - Select the output that is used as the main output for this fertilizer center, as defined in the system hardware.

- Setup - Connected Pipe Line - Select the number of the pipeline that is fertigated by this fertilizer center.
- Setup - Water Meter Number - Select the number of the water meter that all the fertigation programs of this center are related to.
- Setup - Controlled Water Junction Number - Select the number of the mixing junction that supplies water to this fertilizer center. This fertilizer center also sets the required mixing program for the mixing junction.
- Setup - Fertigating According to System's Water Supply Number - Select the number of the Water Supply (one of four), that this fertilizer center fertigates according to its water quality.
- Setup - Start Delay After Pipe Open (Sec.) – upon startup, in order to conserve unnecessary movement time, the system starts from the last fertigation setpoints. The system counts the delay entered in this table's parameter and only then and if needed starts to move the pumps settings according to the system's fertigation automation process.
- Setup - Main Fert. Center Output status During Water Before or After - Set the required state of the Main Fertilizer Center Output when the irrigation is in its Water Before Fert. or Water After Fert. periods, the options are: Auto - keep the main output opened when the irrigation is in its Water Before Fert. or Water After Fert. periods, Stop - close the main output during Water Before Fert. or Water After Fert. periods.
- Setup - Stop Center during Pump Fault - Select the fertilizer center reaction to no pulse fault in one (or more) of its fertilizer pumps, the options are: Continue - continue operation with the remaining pumps, Stop - stop the fertilizer center operation. Note: in uncontrolled Fert. fault in one of its fertilizer pumps, the fertilizer center stops it operation.
- EC - pH Automation Setup - EC Sensor - Select the EC sensor that this fertilizer center operates according to its readings.
- EC - pH Automation Setup - pH Sensor - Select the pH sensor that this fertilizer center operates according to its readings.
- EC - pH Automation Setup - EC/pH Data logging cycle (Min) - Set the time interval for recording the EC and pH readings to the system's Logs.
- EC - pH Automation Setup - Auto. Fert. Method - Select the fertilizer center automation's control method, the options are: change pulse length time, or change wait time.
- EC - pH Automation Setup - Lock Auto. Change During Prog. Overlap - When one of the irrigation programs that use this fertilizer center stops and another program starts, the water flow rate may be changed. Therefore, the user may decide to lock the fertilizing automation process at its current state during the irrigation programs change. The options are: Yes, or NO.
- EC - pH Automation Setup - Water Flow calculation for fertilizing - Select the type of the water flow calculation for operating the fertilizing process of this center, the options are: Time between last 2 pulses - the water flow for fertilizing is calculated according the time passed between the last two water pulses, or Current Flow - the water flow for fertilizing is based on the regular system flow-rate calculation which takes into account more water pulses than the last two.
- EC - pH Automation Setup - Automation Start Delay (Sec) - When an irrigation program starts fertilizing it starts to apply the fertilizer according to its basic program, the fertilization automation control starts only at by the end of the delay, as set in this parameter.
- EC - pH Automation Setup - EC/pH Stabilization delay (Sec) - Set the stabilization delay of the EC/pH PID operation Cycles.
- EC - pH Automation Setup - Max EC Fert. Increase (%) - Set the maximal allowed EC increase by the automation process (in %) over the basic fertilizing program.
- EC - pH Automation Setup - Max EC Fert. Decrease (%) - Set the maximal allowed EC decrease by the automation process (in %) over the basic fertilizing program.
- EC - pH Automation Setup - Max pH Fert. Increase (%) - Set the maximal allowed pH increase by the automation process (in %) over the basic fertilizing program.
- EC - pH Automation Setup - Max pH Fert. Decrease (%) - Set the maximal allowed pH decrease by the automation process (in %) over the basic fertilizing program.
- Alarm Setup - EC Low Deviation for Fert. Alarm - Set the lowest EC level that below it the system issues an Alarm

message.

- Alarm Setup - EC High Deviation for Fert. Alarm - Set the Highest EC level that above it the system issues an Alarm message and stops the operation of the EC fertilizer pump until the reading returns to the normal.
- Alarm Setup - pH Low Deviation for Fert. Alarm - Set the lowest pH level that below it the system issues an Alarm message and stops the operation of the pH fertilizer pump until the reading returns to normal.
- Alarm Setup - pH High Deviation for Fert. Alarm - Set the Highest pH level that above it the system issues an Alarm message. Please note that for OH fertilizer pump the system stopes the OH pump operation in high pH deviation until the reading returns to normal.
- Alarm Setup - Delay Before Alarm (Sec.) - Set the delay time for issuing an alarm message (for the EC and pH deviation). This prevents unnecessary alarms due to momentary reading change.
- Fault Setup - EC Low Deviation for Irrigation Stop - Set the lowest EC level that below it the system enters into fault and stops the irrigation.
- Fault Setup - EC High Deviation for Irrigation Stop - Set the Highest EC level that above it the system enters into fault and stops the irrigation.
- Fault Setup - pH Low Deviation for Irrigation Stop - Set the lowest pH level that below it the system enters into fault and stops the irrigation.
- Fault Setup - pH High Deviation for Irrigation Stop - Set the Highest pH level that above it the system enters into fault and stops the irrigation.
- Fault Setup - Delay Before Irrigation stop (Sec.) - Set the delay time for the system to enter to fault (for the EC and pH irrigation stop). This prevents unnecessary alarms due to momentary reading change.
- Auto Cancel Alarm - Set whether this fertilizer center participates in the automatic alarm resetting, the options are: Yes, or NO. We recommend to set this parameter to NO.

The Fertilizer Center Information tab:

- Name - The name of the Fertilizer Center.
- Status - Status - The current status of the fertilizer center. The options are: Not Active - the fertilizer center is not defined, Active - the fertilizer center is correctly defined but currently it is not fertilizing, Invalid Fert Pump Number - one or more of the fertilizer pumps numbers for this fertilizer center is invalid, Fert Pump Definition Error - one or more of this fertilizer center's pumps definition is incorrect, Pipeline Def. Fault - the fertilizer center pipeline definition is incorrect or the pipeline is in fault, Sensor Def. Fault - the definition of the EC or the pH sensor is incorrect, Main Fert Output Def. Fault - the definition of the main fertilizer output of this fertilizer center is incorrect, Fert Program Definition Fault - one or more of the fertigation programs using this fertilizer center is incorrect, Fertilizing - the fertilizer center is currently fertilizing, Fert Program Alarm - one or more of the fertigation programs using this fertilizer center is in alarm mode, Fert Pump Alarm - one or more of this fertilizer center pumps is in alarm mode, Logic Condition Alarm - one of the system's logic conditions set this fertilizer center to alarm mode, EC Alarm - the EC sensor of this fertilizer center is in alarm mode, pH Alarm - the pH sensor of this fertilizer center is in alarm mode, Water Pressure Alarm - the system's water pressure for this fertilizer center is too low, Water Pump Alarm - the buster pump of this fertilizer center is in alarm mode, Logic Condition Alarm - this fertilizer center is in Alarm due to a logic condition command, Critical EC - the EC is too high so the irrigation stopped, Critical pH - the pH is too low so the irrigation stopped, or the OH is too high and the irrigation stopped, Water Pressure Fault - the system's water pressure for this fertilizer center is too low so the system entered to pause mode, Water Pump Fault - the buster pump of this fertilizer center is in fault mode, Logic Condition Pause - this fertilizer center is in pause due to a logic condition command,
- Status - Main Output - Fert Center - The current status of the main output of the fertilizer center. The options are: On, or Off.
- Status -Fert. Selector - Fert selector is an output that controls the selection of fertilizer tanks that feed this fertilizer center in its current fertilizing program, (such as a system with A and B fertilizer tanks). The options are: On, or Off.
- Status - Logic Condition - In case this fertilizer center may be controlled by a logic condition, this parameter displays the current status of the logic condition. The options are: Not defined - no logic condition is defined for this fertilizer center, Defined - the system has logic conditions that may control this fertilizer center, Paused - the fertilizer center is paused due to a logic condition command; once the logic condition released the fertilizer center resume operation, Fault - the fertilizer center is in fault status due to a logic condition command; in such case the fertilizer center cannot resume operation until the user checks the fault and corrects it.
- Status - Current Active Program - The number of the fertigation program that currently operates this fertilizer center.
- Status - Setup Status - the current status of the fertilizer center setup. The options are: Not Defined - the setup of this fertilizer center is not defined, Defined - the setup of the fertilizer center is correctly defined but currently it does not fertigating, Invalid Pump Number - the number of one of the fertilizer pumps defined for this fertilizer center is invalid, Fert pump definition Error - The definition of one of this fertilize center pumps is in correct, Pipe Definition Error - the definition of the pipeline fed by this fertilizer center is incorrect or invalid, Sensor Definition Error - the definition of the EC or pH sensors of this fertilizer center is incorrect or invalid, Main Fert. Output Error - the fertilizer main output of this fertilizer center is incorrect or invalid, Fert. Program Definition Error - one of the fertilizing programs of this center is incorrect.
- Faults - Uncontrolled Fert. - one of the fertilizer pumps of this fertilizer center in in uncontrolled fertilizer status. The options are Off, or On.
- Fault - No Fert. Pulse - One of the fertilizer pumps of this fertilizer center is in No Pulse Alarm. The options are Off, or On.
- Fault - Fert. Pump Flow Alarm - One of the fertilizer pumps of this fertilizer center is in flow-rate fault. The options are Off, or On.
- EC pH Info - Actual EC - The current reading of the EC sensor of this fertilizer center.
- EC pH Info - Actual pH - The current reading of the pH sensor of this fertilizer center.
- EC pH Info - EC Momentary Average for Automation - The current EC level used by the system's Fertigation Automation.
- EC pH Info - pH Momentary Average for Automation - The current pH level used by the system's Fertigation Automation.
- EC pH Info - EC Status - The current status of the EC fertigation. The options are: O.K. - there is no fault or alarm at the EC fertigation program, Alarm - the EC fertigation is in alarm mode; the operation will resume once the alarm is off, Fault - the EC fertigation is in fault mode; the operation will not resume until the user fix the problem.
- EC pH Info - pH Status - The current status of the pH fertigation. The options are: O.K. - there is no fault or alarm at the EC fertigation program, Alarm - the pH fertigation is in alarm mode; the operation will resume once the alarm is off, Fault - the pH fertigation is in fault mode; the operation will not resume until the user fix the problem.
- EC pH Info - Required EC - The required EC level as set by the current fertigation program.
- EC pH Info - Required pH - The required pH level as set by the current fertigation program.
- EC pH Info - Auto EC Correction % - The correction of the injection rate that is needed to bring the EC level to its required level, in plus or minus percentage.
- EC pH Info - Auto pH Correction % - The correction of the injection rate that is needed to bring the pH level to its required level, in plus or minus percentage.
- EC pH Info - Auto EC pH Lock - In transition between irrigation programs that uses the same fertilizer center, the user may set a lock delay parameter that stopes the Automation Process until the flow-rate of the new program is stabilized. In such case this parameter shows ON during the transition period, and OFF when the Automation Process operates. Note: for analog fertilizer pump that has a number of trials to reach the required EC or pH level before changing the injection calculation, this parameter shows ON (the automation is in locked position) during these trials.
- EC pH Info - EC pH Automation - This parameter shows whether the EC or the pH Automation is On or Off.
- EC pH Info - EC pH stabilization Delay (sec) - The current countdown the stabilization delay of the Automation Process.

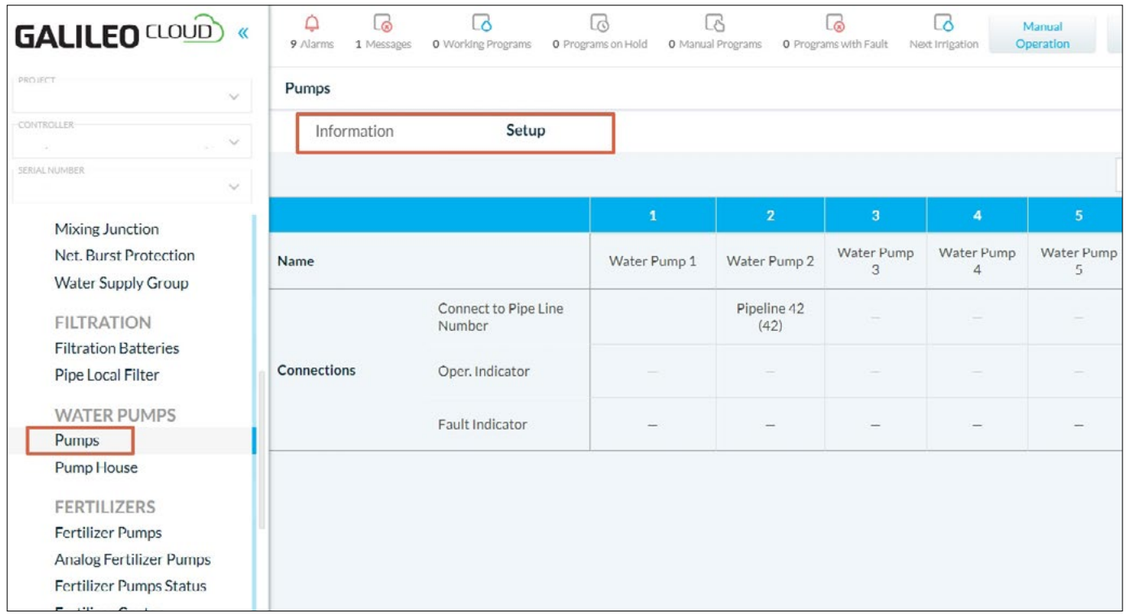
K.14. Water Pumps Tab

Define Pumps

Entering the Pumps tab of the Water Pumps Tab, is done by clicking on the WATER PUMPS -> PUMPS entry of the Galileo main menu.

This screen has 2 tabs: Setup and Information:

The Pumps Setup tab:



- Name - Set a name for the Pump.
- Connections - Connected to Pipe Line Number - Set the Number of the Pipeline fed by this pump.
- Connections - Operation Indicator Number - Select the indicator that turns on when the pump is running correctly; it can be a Condition Input or any other system defined indicator.
- Connections - Fault Indicator Number - Select the indicator that turns on when the pump is in fault (such as tripped Overload); it can be a Condition Input or any other system defined indicator.

The Pumps Information tab:

- Name - The name of the Pump.
- Pump Status - The current status of the pump. The options are: Not Defined - the pump is not defined, Fault - the pump is in fault, Off - the pump is off, ON - the pump is turned on.
- Input Status - Operation Indicator - the status of the pump's operation indicator. The options are: Off - the indicator is off, On - the indicator is on, Start Fault - the pump is in start fault mode (the pump started but no operation indicator received), Stop Fault - the pump is in stop mode fault (the pump stopped but the operation indicator remain on.
- Input Status - Fault Indicator - the status of the pump's fault indicator. The options are: On (the pump is in fault), or Off.
- Input Status - Fault Status - the status of the pump's fault. The options are: Fault (the pump is in fault), or NO.
- Usage Information - Defined in Pump House Number - The number of the pump house that this pump belongs to.
- Usage Information - Started by Pump House - The options are: ON - the pump is currently ON and it was started by a pump house command, or OFF.
- Usage Information - Started by pipeline - The options are: ON - The pump is currently ON and it was started by a pipeline command, or OFF.
- Logic Conditions - Displays whether a logic condition is defined for this pump. The options are: Not Defined - No logic condition is defined for this pump, Defined - there is a logic condition defined for this pump, Start - the logic condition sends a start command to the pump, Stop - the logic condition sends a stop command to the pump.
- Defined in more than a single pump hose - Definition fault; this pump is defined in more than a single pump house. The options are: NO - the pump is OK, or Yes - the pump is in definition fault.

Define Pump House

Entering the Pump house tab of the Water Pumps Tab, is done by clicking on the WATER PUMPS -> PUMP HOUSE entry of the Galileo main menu.

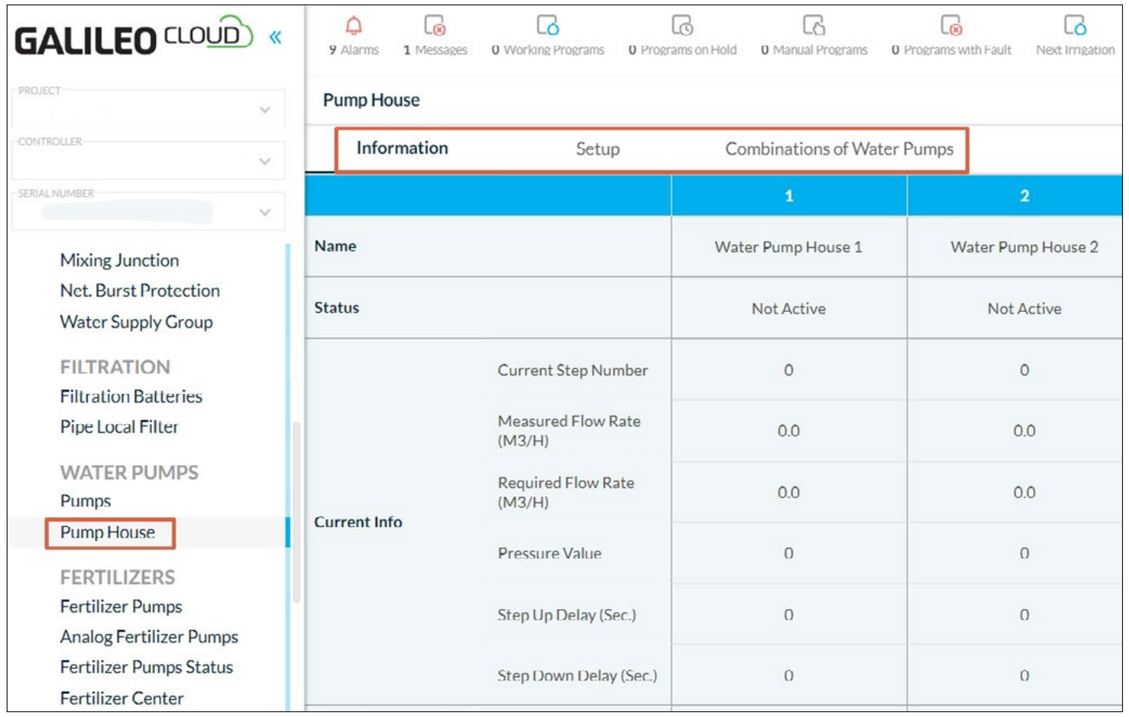
This screen has 3 tabs: Setup, Combinations of Water Pumps and Information:

Important note: a pump house (or a pump station) in Galileo System, is a software element that controls a group of water pumps that together supply water to a predefined pipeline, depending on the required flow-rate or pressure. A pump house can group up to 5 pumps, it can operate up to 10 steps where each step contains a combination of pumps, that operates together when the pump house is in that step.

Regularly the steps are organized according to the sum of the flow rates of the step's pumps, from the lowest to the highest flow, e.g., the total flow-rate supplied by step 1 is lower than the flow-rate supplied by step 2, and so on.

During the setup process of the pump house the user sets the steps and the parameters required for the system to move between the steps (see the Combination of Water Pumps tab screen below).

The Pump House Setup tab:



- Name - Set a name for the Pump house.
- Operation Method - Set the operation method of the pump house, the options are: Not Active - this pump house is inactive (can be used for maintenance purposes), Required Flow - the pump house operates according to the total required flow of all the programs that currently irrigating, Measured Flow - the pump house operates according to the current flow as measured by a pre-defined water meter, Pressure - the pump house maintains a preset pressure level measured by a pre-defined pressure sensor, Logic Condition - the pump house operate according to the status of pre-defined logic conditions.
- Connections - Connected to Pipe Line Number - Set the number of the pipeline fed by this pump house.

- Connections - Water Meter Number - Set the water meter number that its readings are used by this pump house when it operates according to measured flow-rate.
- Connections - Required flow from other controllers - When the pump house operates according to required flow, in addition to the required flow by this controller's irrigation programs, the pump house can also sum flow-rates required by irrigation lines of other controllers that are installed in the system. In such case press on the Show Elements Icon to open a selection box that shows all the relevant other controllers' lines to select from. The pump house can be operated on up to 5 required flow-rates originated in other controllers. Note that for this feature to work, the required lines of the other controllers should be pre-defined in the Communication between Controllers Setup Table of the Galileo Web Site.
- Pressure Setup - Sensor Number - Select the pressure sensor that this pump house operates according to its readings from the sensors list. **Very Important Note:** since the selection window displays all the system's sensors, make sure to select a sensor that is defined as a Pressure Sensor only, selecting a different type of sensor may render the system not operational.
- Pressure Setup - Lowest pressure for stepping up - Set the pressure level that below it the pump house steps up to the next operation step.
- Pressure Setup - Highest Pressure for stepping down - Set the pressure level that above it the pump house steps down by one operation step.
- Pause Setup - Pause Time (HH:MM) - Set a daily time to set this pump house to pause mode.
- Pause Setup - Resume Time (HH:MM) - Set the daily time to resume this pump house operation.
- Pause Logic Condition - If needed, enter a number of a pre-defined logic condition that can pause this pump house operation.
- Pause Setup - Pipe Line Reaction in Pause - Set the pipeline behavior in case this pump house enters to pause mode, the options are: None - do nothing, Alarm Only - only issue an alarm message, Pause Only - pause the pipeline operation, Alarm + Pause - pause the pipeline operation and issue an alarm message.

The Pump House Combinations of Water Pumps tab:

Important note: The Combination screen is used to configure the 10 operation steps where each step can contain up to 5 pumps. When configuring the steps, it is required to start at step number 1 and continue upwards. Step number 1 should have at least one pump. The number of planed steps can vary depending on the user's need (up to 10 steps), however each one of the configured steps should have at least on pump and an empty gap between the configured steps is no allowed.

- The upper line above the table is used for selecting the required pump house number.
- The upper line of the 5 columns to the left of the Steps column is used to select up to 5 pumps to participate in this pump house operation.
- The 5 columns to the left of the Steps column are used to set per each step the pumps that should run (ON) when the pump house is in this step.
- The Step-Up and the Step-Down delay columns are used to set the delays (seconds) for the system to move up or down when needed.
- The Flow-Rate column is used for entering the operation flow-rate per each step. Please note that the system will not move up unless the actual flow-rate reaches to the flow rate of the next step, and will not move to the previous step unless the actual flow-rate reaches the flow-rate of the previous step.
- The Logic Condition column is used to operate any one of the steps according to a pre-defined Logic Condition.

The Pump House Information tab:

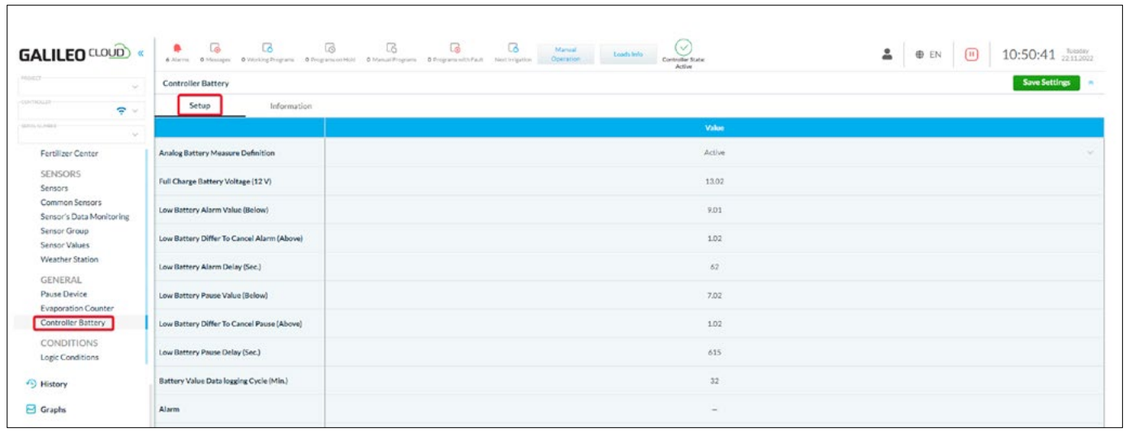
- Name - Select the name of the Pump house.
- Status - The current status of this pump house. The options are: Not Active - the pump house is currently not active (its operation method was set to Not Active and it may be used for maintenance actions), Mode Error - the setting of the operation mode is in error, Invalid Pipe line Number - number of the pipeline defined for this pump house is invalid, invalid water meter number - the number of the water meter defined for this pump house is invalid, water meter definition error - the definition of the water meter is incorrect, Invalid Pressure sensor number- the number of the pressure meter
- Current Info - Current Step Number - The number of the currently running step.
- Current Info - Measured Flow-rate - The current flow-rate, as measured for the measured flow- rate operation mode.
- Current Info -Required Flow-rate - The current flow-rate, as measured for the Required flow- rate operation mode.
- Current Info - Pressure Value - The current treading of the pressure sensor.
- Current Step-up delay (Sec) - The current countdown of the stepping up delay.
- Current Step-Down delay (Sec) - The current countdown of the stepping down delay.
- Pump A - Name - The name of the pump that was defined as pump A for this pump house.
- Pump A - Current Status - The current status of this pump house first pump, the options are: The current status of the pump. The options are: Not Defined - the pump is not defined, Fault - the pump is in fault, Off - the pump is off, ON - the pump is turned on.
- Pump A - Operation Required - This parameter displays whether this pump is required to operate now, the options are On, or Off.
- Pump A - Operation Indicator - The status of this pump's operation indicator, the options are: ON, or Off.
- Pump A - Fault Indicator - The status of this pump's fault indicator, the options are: ON, or Off.
- Pump E - Name - The name of the pump that was defined as pump A for this pump house.
- Pump E -Current Status - The current status of this pump house first pump, the options are: The current status of the pump. The options are: Not Defined - the pump is not defined, Fault - the pump is in fault, Off - the pump is off, ON - the pump is turned on.
- Pump E - Operation Required - This parameter displays whether this pump is required to operate now, the options are On, or Off.
- Pump E - Operation Indicator - The status of this pump's operation indicator, the options are: ON, or Off.
- Pump E - Fault Indicator - The status of this pump's fault indicator, the options are: ON, or Off.

K.15. General Tab

Define Controller Battery

Entering the Battery tab of the General Tab, is done by clicking on the GENERAL -> CONTROLLER BATTERY entry of the Galileo main menu. This screen has 2 tabs: Setup and Information:

The Controller Battery Setup tab:

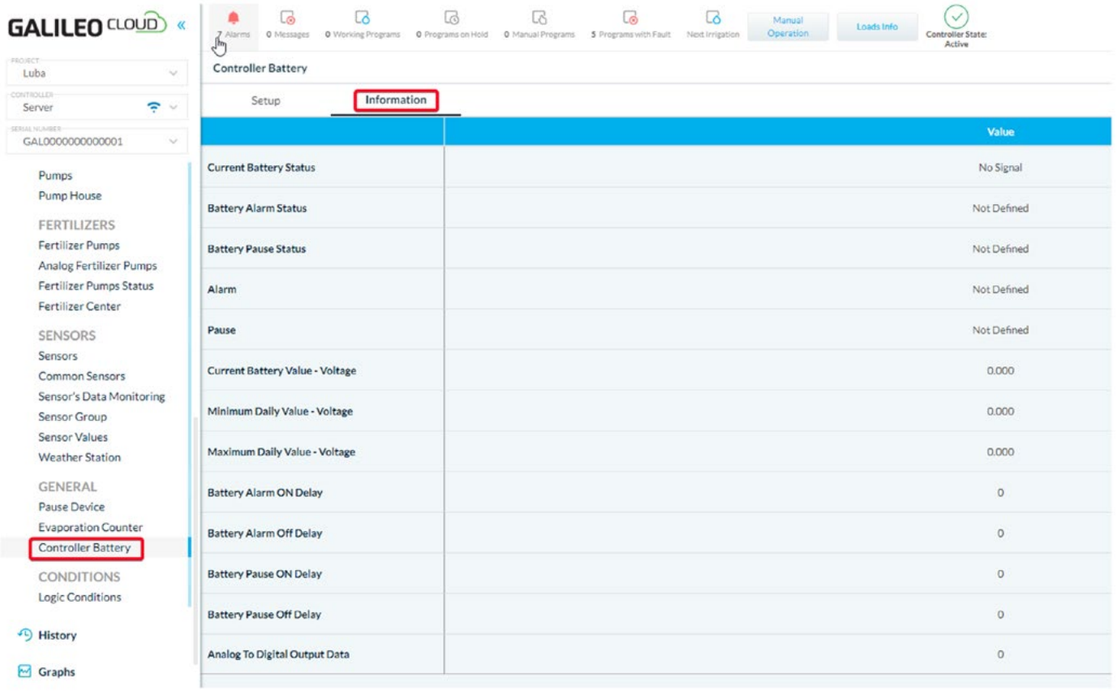


- Analog Battery Measure Definition – set whether this controller has an analog input for reading the battery level,

the options are Active, or Idle. Note that when this parameter is set to Idle the system ignores the rest of the parameters that are related to the analog battery level reading.

- Full Charge Battery Voltage (12V) – enter the battery's optimal operation level.
- Low Battery Alarm Value (Below) – enter the battery's level for issuing a low battery alarm.
- Low Battery Defer to Cancel Alarm (Above) – set the battery level that above it the system exits the battery alarm status.
- Low Battery Alarm Delay (Sec.) – set the delay time for entering to low battery alarm; this prevents unnecessary entering to alarm state due to momentary voltage drop.
- Low Battery Pause Value (Below) – enter the battery's level for pausing the controller due to low battery level.
- Low Battery Defer to Cancel Pause (Above) – set the battery level that above it the system exits the battery pause status.
- Low Battery Pause Delay (Sec.) – set the delay time for entering to battery pause state; this prevents unnecessary entering to alarm state due to momentary voltage drop.
- Battery Value Data Logging Cycle (Min.) – set the interval of the battery level checking.
- Alarm – for systems without an analog battery level reading, select the condition input that is used by the system for reading the battery alarm level.
- Pause – for systems without an analog battery level reading, select the condition input that is used by the system for reading the battery pause level.

The Controller Battery Information tab:



- Current Battery Status – The current status of the battery, the options are: Not Defined, Battery OK, Alarm, pause system, Range Error – the analog reading is out of its normal reading range, and No signal – no signal is received from the analog battery level reading device.
- Battery Alarm Status – The current status of the battery alarm, the options are: Not Defined, OK, and Alarm.
- Battery Pause Status – The current status of the battery pause signal, the options are: Not Defined, OK, and Pause.

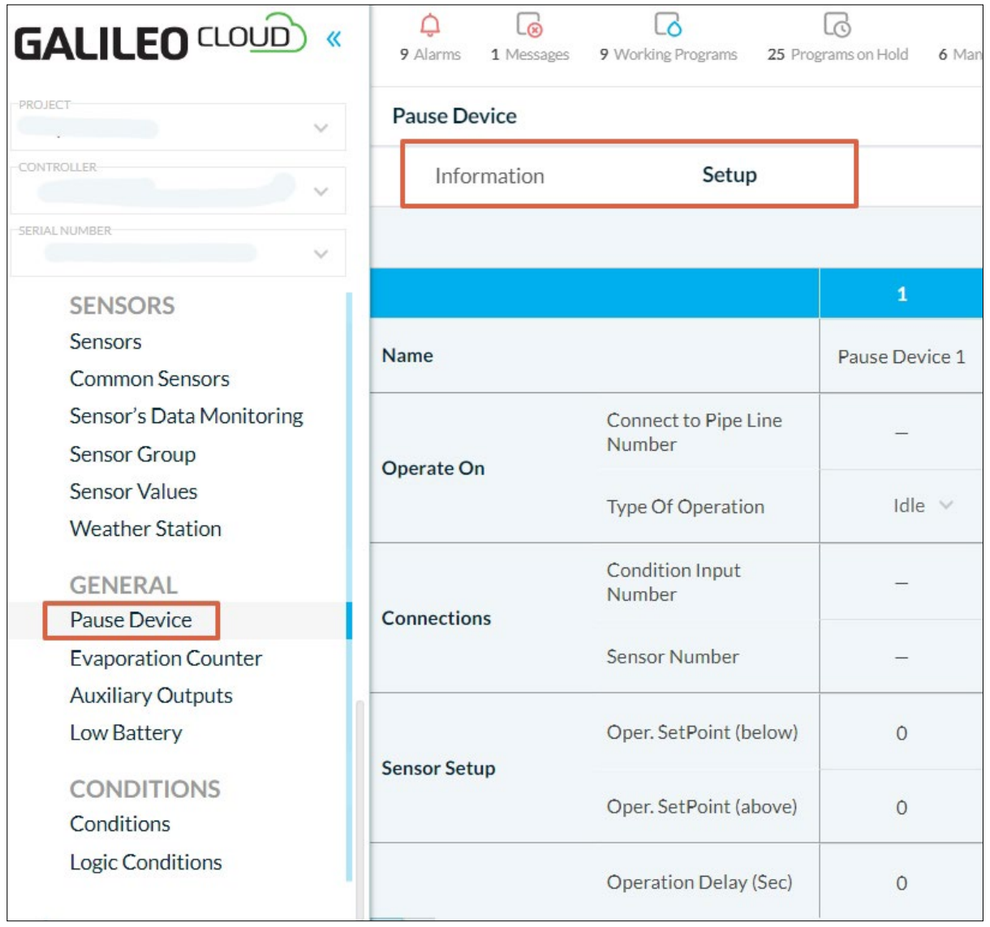
- Alarm – The status of the digital alarm condition input, the options are: Not defined, Off, Alarm, and Input Definition Error.
- Pause – The status of the digital pause condition input, the options are: Not defined, Off, Pause, and Input Definition Error.
- Current Battery Value – Voltage – The current reading of the battery voltage.
- Minimum Daily Value – Voltage – The lowest level of the battery voltage that was registered today.
- Maximum Daily Value – Voltage – The highest level of the battery voltage that was registered today.
- Battery Alarm ON Delay – The current reading of the Alarm ON delay counter.
- Battery Alarm OFF Delay – The current reading of the Alarm OFF delay counter.
- Battery Pause ON Delay – The current reading of the Pause ON delay counter.
- Battery Pause OFF Delay - The current reading of the Pause OFF delay counter.
- Analog to Digital Output Data – the actual hardware reading of the analog battery level reading device.

Define Pause Device

Entering the Low Battery tab of the General Tab, is done by clicking on the GENERAL -> PAUSE DEVICE entry of the Galileo main menu.

This screen has 2 tabs: Setup and Information:

The Pause Device Setup tab:



Important note: The Pause Device feature of the Galileo system, enables the user to force a predefined operation on

a Pipe Line as a result of the status of specific Condition Input (a hardware input) or a predefined reading level of a Sensor.

- Name - Set a name for the Pause Device.
- Operate On - Connect to pipe Line Number - Select the number of the pipe line on which this Pause Device operates.
- Operate On - Type of Operation - Set the operation type that this Pause Device imposes on the pipe line. The Options are: Idle - do nothing, Alarm - set the pipeline to an alarm mode, Pause - pause the operation of this pipeline, Fault - set this pipeline to fault mode.
- Connections - Condition Input Number - select the number of condition input that operates this pause device.
- Connections - Sensor Number - select the number of the sensor that operates this pause device.
- Sensor Setup - Operation Setpoint (below) - set the reading level of the sensor that below it the pause device operates
- Sensor Setup - Operation Setpoint (above) - set the reading level of the sensor that above it the pause device operates.
- Time Delay - Operation Delay (Sec.) - set the delay in seconds for the pause device to start operation once a signal is received from the condition input or the sensor.
- Time Delay - Stop Delay (Sec.) - set the delay in seconds for the pause device to stop operation once the signal of the condition input ends, or the sensor reading exits its operation level.
- Time Delay - Alarm Delay (Min.) - set the delay in Minutes for the pause device to issue an Alarm.

The Pause Device Information tab:

- Name - The name of the Pause Device.
- Info - Status - The current status of the pause device, the options are: No defined - this pause device is not defined, Off - the pause device is correctly defined and currently it is in its OFF status, ON- the pause device id currently ON, Alarm - the pause device issued an alarm, Pause - the pause device forced the pipeline to pause, Fault - the pause device forced the pipeline to fault status, Input Definition Error - The definition of the condition input of this pause device is incorrect, Sensor Definition Error - The definition of the sensor of this pause device is incorrect, Pipe Definition Error - The definition of the pipeline of this pause device is incorrect.
- Infor - Input Name - The name of the condition input of this pause device.
- Info - Input Status - The current status of the condition input, the options are: Not defined - no input is defined for this pause device, Off - the condition input is currently Off, ON - the condition input in currently ON, Definition Error - the definition of the pause device is incorrect.
- Info - Sensor Name - The name of the sensor of this pause device.
- Info - Sensor Value - The current reading of the sensor.
- Info - Sensor Status - The current status of the sensor, the options are: Not defined - no sensor is defined for this pause device, Active - the sensor is correctly defined, Low Value - the sensor reading is below its low-level setting, High Value - the sensor reading is above its high-level setting, Definition Error - the definition of the sensor is incorrect.

K.16. Filtration Tab

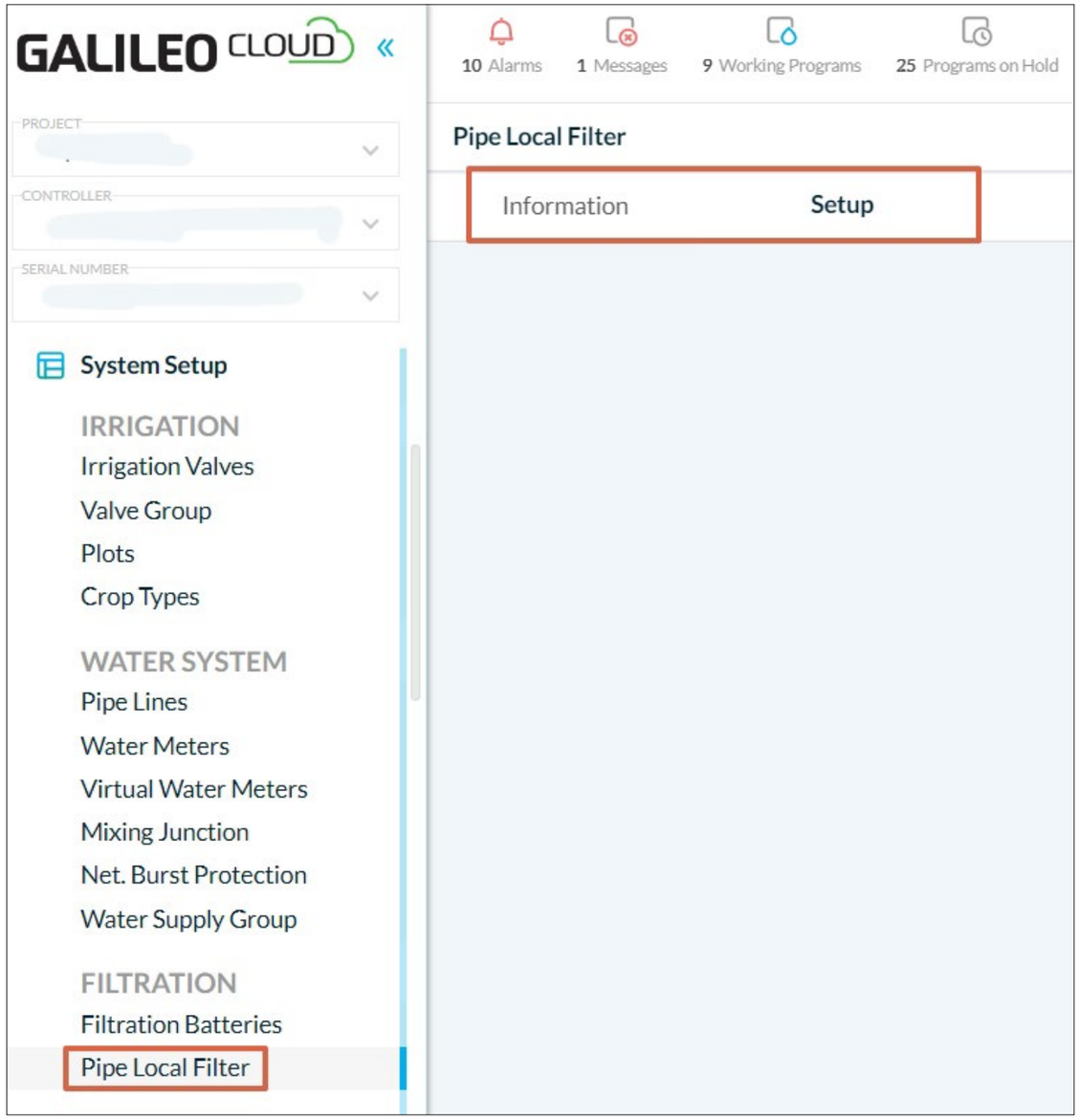
Important note: The Galileo system defines between two types of filtration options; local pipe filtration, and filtration battery. The local pipe filtration is a feature designed to operate a single output command for operating a single filter or for sending a command to an external filtration controller. The Filtration battery feature contains all the parameters to control a full-size filtration battery.

Define Pipe Local Filter Flush

Entering the Define Pipe Local Filter Flush tab of the General Tab, is done by clicking on the FILTRATION -> PIPE LOCAL FILTER FLUSH entry of the Galileo main menu.

This screen has 2 tabs: Setup and Information:

The Pipe Local Filter Flush Setup tab:



Important note: The maximal number of Pipe Local Filter Flush elements is the same as the defined system's Pipelines', where each such element requires a single hardware output.

- Name - Set a name for the Local Filter.
- Program - Flushing Time (Sec.) - Set the time for the filter to flush. In order for the filter flush to operate this parameter should be greater than zero. Note that for filters that have an internal flushing time, set the flushing time at this parameter longer or equal to the filter's internal flushing time, if it is shorter than the filter's flush time, the system may enter to continuous flushing mode that may end in Fault and Alarm.
- Program - Time Interval (HH:MM) - Set the time interval between flush cycles. Please note that the system counts the time only when irrigation is taking place, this means that the time counting stops at the end of the irrigation; the system continues the time counting from the point it stopped at the beginning of the next irrigation operation on the same pipeline.
- Program - Water Meter for Interval - Set the number of the water meter that is used by the system for starting the filter flush according to predefined quantity of irrigated water.

- Program - Quant. Interval (M³) - Set the volume of water in m³ that once irrigated, the system starts a flushing cycle of the filter. Please note that that the water-quantity counting stops at the end of the irrigation; the system continues the water-quantity counting from the point it stopped at the beginning of the next irrigation operation on the same water meter.
- Program - P.D. Switch - Condition Input - Set the number of a hardware defined Condition Input to serve as the Pressure differential (PD) switch for beginning flushing cycle of this filter. Important Note: The P.D. level for starting flush cycle, and the P.D. delay time, should be configured in the Condition Input screen and not in this screen.
- Setup - Max Continuous flushes - Set the maximal allowed consecutive flush cycles, before the system enters to Continuous flushing fault and stops the filter; the default is 5 cycles. Please note that the system can enter to this type of fault only when the flushing trigger is a P.D. switch; if at the end of any flushing cycle the P.D. signal remains ON, this cycle is counted by the Continuous flushing fault counter. When at the end of a flushing cycle the P.D. switch returns to Off, the system resets the Continuous flushing fault counter.
- Setup - Pipeline Fault Reaction - Set the pipeline reaction to Continuous flushing fault, the options are: Idle - do nothing (note that continuing irrigation when the filter is clogged may damage your irrigation system), Alarm - issue an alarm only, Pause - pause the pipeline irrigation operation, Fault - issue an alarm and set the pipeline to fault.
- Setup - Pause Irrigation While Flushing - Set whether the irrigation continues during flushing or it stopes. If there is not enough pressure to flush the filter while irrigating, set this parameter to pause the irrigation till the end of the flushing process. The options are: Continue irrigation, or Pause Irrigation.
- Setup - Pipeline Delay for P.D. Flush (Min) - Set the delay time for the system to ignore a P.D. signal at the beginning of an irrigation. this prevents entry to a flushing cycle while the pipeline pressure is still not stable at the beginning of the irrigation.

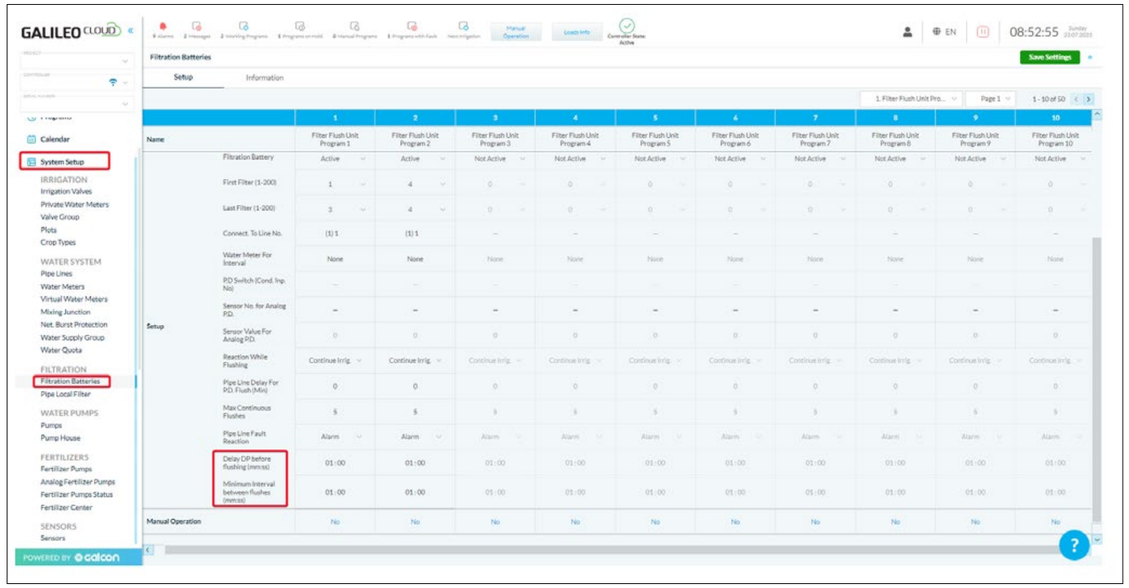
The Pipe Local Filter Flush Information tab:

- Name - The name of the Local Filter.
- Status - the current status of the local filter, the options are: Not Defined - this local filter is not defined, Active - the filter is correctly defined but currently there is no irrigation, Irrigating - the filter is active and there is an irrigation taking place, Flushing - the filter currently flushing, Fault - the filter is in continuous flushing fault, Invalid Output Definition - the filter hardware output is invalid or incorrect.
- Total Daily Cycles - the number of flush cycles performed since the beginning of the current day.
- Data - Quantity from Last Flush (M³) - The amount of water passed through the water meter of this filter since the previous filter flush cycle.
- Data - Time from Last Flush (MM:HH) - The time passed since the previous filter flush cycle.
- Data - Continuous Flushes Counter - The current reading of the Continuous Flushes counter.

Define Filter Flush Program

Entering the Filter Flush tab of the Irrigation Tab, is done by clicking on the SYSTEM SET UP -> FILTRATION -> FILTRATION BATTERIES entry of the Galileo main menu.

The Filter Flush Program Setup tab:



- Name - Set a name for the Filter Flush Program.
- Status - the status of the filter flush program, the options are: Not Defined - this program is not defined, Invalid Pipe Line No. - the number of the pipeline defined for this filtration battery is invalid, Invalid Filter Unit No. - the number of the selected filter units is invalid, Filter Unit Output Def. Err. - the definition of at least on of the filter units is incorrect, Filter Units Order Err. - the order of the selected filter units is not in ascending order, Filter Units Overlapping Err. - at least one of the filter units is already defined in another filtration battery, Flushing Time Not Def. - there is no flushing time for this battery, Operation Program Not Def. - there is no operation program for this battery, Water Meter Not Def. - this battery is defined to operate according to water quantity but no water meter is defined for measuring the water quantity, Water Quantity Err. - the water quantity defined for this battery is incorrect, Time Definition Err. - the operation time defined for this battery is incorrect, P.D. Input Err. - the condition input set as P.D. for this battery is incorrect, Active - the battery is defined correctly, it is active but currently it is not flushing, Irrigating - the pipeline of this battery is irrigating, Sustaining - the sustaining valve of this battery is on, Flushing - the battery is currently flushing, Fault - the filtration battery is in fault due to continuous flush cycles or due to logic condition.
- Program - Time Interval (HH:MM) - Set the time interval between flush cycles. Please note that the system counts the time only when irrigation is taking place, this means that the time counting stops at the end of the irrigation; the system continues the time counting from the point it stopped at the beginning of the next irrigation operation on the same pipeline.
- Program - Quant. Interval (M³) - Set the volume of water in m³ that once irrigated, the system starts a flushing cycle of the filter. Please note that that the water-quantity counting stops at the end of the irrigation; the system continues the water-quantity counting from the point it stopped at the beginning of the next irrigation operation on the same water meter.
- Program - Start Sustain Before Flush (Sec.) - The delay time for the system to stabilize the pressure before beginning the first filter flushing operation - this may be used when a downstream valve is installed at the outlet of the filtration battery, so this parameter is the time it takes this valve to close.
- Program - Unit's flushing time - Set the time per each one of the filters to flush. In order for the filter flush to operate this parameter should be greater than zero. Note that for filters that have an internal flushing time, set the

flushing time at this parameter longer or equal to the filter's internal flushing time, if it is shorter than the filter's flush time, the system may enter to continuous flushing mode that may end in Fault and Alarm.

- Program - Delay Between Filters (Sec.) - Set the delay between the end of the flushing process of a filter, and the beginning of the flushing process of the next filter of the battery.
- Setup - Filtration Battery - The operation status of the battery, the options are Active, or Not Active.
- Setup - First Filter Number (1-200) - Set the number of the first filter of this battery.
- Setup - Last Filter Number (1-200) - Set the number of the last filter of this battery.

  Important notes:

  * The range of the filters' numbers of a battery must be selected in ascending order.
  * A Filter unit can serve only in a single filtration battery; the same filter number cannot appear in more than a single battery.
  * In case of a battery with only a single filter, set the first filter number and the last filter number to the number of the single filter unit.
- Setup - P.D. Switch - Condition Input - Set the number of a hardware defined Condition Input to serve as the Pressure differential (PD) switch for beginning flushing cycle of this filter. Important Note: The P.D. level for starting flush cycle, and the P.D. delay time, should be configured in the Condition Input screen and not in this screen. The system does not react to a P.D. signal to start a flushing cycle at the beginning of irrigation until the Delay for flushing (Min) parameter is counted down to zero; this prevents entry to a flushing cycle while the pipeline pressure is still not stable at the beginning of the irrigation.
- Setup Sensor No. for Analog P.D. – Select an analog sensor (sensor group) to be used triggering a flush cycle for this filtration battery. This parameter can be used for setting a calculated P.D. value by subtracting the reading of the battery's outlet pressure sensor from the reading of the inlet pressure sensor.
- Setup - Pipeline Fault Reaction - Set the pipeline reaction to Continuous flushing fault, the options are: Idle - do nothing (note that continuing irrigation when the filter is clogged may damage your irrigation system), Alarm - issue an alarm only, Pause - pause the pipeline irrigation operation, Fault - issue an alarm and set the pipeline to fault.
- Setup - Pipeline Delay for P.D. Flush (Min) - Set the delay time for the system to ignore a P.D. signal at the beginning of an irrigation. this prevents entry to a flushing cycle while the pipeline pressure is still not stable at the beginning of the irrigation.
- Setup - Max Continuous flushes - Set the maximal allowed consecutive flush cycles, before the system enters to Continuous flushing fault and stops the filter; the default is 5 cycles. Please note that the system can enter to this type of fault only when the flushing trigger is a P.D. switch; if at the end of any flushing cycle the P.D. signal remains ON, this cycle is counted by the Continuous flushing fault counter. When at the end of a flushing cycle the P.D. switch returns to Off, the system resets the Continuous flushing fault counter.
- Setup - Delay DP trigger before flushing (mm:ss) – this parameter prevents unnecessary flush cycle due to a momentary signal received from the DP switch (for example, a short change in pressure due to vale opening).
- Setup - Minimum Interval between flushes (mm:ss) – this parameter prevents an entry to an additional flush cycle in very short time after the completion of a flush cycle and before the system pressure is stabilized.
- Manual Operation - An option for the user to manually start a flush cycle, or to manually stop a running flushing cycle.

The Filter Flush Program Information tab:

- Name - The name of the Filter Flush Program.
- Flush Data - Status - the status of the filter flush program, the options are: Not Defined - this program is not defined, Invalid Pipe Line No. - the number of the pipeline defined for this filtration battery is invalid, Invalid Filter Unit No. - the number of the selected filter units is invalid, Filter Unit Output Def. Err. - the definition of at least one of the filter units is incorrect, Filter Units Order Err. - the order of the selected filter units is not in ascending order, Filter Units Overlapping Err. - at least one of the filter units is already defined in another filtration battery, Flushing Time Not Def. - there is no flushing time for this battery, Operation Program Not Def. - there is no operation program for this battery, Water Meter Not Def. - this battery is defined to operate according to water quantity but no water meter is defined for measuring the water quantity, Water Quantity Err. - the water quantity defined for this battery is incorrect, Time Definition Err. - the operation time defined for this battery is incorrect, P.D. Input Err. - the condition input set as P.D. for this battery is incorrect, Active - the battery is defined correctly, it is active but currently it is not flushing, Irrigating - the pipeline of this battery is irrigating, Sustaining - the sustaining valve of this battery is on, Flushing - the battery is currently flushing, Fault - the filtration battery is in fault due to continuous flush cycles or due to logic condition.
- Flush Data - Flush Command - This parameter displays if there is a start-flush cycle request, sent by any one of the possible start-flush triggers of this battery, the options are: Off - no start-flush cycle request exists, On - a start-flush cycle request exists.
- Flush Data - Flushing Filter No. - The number of the filter that is currently flushing.
- Flush Data - Total Daily Cycles - the number of flush cycles performed since the beginning of the current day.
- Quant\Time Passed - Quantity from Last Flush (M^3) - The amount of water passed through the water meter of this filter since the previous filter flush cycle.
- Quant\Time Passed - Time from Last Flush (MM:HH) - The time passed since the previous filter flush cycle.
- P.D. Data - Continuous Flushes Counter - The current reading of the Continuous Flushes counter.
- P.D. Data - P.D. Input Status - The current status of the P.D. input, the options are: Off, or ON.
- P.D. Data - Pipeline Delay for P.D. Flush (Min) – The status of the delay time for the system to ignore a P.D. signal at the beginning of an irrigation. The options are On, or OFF.
- P.D. Data – Analog P.D. Status – the current status of the analog sensor that is used for triggering a flush cycle, the options are: Off – no analog P.D. sensor is defined for this battery, On – an analog sensor is defined to trigger flush cycles for this battery.
- P.D. Data – Curr. Sensor P.D. Value – the current reading of the analog sensor that can trigger a flush cycle for this battery.
- Logic Condition Status - Start Logic Condition - the status of the Start logic condition that is defined for this battery, the options are: Not defined - no start logic condition is defined for this battery, Off - the logic condition is Off, On - the logic condition is On.
- Logic Condition Status - Paus Logic Condition - the status of the Start logic condition that is defined for this battery, the options are: Not defined - no pause logic condition is defined for this battery, Off - the logic condition is Off, On - the logic condition is On.
- Logic Condition Status - Fault Logic Condition - the status of the Fault logic condition that is defined for this battery, the options are: Not defined - no fault logic condition is defined for this battery, Off - the logic condition is Off, On - the logic condition is On.
- Manual Operation - An option for the user to manually start a flush cycle, or to manually stop a running flushing cycle.

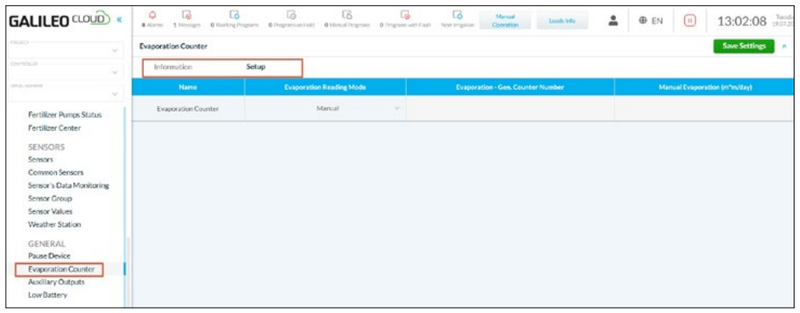
K.17. Evaporation Counter Tab

Evaporation Counter

Entering the Evaporation Counter tab of the Galileo system, is done by clicking on the SYSTEM SETUP -> GENERAL -> EVAPORATION COUNTER entry of the Galileo main menu.

Important note: The evaporation counter of the Galileo system is used by the irrigation programs to enable irrigation based on water amounts that are calculated according to the crop type and the reading of the accumulated evaporation between the irrigation cycles. Please refer to the irrigation programs section of the Galileo system for details on setting an irrigation according to evaporation; the following paragraph explains the setting of the evaporation counter only.

This screen has 2 tabs: Setup and Information:



- Name - Set a name for the Evaporation Counter.
- Evaporation Reading Mode - select the reading mode of the evaporation counter, the options are: Manual - the user has to manually enter the reading of the evaporation in mm/day in the Manual Evaporation parameter of this screen, Auto - the evaporation reading is by an automatic evaporation meter device so the user has to select the number of the hardware's General Counter to which the meter is connected to, and set it in the Evaporation - Gen. Counter Member parameter of this screen.
- Evaporation - Gen. Counter Number - for Automatic evaporation reading mode, select the number of the hardware general counter input that the evaporation meter is connected to.
- Manual Evaporation (mm/day) - For Manual evaporation reading, enter the daily evaporation rate in mm/day. Important Note: Make sure to enter a valid number that suits your field, weather and crop conditions; entering zero in this parameter will cancel the irrigation for valves that are set for irrigation according to evaporation.

The Evaporation Counter Information tab:

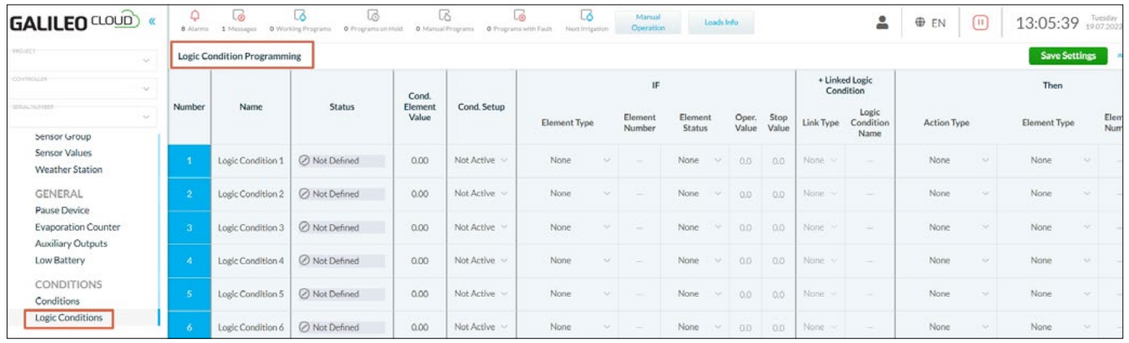
- Evaporation Today - This parameter displays the accumulated evaporation since the beginning of the current day.
- Evaporation Yesterday - The accumulated evaporation along the day of yesterday.

K.18. Logic Conditions Tab

Logic Conditions Programing

Entering the Logic Conditions Programing tab of the Galileo system, is done by clicking on the SYSTEM SETUP -> CONDITIONS -> LOGIC CONDITIONS entry of the Galileo main menu.

Important note: The Logic Conditions of the Galileo system is a feature that enables the user to automatically perform predefined actions on specific system elements according to a predefined status of other system's elements; the conditions operate in an IF -> Than manner, e.g., If irrigation program number XX starts, then start the operation of water pump number YY. The system can operate up to 60 different logic conditions (60 rows in the following screen).



The structure of the screen is divided into 3 major sections; the first 4 left columns display the "status" of the logic condition; the next 7 columns are used for setting the "If" part of the logic condition; and the last 7 columns are for setting the "Then" part of the logic condition and its operation timings.

For setting a logic condition follow the order of the following list:

- Set a name for the logic condition.
- Select the required operation mode of the logic condition in the Operation Mode column, the options are: Not active - the logic condition is not active, Active - the logic condition is operational, By Time - in this mode the system ignores the "If" section of the logic condition and operates the "Then" section according to the logic condition timing settings, Manual - this mode is used for testing the logic condition operation immediately, Important: once the logic condition operation is checked, the user should change the operation mode to another mode, otherwise the "Then" section of the logic condition will stay ON.

Setting the "If" section of the logic condition:

- Select the required Element Type of the "If" section - the system opens a dropdown list containing the types of all the possible system elements that may be used in the "If" section of the logic condition. Note that the system has two categories of element types, Digital and Analog; the rest of the "If" selection columns react according to these categories, e.g., for analog sensors category the user may select specific reading values for the "If" section, but such reading value cannot be selected for digital elements such as pipeline or irrigation valve.
- Select the Element Number of the "If" section - according to the selected element type, the system displays a window with all the existing elements of the type selected.
- Select the required condition type at the Element Status column, Please note that the options vary according to the digital or analog element types.

The options for digital elements (such as irrigation valves) are:

* None - The "If" element is not checked.
* On - the system checks the real time status of the "If" element and sets the logic condition to On when the "If" element is in its On status.
* Off - the system checks the real time status of the "If" element and sets the logic condition to On when the "If" element is in its Off status.
* Off > On - the system checks the real time status of the "If" element and sets the logic condition to On when the "If" element changes its status from Off to On.
* On > Off - the system checks the real time status of the "If" element and sets the logic condition to On when the "If" element changes its status from On to Off.

The options for Analog elements (such as pressure sensor) are:

* None - The "If" element is not checked.
* Below - the system checks the real time reading of the "If" element and sets the logic condition to On when the "If" element real time reading is below the value set in the Oper. Value column; the system sets the logic condition to Off when the reading of the sensor reaches the value set on the Stop Value column. Note that is this case the Stop Value must be greater than the Oper. Value.
* Above - the system checks the real time reading of the "If" element and sets the logic condition to On when the "If" element real time reading is above the value set in the Oper. Value column; the system sets the logic

condition to Off when the reading of the sensor reaches the value set on the Stop Value column. Note that is this case the Stop Value must be smaller than the Oper. Value.

* In Range - the system checks the real time reading of the "If" element and sets the logic condition to On when the "If" element real time reading is in the range set between the Oper. Value column and the Stop Value column.
* Out of Range - the system checks the real time reading of the "If" element and sets the logic condition to On when the "If" element real time reading is in out of the range set between the Oper. Value column and the Stop Value column.

- In case of an analog element and according to the selection of the Element Status, set the required Operation and the Stop values in their designated columns.
- + Linked Logic Condition - Link Type - The system allows the user to chain an existing logic condition to this logic condition. In such case, first select the type of the link. The options are: None - no one of the other logic conditions is chained to this logic condition, Or - for the system to set this logic condition to On, only one of the two conditions should be in On status, And - both conditions should be On, for the system to set this logic condition to its On state.
- + Linked Logic Condition - Logic Condition Name - Select the name of the logic condition to be chained to this logic condition.

Setting the "Then" section of the logic condition:

- Action Type - Select the required action for the system to perform on the "Then" element once the logic condition is in its On state, the options are: None - do nothing, Alarm - set the "Then" element to its Alarm state, Pause - set the "Then" element to pause, Fault - set the "Then" element to fault, Start - start the "Then" element operation, Stop - stop the "Then" element operation.
  Important: The Operate while Active action is an action type that is a combination of the start and the stop actions, this means that once the condition turns On, the "Than" element starts, and when the condition turns Off, the operation of the "Then" element is stopped, e.g., if the " Then" element is a filtration battery with few filters, and the Action is set to Operation while Active, the flushing process starts when the condition turns On, but the flushing stops in the middle of its process once the condition turns Off. In contrary to regular start action in which the flushing process continues till the end even if the start action is already ended.
- Element type - Select the type of the element that is affected by the "Then" Action. The system opens a dropdown list containing the types of all the possible system elements that may be used in the "Then" section of the logic condition.
- Select the Element Number of the "Then" section - according to the selected element type, the system displays a window with all the existing elements of the type selected.
- Timing - Delay (Sec.) On - set the delay time between the logic condition turn on, and the actual performance of the "Then" action.
- Timing - Delay (Sec.) Off - set the delay time between the logic condition turn off, and the actual performance of the "Then" action.
- Timing - Start Time - in case when it needed to restrict the operation of the logic condition to a specific daily time frame, set the start time in this parameter.
- Timing - End Time - in case when it needed to restrict the operation of the logic condition to a specific daily time frame, set the end time in this parameter.

For monitoring a logic condition see the following list:

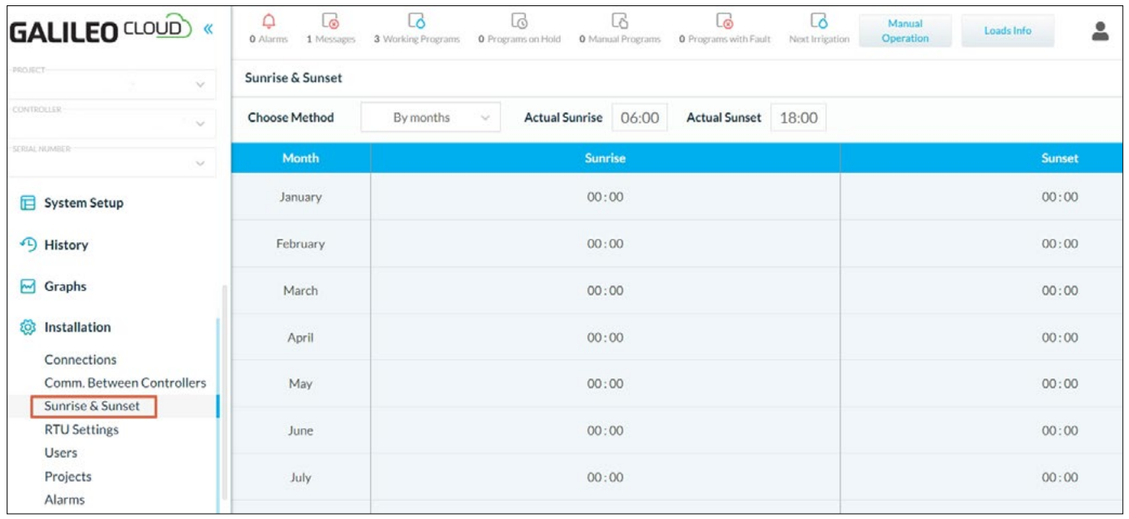
- Member - The Number of the logic condition (1-60).
- Name - The Name of the logic condition.
- Status - the current status of the logic condition, the options are: Not Defined - the logic condition is not defined or not active, Off - the condition is currently Off, On - the condition is currently On, Out of Time - the condition is correctly defined but currently it is out of its operation time range, Element Def. Error - the "If" element definition is in error, Cond. Link Error - the chained logic condition is in error, Time Definition Error - the timing set to this logic condition is incorrect, Element Type Error - the "Then" element type is incorrect, Operation Definition Error - the action set for the "Then" element is incorrect, Invalid Operated Element Number - the number of the "Then" element is invalid, Analog Condition Error - the definition of the analog sensors values is incorrect.

- Condition Element Value - The current reading/value of the "If" element, in case of a sensor this parameter displays the real time reading of the sensor, and in case of a digital element (such as a valve) this parameter displays the On (1) or Off (0) real time status of the element.

K.19. Sunrise - Sunset Tab

Define Sunrise Sunset Setup Tab

Entering the Sunrise Sunset Setup tab of the Galileo system, is done by clicking on the INSTALLATION -> Sunrise & Sunset entry of the Galileo main menu.



Important note: The Sunrise and the Sunset parameters of the Galileo system are used for changing the start/stop timing and other irrigation parameters according to the change in the day light along the seasons.

Upon entering to this screen, the user can select the operation method of the sunrise/sunset parameters entry. The options are: By months - the user has to enter the sunrise and sunset hours and minutes per each month of the year, or By constant hour - the user enter a single set of sunrise/sunset times for all the year.

The upper line of the table displays the current day's actual sunrise and sunset times.

K.20. Fertilizer Center - fertilizing programs Tab

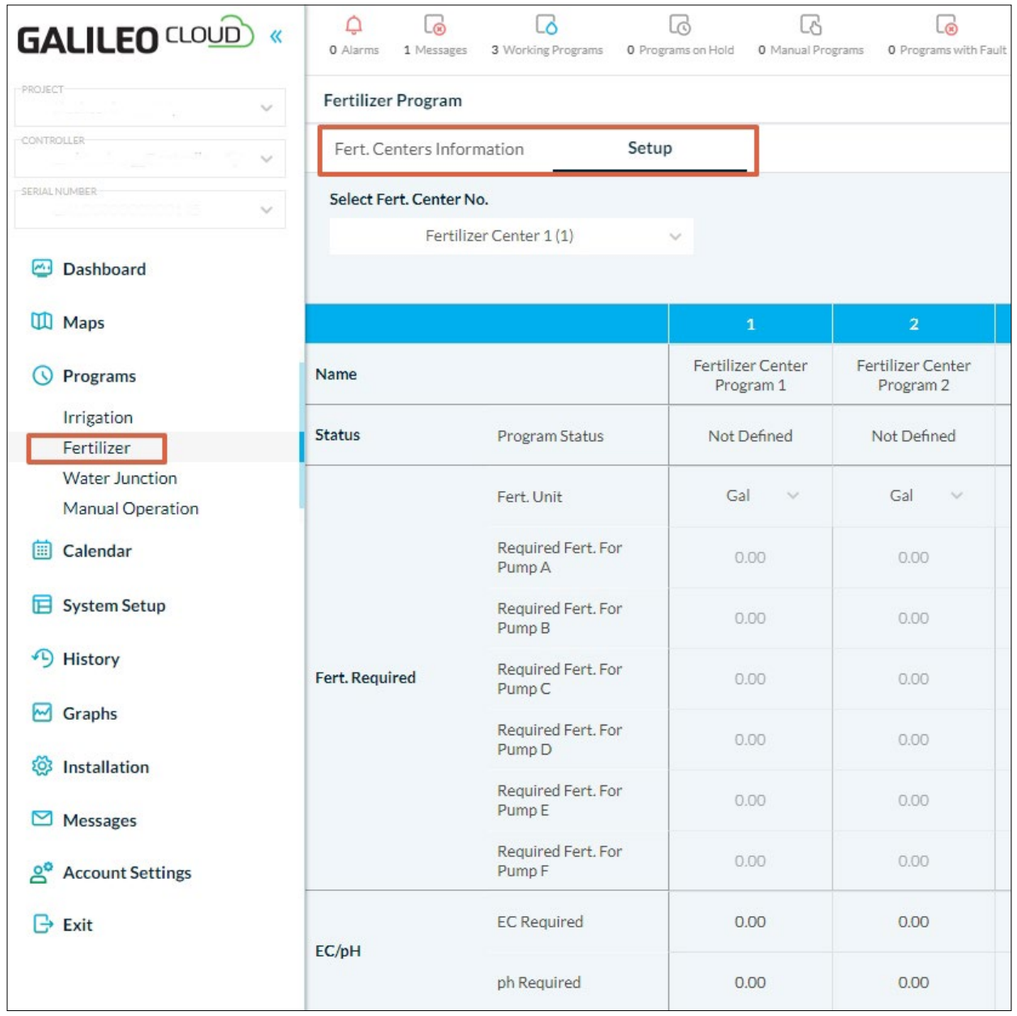
Define Fertilizer Center's Fertilizing Programs Tab

Entering the Define Fertilizer Center's Fertilizing Programs tab of the Galileo system, is done by clicking on the PROGARMS -> FERTILIZER CENTERS entry of the Galileo main menu.

This screen has 2 tabs: Setup and Information:

Very Important note: The setup tap enables the user to set up to 20 fertilizing programs per each one of the 8 available fertilizer centers of the Galileo system, but the Information tab displays information on all the 8 centers in the same single screen.

The Setup tab:



Very Important note: The first action to be done once entering this screen is to select the number of the fertilizer center for which fertilizing programs need to be entered. The user can select the range of the fertilizer centers to be displayed in this tab; first select in the right-side selection box, the highest fertilizer center to be displayed on this tab and only then select the lowest number of the fertilizer centers to be displayed on the left-side selection box. The system displays a setup table for each one of the selected fertilizer centers of the range, in ascending order one below the other along the screen. Each such table enables the user to set up to 20 fertilizer programs per each fertilize center; a filter selection boxes on the right-side of the programs' table enables the user to display the required number or page of the fertilizing programs.

- Set a name for the Fertilizer Program.
- Program Status - This parameter display's the current status of the fertilizer program, the options are: Not Defined - this program is not defined, Defined - the program is correctly defined but currently it is not fertilizing, Fertilizing - the program is currently fertilizing, Pump. Fault - at least one of the fertilizing pumps of this fertilizer center is currently in fault mode, EC Alarm - the EC level is too high or too low and the system issues an alarm message; in high EC alarm the fertilization is stopped but the irrigation continues, pH Alarm - the pH level is too high or too low and the system issues an alarm message; in low pH the fertilization is stopped but the irrigation continues (for OH pump the pump is stopped in high pH alarm), EC Fault - the EC level is too high or too low; it is in fault and the irrigation program enters also to fault mode, pH fault - the pH level is too high or too low; it is in fault and the irrigation program enters also to fault mode, Quant. Error - error in the fertilizer quantity definition of a fertilizer pump, Invalid pump number - a number of a fertilizer pump is missing or invalid, Pump Def. Error - the definition of a fertilizer pump is incorrect, Invalid Selector Number - the number of the output selected as a fertilizers' tank selector is invalid, Selector Definition Error - the definition of the output for the tanks selector is incorrect, Invalid EC/pH Number - the system should maintain EC or pH levels but the number of the sensor is invalid, Fert. Unit Definition Error - the selected fertilizer unit is incorrect, Invalid Water Meter Number - when fertilizing in liter/m^3 mode and the number of the selected water meter is invalid, Water Meter Definition Error - when fertilizing in liter/m^3 mode and the definition of the selected water meter is incorrect, Invalid Water Mixing Jun. No. - the number of the water mixing junction is invalid, Water Mixing Jun. Def. Err. - the definition of the water mixing junction is incorrect, Invalid Water Mixing Jun. Prg. No. - the program number of the mixing junction is invalid, Water Mixing Jun. Prg. Def. Err. - the definition of the water mixing junction program is incorrect.
- Fert. Required - Select Fertilizer Unit - select the fertilizing mode of all the pumps of this fertilizing program of the current fertilizer center, the options are: Liter - fertilizing by liters, MM:SS - fertilizing by time, L/Dunam- fertilizing by liter per dunam, Related - the system evenly divides the amount of fertilizer along the operation of the irrigation program.
- Fert. Required - Required Fert. for Pump A - the amount of fertilizer to be applied by pump A according to the fertilizer unit selected.
- Fert. Required - Required Fert. for Pump F - the fertilizer to be applied by pump F according to the fertilizer unit selected.
- EC/pH - Required EC - Set the required level of EC when the current program of the current fertilizer center controls the EC level of the irrigated water.
- EC/pH - Required pH - Set the required level of pH when the current program of the current fertilizer center controls the pH level of the irrigated water.
- Water Mixing Junction - Program Number - Select the number of the program of the designated water mixing junction to be operated due to a request issued by the current fertilizing program of the current fertilizer center.
- Fert. Selector - Number - Set the number of the fertilizer selector output that opens when the current fertilizing program starts.
- Automation Data - EC pump adjustment (%) - This parameter stores the automation settings applied in the previous irrigation cycle for controlling the required EC level. This stored value is applied in the beginning of the next irrigation cycle for shortening the time takes the system to reach the required EC level.
- Automation Data - pH pump adjustment (%) - This parameter stores the automation settings applied in the previous irrigation cycle for controlling the required pH level. This stored value is applied in the beginning of the next irrigation cycle for shortening the time takes the system to reach the required pH level.
- Secondary Fert. Programs - Fert. Program A. - Select the fertilizer program (out of the 20 programs of this fertilizer center) to be operated when the water source of this fertilizer center changes its operation mode to range A.
- Secondary Fert. Programs - Fert. Program B. - Select the fertilizer program (out of the 20 programs of this fertilizer center) to be operated when the water source of this fertilizer center changes its operation mode to range B.
- Secondary Fert. Programs - Fert. Program C. - Select the fertilizer program (out of the 20 programs of this fertilizer center) to be operated when the water source of this fertilizer center changes its operation mode to range C.

The Fertilizer centers Information tab:

Very Important note: In this screen the Information tab displays the information of all the 8 system's fertilizing centers.

- Current Active Fert. Program - The number of the currently active fertilizing program of each one of the system's fertilizer centers.
- Logic condition Status - The status of the logic condition that controls the fertilizer center, the options are: Not Defined - no logic condition is defined for this fertilizer center, Defined - a logic condition is defined for this fertilizer center but currently the condition is in its Off status, Paused by Logic Condition - the fertilizer center is paused due to a logic condition, Fault by Logic Condition - the fertilizer center in in fault due to a logic condition.
- Status - Fert. Center Status - the current status of each one of the system's fertilizer centers, the options are: Not Defined - no program is defined, Defined - a program is correctly defined but currently it is not fertilizing, Fertilizing - the program is currently fertilizing, Pump. Fault - at least one of the fertilizing pumps of this fertilizer center is currently in fault mode, EC Alarm - the EC level is too high or too low and the system issues an alarm message; in high EC alarm the fertilization is stopped but the irrigation continues, pH Alarm - the pH level is too high or too low and the system issues an alarm message; in low pH the fertilization is stopped but the irrigation continues (for OH pump the pump is stopped in high pH alarm), EC Fault - the EC level is too high or too low; it is in fault and the irrigation program enters also to fault mode, pH fault - the pH level is too high or too low; it is in fault and the irrigation program enters also to fault mode, Quant. Error - error in the fertilizer quantity definition of a fertilizer pump, Invalid pump number - a number of a fertilizer pump is missing or invalid, Pump Def. Error - the definition of a fertilizer pump is incorrect, Invalid Selector Number - the number of the output selected as a fertilizers' tank selector is invalid, Selector Definition Error - the definition of the output for the tanks selector is incorrect, Invalid EC/pH Number - the system should maintain EC or pH levels but the number of the sensor is invalid, Fert. Unit Definition Error - the selected fertilizer unit is incorrect, Invalid Water Meter Number - when fertilizing in liter/m³ mode and the number of the selected water meter is invalid, Water Meter Definition Error - when fertilizing in liter/m³ mode and the definition of the selected water meter is incorrect, Invalid Water Mixing Jun. No. - the number of the water mixing junction is invalid, Water Mixing Jun. Def. Err. - the definition of the water mixing junction is incorrect, Invalid Water Mixing Jun. Prg. No. - the program number of the mixing junction is invalid, Water Mixing Jun. Prg. Def. Err. - the definition of the water mixing junction program is incorrect.
- Irrigation Program Using - Irrigation Program A to Irrigation Program E - Since at the same time only up to 5 irrigation programs can use each fertilizer center, the parameters A - E display the numbers of the irrigation programs currently using the fertilizer center.

K.21. Programs -Irrigation - Program Setup

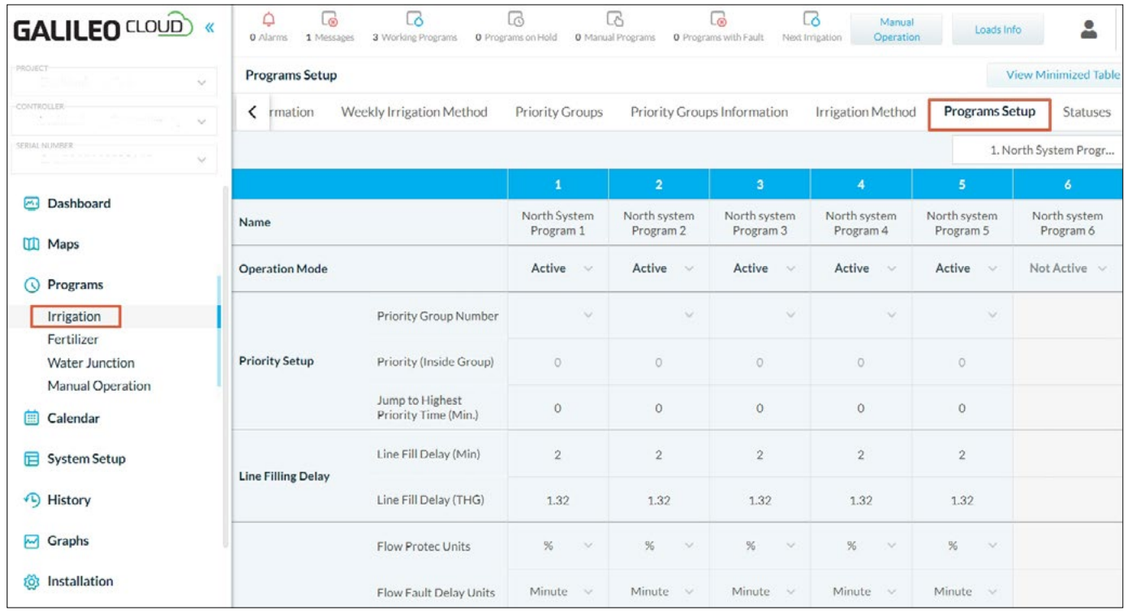
Define Program Setup

Entering the Define Program setup tab of the Irrigation entry of the Galileo system, is done by clicking on the PROGARMS -> IRRIGATION -> ALL PROGRAMS entry of the Galileo main menu.

This screen has 10 tabs: Information, Operation Table, Multi Programs, Irrigation Days Method, Priority Groups Information, Irrigation Method, Programs Setup, Statuses, and Last Cycle Data:

Very Important note: The tabs of the Irrigation entry of Galileo's Programs Section, contain two types of screens; setup screens and information screens. This chapter of the Galileo user manual contains explanations on the setup tabs only. The information tabs explanation appears on the Operation Chapter of this document (Chapter L).

The Programs Setup tab:



- Set a name for the Irrigation Program. (Up to 200 available irrigation programs)
- Program Operation Mode - Set the operation mode of the program, the options are: Not Active - the operation mode is not active (the program is correctly defined, but currently is set to not active mode; all its current operations, such as daily cycles, are cleared, Active - the program is correctly defined and its operation mode is Active; it may start irrigating according to its program parameters, Paused - the operation of the program is set to paused mode; once its mode is set back to Active the program resumes its operation.
- Important: The Galileo system distinguishes between Priority Groups and Priority Within the Group. Priority Group is a group of irrigation programs that only one of them can irrigate at the same time; the system has up to 50 priority groups. Within a Priority Group each program has its own Priority Within the Group. Each group has up to 10 possible priorities within the group (1-10), where the higher the number the higher the priority. Since only one program can irrigate at the same time, beginning irrigation of a program which has a higher priority, pauses the irrigation of the lower priority irrigation program. Therefore, the system prioritizes the operation of the Priority Group programs according to their specific priorities within the group.
- Priority Setup - Priority Group - Select the priority group for this irrigation program. (0 = the program is not depended in the priorities of the other programs within this group).
- Priority Within the Group - Select the Priority Within the Group for this program.
- Priority Setup - Jump to Highest Priority Time (min) - For ensuring irrigation of a lower priority program, it is possible to set the maximal time for this program to be paused due to its lower priority; once this parameter's time passes, the program jumps to the highest priority and pauses the irrigating program. Please note that in case that the running program also has the highest priority level, the program that jumped waits until the end of the running program operation.
- Line Filling Delay - Line Fill Delay (min) - Set the delay for pipeline filling of this program in minutes. The delay can be either a time delay or a volumetric delay. In case the two options exist, the actual filling delay ends when the first option ends its countdown.
- Line Filling Delay - Line Fill Delay (M³) - Set the delay for pipeline filling of this program in M³. The delay can be either a time delay or a volumetric delay. In case the two options exist, the actual filling delay ends when the first option ends its countdown.
- High Flow Alarm Setup - Flow protect. Unit - Select the units of the flow-rate protection, the options are: % - the high flow level is set as a percentage above the regular flow-rate of the program, M³/h - the high flow level is set as a specified flow-rate, above the regular flow-rate of the program.

- High Flow Alarm Setup - Flow Fault Delay Units - Set the units for the delay parameter, the options are: Minutes or %.
- High Flow Alarm Setup - Flow Fault Delay (Min) - Set the delay in minutes for the system to enter to flow-rate alarm; this prevents entering to alarm mode due to momentary change in the actual flow-rate.
- High Flow Alarm Setup - Flow Fault Delay (M^3) - Set the delay in M^3 for the system to enter to flow-rate alarm; this prevents entering to alarm mode due to momentary change in the actual flow-rate.
- Water High flow rate setting - Set the value (in M^3/h or Min, depends on the selected flow protection unit) that above it the system enters to alarm mode and stops the irrigation.
- Low Flow Alarm Setup - Flow protect. Unit - Select the units of the flow-rate protection, the options are: % - the high flow level is set as a percentage below the regular flow-rate of the program, M^3/h - the high flow level is set as a specified flow-rate, below the regular flow-rate of the program. Important Note: the selected protection unit in this parameter, applies also to the High Flow Protection.
- Low Flow Alarm Setup - Flow Fault Delay Units - Set the units for the delay parameter, the options are: Minutes or %. Important Note: the delay units set in this parameter, applies also to the High Flow Protection delay units.
- Low Flow Alarm Setup - Flow Fault Delay (Min) - Set the delay in minutes for the system to enter to flow-rate alarm; this prevents entering to alarm mode due to momentary change in the actual flow-rate..
- Low Flow Alarm Setup - Flow Fault Delay (M^3) - Set the delay in M^3 for the system to enter to flow-rate alarm; this prevents entering to alarm mode due to momentary change in the actual flow-rate. Important Note: the delay time set in this parameter, applies also to the High Flow Protection delay.
- Water Low flow rate setting - Set the value (in M^3/h or Min, depends on the selected flow protection unit) that below it the system enters to alarm mode.
- Low Flow Reaction - Set the system reaction to Low Flow Alarm, the options are: Alarm - issue an alarm message only, Fault - issue an alarm message and stop the irrigation. Note - for high flow alarm the system reaction is always "Fault".
- General Setup - Limit Flow By Pipe Number - This parameter prevents the operation of the irrigation program in case its expected flow-rate exceeds the flow-rate that is currently available in the pipeline irrigated by it, e.g., if the pipeline already discharges water and the expected additional flow-rate of this program exceeds the maximal capacity of the pipeline flow-rate, this program enters to pause until there will be sufficient room for its expected flow rate in the pipe. Select the pipeline number that its currently available flow rate limits the operation of this program.
- General Setup - Irrigation Method Number - Galileo system has an option to operate each irrigation program in up to 10 different interval modes, or with up to 5 different operation timings. The user may use this feature for affecting the basic program parameters (such as water quantity or irrigation interval) according to the Modes Timing, please refer to the Irrigation Method screen for details on the usage of the Irrigation methods. In this parameter select the number of the required irrigation mode for this irrigation program. If no Irrigation Method is selected for this irrigation program (zero is entered in this parameter), it will perform its basic program settings only.
- General Setup - Irrigation when Fert. not available - Select the system response in case the fertilizer is not available due to some Fertilizer Faults, the options are: Continue - continue the irrigation even when the fertilizer is not available (important if the soil must remain wet), or Stop - stop the irrigation during the fertilization fault. Important note: selecting continue irrigation, operates only for some fertilizer faults, in faults such as Uncontrolled Fert. the irrigation will be stopped anyway.
- General Setup - Auto Cancel Alarm - Set the Auto Cancel Alarm for this program to Yes or No.
- Program Conditions - Logic Condition Number - Select the number of the logic condition to affect this irrigation program (only when such condition is required).
- Program Conditions - Start by Element Type - In case where this irrigation program should be started by a system element (such as sensor), select the type of the element that starts the program, the options are: None - no element is selected for starting this irrigation program, Sensor Accumulation - start the program according to the accumulation level of a selected sensor, General Counter Accumulation - start the program according to the accumulation level of a general counter, Accumulated Evaporation - start the program according to the accumulation level of the evaporation, Above Sensor Value - start the irrigation program when the reading of the selected sensor is above a certain level, Below Sensor Value - start the irrigation program when the reading of the selected sensor is below a certain level, Condition Input - start the program according to the status of a condition input.
- Program Conditions - Start by Element Number - Select the number of the element selected in the Element Type parameter
- Program Conditions - Value to Start - Set the reading value of the selected element for starting the irrigation program.
- For Conditioned Programs - Start Anyway After (min) - This is a protection feature that ensures irrigation for programs that their start command is issued by an element or a logic condition, but not by a pre-defined timing. Enter the maximal allowed time in minutes, that if passed since the last irrigation interval of this program, the program will start anyway, even if its start condition or start element did not start it. This protection feature ensures irrigation if the regular start element or logic condition command is faulty.
- Water Multiply - Water (0-200%) - This parameter is a permanent multiplying the program's basic water amount by a pre-defined percentage.

The Galileo Water Multiply feature options: Water amount multiplying is a feature that allows the user to increase or decrease the basic water amount of an irrigation program by multiplying it by a specific percentage within the range of 10-200%. This may be required due to specific agrotechnical crop requirements.

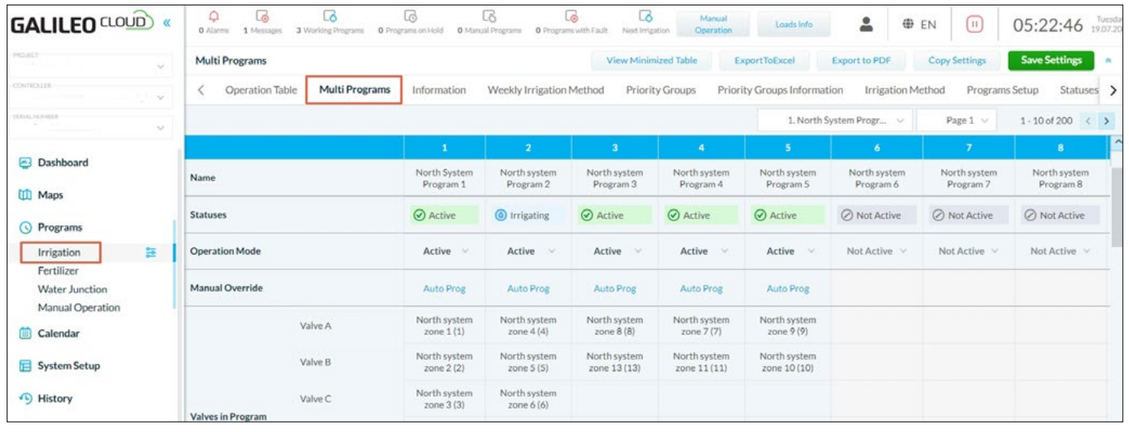
Although the Galileo system has some options for water multiplying, it is important to understand that all these options are organized in a hierarchical order, where only the highest hierarchy of them can actually affect the basic water amount. In case where an irrigation program has more than one type of multiplying options only the highest of them takes effect. The following are the multiplying options arranged from the highest to the lowest priority of the hierarchy:

* Water Multiply for Current Irrigation (%) - found in the Multi Programs screen.
* Permanent Water Multiply - found in the Programs Setup Screen.
* The water multiplying of the water method - found in the Irrigation Method screen.
* The water multiplying of the Water Source rout: In Menu->System Setup-> WATER SYSTEM-> Water supply Group->Setup->Water Quantity Multiplying (%)
* The water multiplying of the plot for today rout: In Menu-> System Setup->IRRIGATION->Plots->I nformation->Manual Info->Today Water Multiply
* The permanent water multiplying of the plot rout: In Menu-> System Setup->IRRIGATION->Plots->Setup-> Manual Commands-> Permanent Water Multiply

Cancel Fertilizing - Permanently Cancel Fert. - Cancel the fertilizing of this program permanently, the options are: No - do not cancel the fertigation, Cancel - stop any fertilizing of this program permanently; may be used for stopping fertilizing by the end of the growing season but continue enabling the irrigation.

- Cancel Fertilizing - Cancel Fert. for Today - Cancel the fertilizing of this program for today (Midnight to Midnight), the options are: No - do not cancel the fertigation, Cancel - stop any fertilizing for today.

The Multi Programs Setup tab:



- Set a name for the Irrigation Program (Up to 200 available irrigation programs), note that it is the same name as appears in the Program Setup screen; a change here applies also there.
- Status - The status of the program, the options are: Not Active - the program is not defined or defined but not active, Definition Error - the definition of the program is incorrect, No Start Time - this program has no operation timing; it can be started by a manual start command, Conditioned - this program may be started by a condition, Active - the program is correctly defined; it has start timings and it is not conditioned, Active + Alarm - the program is active but it has an alarm; it can still irrigate, Paused - the program is in pause mode, Fault - the program is in fault mode; it cannot irrigate unless the fault status is cleared and canceled, In Queue - the program is started but cannot irrigate due to the operation of other high priority program, In Queue + Alarm - the program is in Queue but it has an alarm, Irrigating - the program is currently irrigating, Fertigating - the program is currently irrigating and fertilizing, Irrigating + Alarm- the program is currently irrigating but has an alarm, Fertigating + Alarm - the program is currently Fertigating bur it has an alarm.
- Program Operation Mode - Set the operation mode of the program, the options are: Not Active - the operation mode is not active (the program is correctly defined, but currently is set to not active mode; all its current operations, such as daily cycles, are cleared, Active - the program is correctly defined and its operation mode is Active; it may start irrigating according to its program parameters, Paused - the operation of the program is set to paused mode; once its mode is set back to Active the program resumes its operation.
- Manual Override - in this parameter the user can switch the program to various manual operation modes, the options are: Auto Prog. - set the program to automatic operation mode (no manual overriding), Start Prog. - manually start the program; the status shown in this parameter remains "Start Prog." until the program finishes its irrigation and then the parameter returns to "Auto Prog.", Start Program W/O Fert. - start the program without operating the fertilization, Stop Prog. - manually stop the program; the program immediately stops and the status shown in this parameter returns to "Auto Prog.", Pause Prog. - pause the operation of the program; it remains in this status until the user switches it back to "Auto Prog.", Resume Paused Program - set the paused program back to "Auto Prog." Status, Cancel Program Today - cancel the operation of the program for today (midnight to midnight) the program returns to "Auto Prog." at midnight, Cancel Program - cancel the operation of this program; it remains canceled until the user switches it back to "Auto Prog.", Start Sequence - start a sequence of programs that are listed as sequence from this program on; each one of these programs receives a manual start command and enters the operation queue, Start Seq. W/O Fert. - start this program sequence without operating the fertilization of the programs of the sequence, Stop Sequence - stop the operation of the program and all its following programs in the sequence, Pause Sequence - pause the sequence operation; the current program and each one of the following programs of the sequence receive manual Pause command, Resume Paused Sequence - for the current program and all the following programs of the sequence set the programs back to "Auto Prog." Status, Cancel Sequence Today - cancel the operation of the current program and the following programs of the sequence for today (midnight to midnight) the programs return to "Auto Prog." at midnight, Cancel Sequence - cancel the operation of this sequence; it remains canceled until the user switches it back to "Auto Prog.", Auto Sequence - switch the sequence to "Auto Prog." Mode.
  Important note - A sequence contains number of irrigation programs in an ascending order, the sequence operation starts once the first program is started, once the first program finishes, the next program of the sequence starts; the operation continues in this manner till the end of the operation of the last program of the sequence. In case when a manual command starts a program that it is not the first program of the sequence, the system ignores the programs listed before this program, and continues till the end of the sequence. In case when manual command stops a program that is currently in the queue, this program and the following programs of the sequence receive stop command.
- Valves in Program - Valve A - Select the number of the first valve of the program.
- Valves in Program - Valve B/C/D/E - select the number of the valve of the program.

Important note: In Galileo system an irrigation program is a group of up to five valves, groups of valves, or a combination of valves and group of valves. Once the irrigation program starts, all its A-E participants members start to irrigate together. The amount of water to be irrigated by the program is the amount calculated by the system for all the program's participating valves together.

- Valves in Program - Valve Finish Method - At the beginning of the program's operation, the system calculates out of the total water amount parameter of the program the amount of water to be applied to each one of the 5 possible participating valves. During irrigation, the system monitors the amount of water applied to each one of these valves. In this parameter the user can control the way the system ends the operation of its participating valves at the end of the irrigation process, the options are: Parallel - Once the program's total water amount is delivered, the program stops the operation of all its participating valves together and finishes its operation, Separated - in case where all, or some, of the participating valves have water meters, the program stopes the operation of each such valve once it delivers its calculated amount of water; the program itself finishes its operation once the last valve complete delivering its water amount.
- Next Irrigation - Days to Next Start - The system displays the number of days left till the next irrigation day of this program. This is an editable real time value, so if needed, the user can change the number of days left.
- Next Irrigation - Next Start Time - The system displays the next start time of the program; in case of a program that has cycles, this is the planed start time of the next cycle. This is an editable real time value, so if needed, the user can change the next start time.
- Next Irrigation - Remaining Cycles - For a program that include cycles, the system displays the number of cycles remaining till the end of this program's operation.
- Irrigation Timing - Timing Method - Galileo system has few options for the irrigation program start method, the options are: By Time - the user set specific start time and start date for the program, Following - this program is part of a sequence; it starts upon the end of its previous program of the sequence, Sunrise - the program starts relatively to the sunrise of the irrigation day; the user should enter, in the next parameter, the shifted timing relatively to the sunrise time (time before or time after the sunrise moment; maximal shift +/- 24 hours), Sunset - the program starts relatively to the sunset of the irrigation day; the user should enter, in the next parameter, the shifted timing relatively to the sunset time (time before or time after the sunset moment; maximal shift +/- 24 hours), Opn. + Protec - once this mode is selected and saved the program immediately starts and remains constantly in operation; during this operation method the program may stop only due to a major fault such as flow-rate fault (please note that if this program has a fertilizing plan, it will also operate in this operation method mode, Without Timing - the program has no start timing; it can be operated only by manual override.
- Irrigation Timing - Start Timing Setpoint - In this parameter the user should enter the timing set point according to the selected Irrigation Method, e.g., for By Time method enter the start time parameter, for Sunrise method enter the required shift from the sunrise moment, etc.
- Irrigation Timing - Irrigation Days method - Select the required irrigation days method, the options are: Days Interval, or Weekly. In case of interval days enter the required interval in the next parameter of this screen. In case of irrigation by the days of the week, set the required days in the Irrigation Days Method Tab of the Galileo system.
- Irrigation Timing - Interval days - Enter the interval days between the start days of this program. e.g., for irrigation every 3 days, enter the number 3.
- Irrigation Timing - Cycles Per Day - for operating this program in multiple cycles per irrigation day enter the number of the require cycles.
- Irrigation Timing - Cycles Interval (Min.) - When the cycles per day are greater than 1, enter the interval between the cycles' start timing in minutes.
- Irrigation Timing - End Time (HH:MM) - When needed enter a daily end time; by this time the operation of this program ends, even if it has not finished delivering the water amount or finish the daily cycles. Notes - This parameter is effective only for irrigation programs that have start times. For Irrigation sequence the End Time parameter ends all the programs of the sequence.
- Water Data - Water Unit - Select the required water unit for this program, the options are: MM:SS - irrigation by time; minutes and seconds, M^3 - irrigation by volume; M^3, M^3/Dunam - irrigation by specific volume per each irrigated Dunam, Evap. Crop Factor - irrigation by multiplying the crop factor by the accumulated evaporation, mm/Dunam - irrigation by specified mm of water per each irrigated dunam.
- Water Data - Water Amount - Depends on the selected water unit, enter the required water amount, e.g., for M^3 unit enter the required number of cubic meters of water to be irrigated, for Evap. Crop Factor enter the number to be multiply by the evaporation value in order for the system to calculate the required water amount for that specific crop.
- Water Data - Water Remaining - The remaining amount of water (time or volume) to be irrigated till the end of the program's operation. This is an editable real time value, so if needed, the user can change the number on the fly.
- Water Data - Water multiply for current Irrigation (%) - In case there is a need to multiply the amount of water

of this program, for the current irrigation only, enter the percentage required. This is an editable real time value, so if needed, the user can change the number on the fly. Once the current irrigation ends this parameter is automatically set to zero (no multiplying of the basic water amount). Please note that in irrigation program with daily cycles this parameter affects only the current cycle.
Very important note: The Galileo system has some options for multiplying the water amount by a specific percentage, this may be done due to agrotechnical requirements of the crop. Please refer to the control philosophy chapter of this document for details on the different water multiplying features.

- Fertilizing - Water Before - Enter the water amount (time or volume) that should be applied once the irrigation program starts and before the fertigation starts. This parameter can be used for wetting the soil before starting the implementation of the fertilizer.
- Fertilizing - Water After - Enter the water amount (time or volume) that should be applied by the irrigation program after the fertigation process ends. This parameter can be used for preventing fertilizers residue on the crop leaves.
- Fertilizing - Local Fert. Pump Number - Select the fertilizer pump number that operates as a local fertilizer pump for this irrigation program.
- Fertilizing - Local Fert. Unit - Select the fertilizer unit for the local pump, the options are: Liter - the amount of fertilizer is given in volume, MM:SS - the amount of fertilizer is given in time, L/Dunam - the amount of fertilizer is given in liters per each irrigated dunam, l/M³ - the amount of fertilizer is given in liters per each cubic meter of irrigated water, Related liters - the fertilizer is given in liters and the system divides the fertilizer amount along all the fertigation time.
- Fertilizing - Local Fert. Amount - According to the fertilizer unit, enter the required fertilizer amount for the local pump.
- Fertilizing - Fert center number - Select the number of the fertilizer center that serves this irrigation program.
- Fertilizing - Fert. Center Prog. Number - Select the program of the fertilizer center that is used for fertilizing this irrigation program.
- Initialization - Restart - Use this option to clear the real time data of the program and restart it again.

Very important notes:

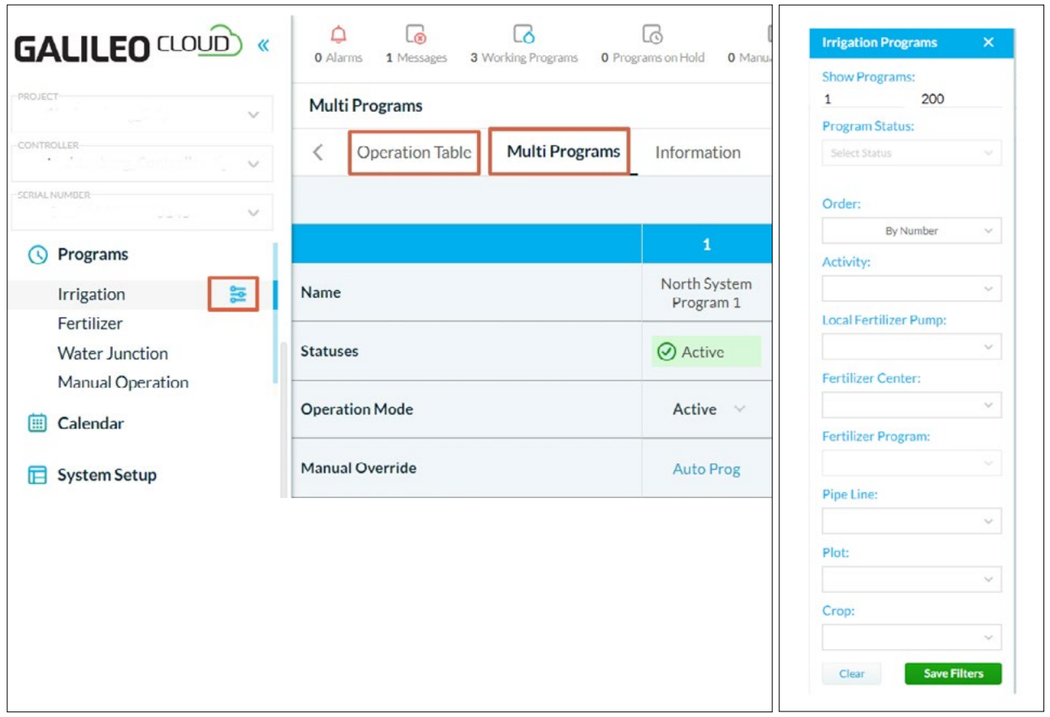
This option does not delete the program; when the program restarts, the system calculates its timings and continue the program's operation from the point its real time data was cleared.

This means that for a program with defined cycles per day, the program will operate the next cycle, as if the real time data was not cleared.

If after the reset of the program, the operator would like to ignore the cycles left for the day, and let the system restart the program only in the next irrigation day, the user should pause the program and resume its operation in the next day before its first start time.

The Multi Programs Filter:

The Galileo System has an option that allows the user to filter the data displayed on some specific screens so only the required data appears on screen. The multi programs screen has this option also and it is accessible by clicking on the filter icon on the menu at the left of the screen. The following filter window appears to the left of the multi programs screen:



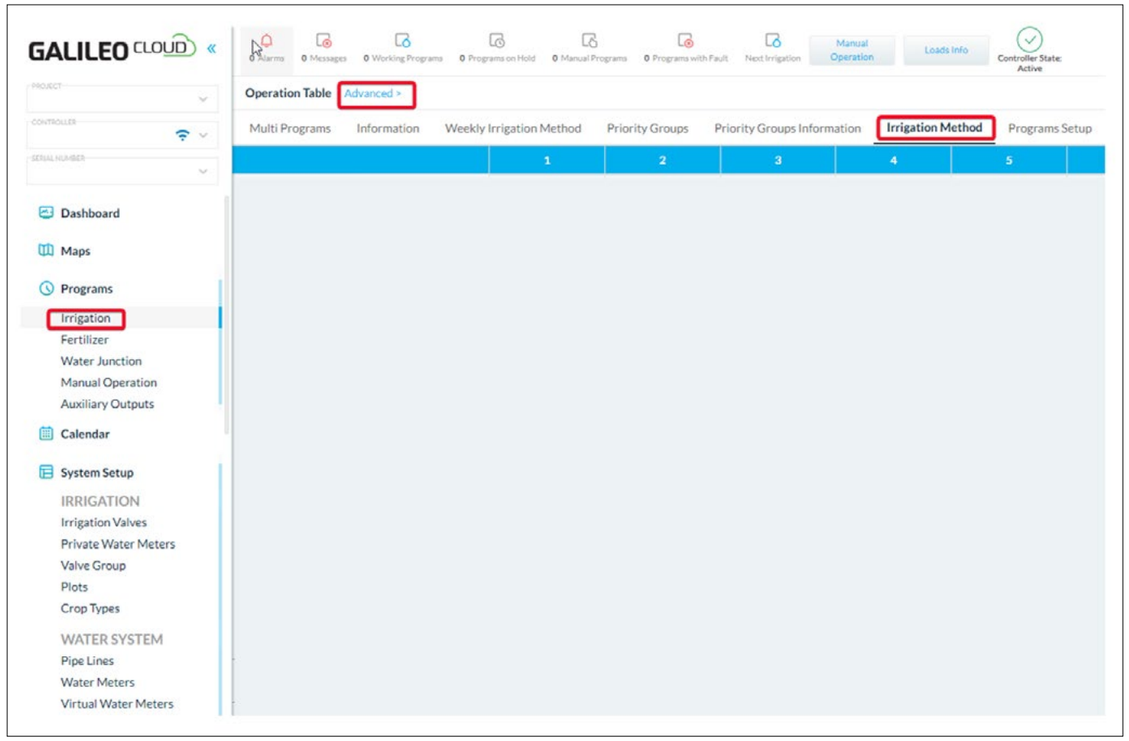
The filter window operates in "and" manner; the selection of each parameter affects the content of its following parameters. The filter displays the information on the main screen in real time, so the information changes immediately with the parameter's selection.

- The first parameter displays an option for selecting a range of irrigation programs.
- The second parameter displays an option for selecting the programs statuses (multi selection of statuses from a list).
- In the third parameter the user can select the order of the filtered data, the options are: by Number – by the numbers of the filtered programs, or by Status Order – once this option is selected, the system displays a popup table with all the available statuses, the user can move the row of this table up and down in order to set the required order of the filtered programs.
- The fourth parameter displays an option for selecting the programs activities (multi selection of activities from a list).
- Local Fertilizer pump – select the required fertilizer pumps for filtering the programs accordingly.
- Fertilizer Center – select the required fertilizer Center for filtering the programs accordingly.
- Pipe Line – select the required pipeline for filtering the programs accordingly. The filter displays programs that their valves are configured for the selected pipeline number.
- Plot - select the required plot for filtering the programs accordingly. The filter displays programs that their valves are configured for the selected Plot.
- Crop - select the required crop for filtering the programs accordingly. The filter displays programs that their valves are configured for the selected crop.

Save Filter – save the filter parameters for future use.

Clear – clears all the filter's selections.

Important - the main screen continues to display only filtered information as long as the user does not clear the filter parameters.



Important: The Irrigation Method is a special feature of the Galileo system that allows the use to change the water amounts and the daily intervals of an irrigation program along the irrigation day by 5-200% relatively to the basic water amounts and the day intervals timings of the program.

Galileo system provides two interchangeable features to perform the manipulation on the basic program parameters: changing the water amount irrigated in up to 10 cycles per day, or setting up to 5 different daily schedules, for changing the basic water amount and the daily intervals of the program.

- Operation Method Setup - Select the required operation method of the program, the options are: Not Active - this program is not active or not defined, By time - the program operates by predefined start timings, Sunrise - the program starts relatively to the sunrise of the irrigation day; the user should enter the shifted timing, relatively to the sunrise time (time before or time after the sunrise moment; maximal shift +/- 24 hours), Sunset - the program starts relatively to the sunset of the irrigation day; the user should enter the shifted timing, relatively to the sunset time (time before or time after the sunset moment; maximal shift +/- 24 hours).

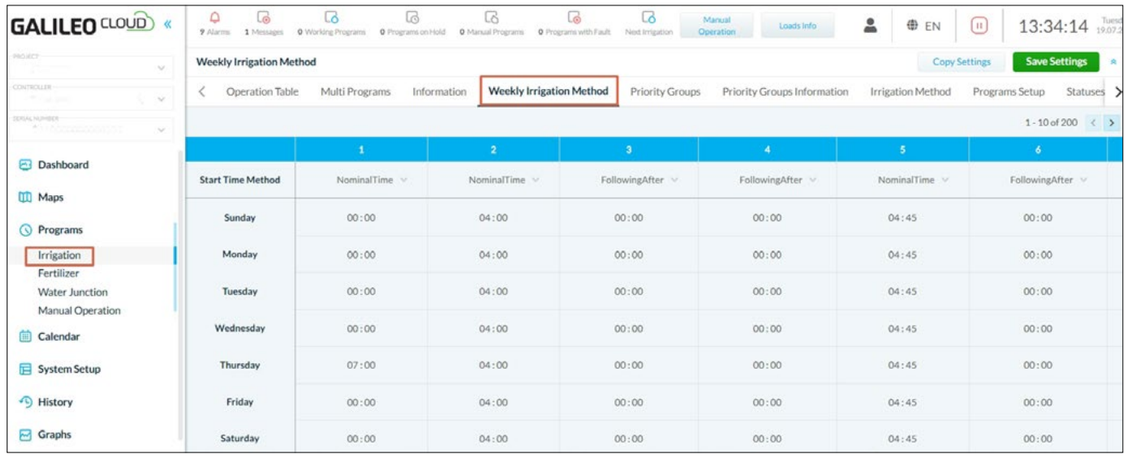
Irrigation Method by changing the water amounts of the daily intervals:

- Water Multiply According to Cycle Num. - Change Water According to Cycle Number - Select Yes for the ability to change the water amount of this irrigation program intervals, or No. **Very important:** Galileo system can operate only one type of irrigation method manipulation features at a time, therefore once this parameter is set to YES the Irrigation Method by up to 5 different daily schedules cannot be programmed, and vice versa.
- Water Multiplying According to Cycle Num. - Water Multiplying for cycle A (%) - Set the percentage (10-200%) for multiplying the basic program's water amount while the program operates it daily interval number 1.
- Water Multiplying According to Cycle Num. - Water Multiplying for cycle B (%) - Set the percentage (10-200%) for multiplying the basic program's water amount while the program operates it daily interval number 2.
- Water Multiplying According to Cycle Num. - Water Multiplying for cycle J (%) - Set the percentage (10-200%) for multiplying the basic program's water amount while the program operates it daily interval number 10. **Important** - this feature can work for up to 10 daily intervals only.

Irrigation Method by up to 5 different daily schedules:

- Timing A - Start Time - Set a start time for the first daily schedule. Please note that if the operation method is "sunrise" or "sunset" the time entered in this parameter is the shift in HH:MM from the current day sunrise or sunset.
- Timing A - Stop Time - Set a stop time for the first daily schedule. Please note that if the operation method is "sunrise" or "sunset" the time entered in this parameter is the shift in HH:MM from the current day sunrise or sunset.
- Timing A - Water Quantity Multiplying (%) - Set the percentage (10-200%) for multiplying the basic program's water amount while the program operates in Timing Schedule A.
- Timing A - Interval Time (%) - Set the percentage of the interval length (10-200%) to be performed while the program is in schedule A. (the default is 100%).
- Timing A - Accum. Sensor Multiplying (%) - Set the percentage (10-200%) for multiplying the accumulation of an Accumulation Sensor (such as Solar Radiation Sensor) that is set to start an irrigation interval of this program, while the program is in schedule A. (the default is 100%).
- Timing B - Timing E - Set the parameters as described in Timing A - Make sure that the timings of the schedules are separated from each other so at any given time only one such schedule can be active.

The Weekly Irrigation Method tab:

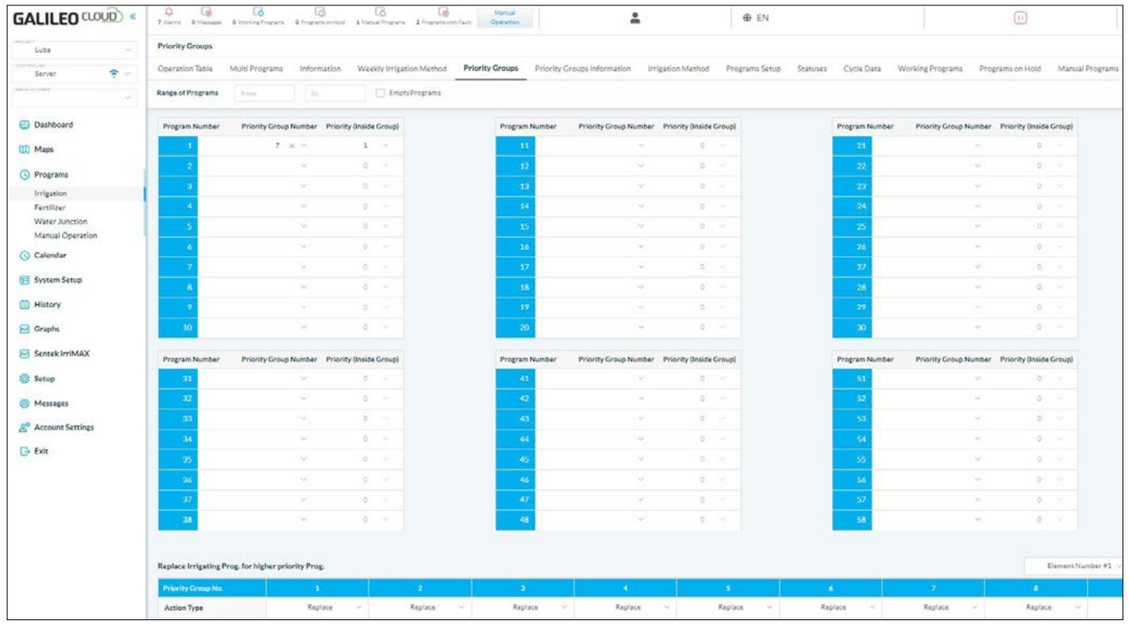


Important: Galileo system can operate an irrigation program either in days interval or by the days of the week. If the user selects Weekly as the required Irrigation Days method, he should refer to this screen for setting the days of the week schedule for the programs that operates according to days of the week. In such case the start time as set in the multi programs screen is ignored and the program starts according to its days of the week schedule.

- Start Timing Method - Galileo system has few options for the irrigation program start method, the options are: By Time - the user set specific start time and start date for the program, Following - this program is part of a sequence; it starts upon the end of its previous program of the sequence, Sunrise - the program starts relatively to the sunrise of the irrigation day; the user should enter, in the next parameter, the shifted timing relatively to the sunrise time (time before or time after the sunrise moment; maximal shift +/- 24 hours), Sunset - the program starts relatively to the sunset of the irrigation day; the user should enter, in the next parameter, the shifted timing relatively to the sunset time (time before or time after the sunset moment; maximal shift +/- 24 hours), Opn. + Protec - once this mode is selected and saved the program immediately starts and remains constantly in operation; during this operation method the program may stop only due to a major fault such as flow-rate fault (please note that if this program has a fertilizing plan, it will also operate in this operation method mode, Without Timing - the program has no start timing; it can be operated only by manual override.
- Sunday - Set the start time for this program on Sunday.
- Monday - Set the start time for this program on Monday.

- Tuesday - Set the start time for this program on Monday.
- Wednesday - Set the start time for this program on Monday.
- Thursday - Set the start time for this program on Monday.
- Friday - Set the start time for this program on Monday.
- Saturday - Set the start time for this program on Saturday

The Define Priority Group tab:



Important: Please refer to the control philosophy chapter of this document and the program setup of the irrigation tab for explanation on the priority groups of the Galileo System.

The upper part of this screen displays all the programs of the system, in groups of ten programs in each group.

For each program the user can set a group number and a priority within the group.

The lower table of the screen, named "Replace Irrigating Program for higher Priority Program" defines, for each group, the action to be performed when a higher priority program starts at a time where a lower priority program of the same group is irrigating.

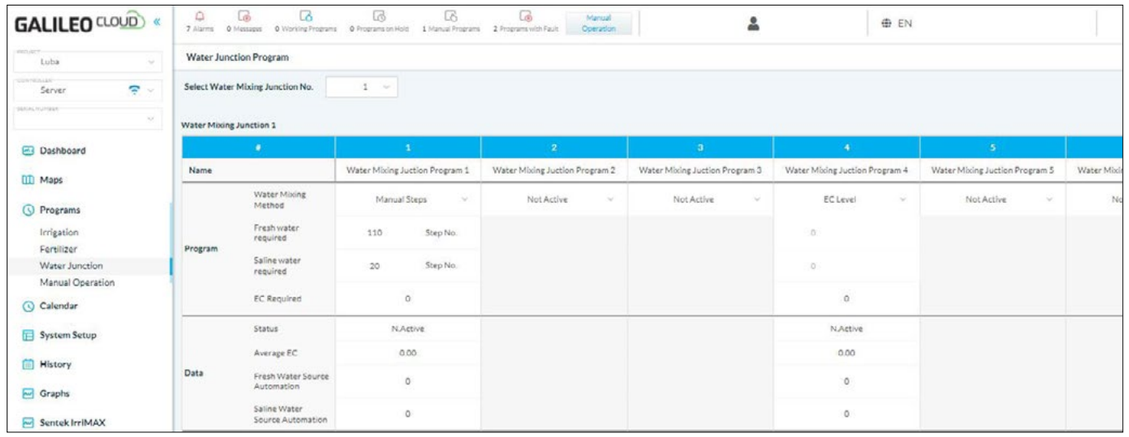
There are two options for the Action Type parameter:

- The first option is Replace; immediately pause the operation of the lower priority program and start the operation of the higher priority program. In such case the lower priority program waits in the program's queue until it can resume its operation. Note that this happens only if the lower priority program has more than 2 minutes left for finishing it current irrigation.
- The second option is Wait; wait until the lower priority program finishes its irrigation, and only then to start the higher priority program.
- Next - Next Program Priority - The priority within the group of the next program to irrigate.
- Change Program Request - This parameter shows whether there is a request to change the irrigation program due to the start of a higher priority program. The options are Yes or No.

K.22. Programs - Define Water Junction Programs - Program Setup

Define Water Junction Programs

Entering the Define Water Junction Program tab of the Programs entry of the Galileo system, is done by clicking on the PROGARMS -> WATER JUNCTION entry of the Galileo main menu.



Please note: The selection boxes above the table enable the user to display more than single water junction on the screen; the first box is the "From" box and the second one is the "To" box. The system has up to 4 mixing junctions where each one of them has up to 6 different programs.

- Name - Set a name for the program.
- Program - Water Mixing Method - Select the operation method of the program, the options are: Not Active - the program is not defined or not active, Manual Steps - in this mode the used sets the opening step of each water source valve and the system keeps the valves opened accordingly, EC Level - in this mode the system controls the EC level of the water supplied by this mixing junction; in this case the user should specify the required EC level in the Required EC parameter of this screen, Percentage - in this mode the user sets the required percentage of the saline and the fresh water in the mixture and the system divides the real time flow-rate according to these settings.
- Program - Required Fresh water - Depends on the selected operation method, the user enters the required Fresh water (Percentage or Steps). Note that this parameter is grayed out in case of the EC level method.
- Program - Required Saline water - Depends on the selected operation method, the user enters the required Saline water (Percentage or Steps). Note that this parameter is grayed out in case of the EC level method.
- Program - Required EC Level - This parameter is in use only when the selected operation method is "EC Level", the used should enter the required EC level in this parameter.
- Data - Program Status - The current status of the mixing program, the options are: Not Active - the program is not defined or not active, Fresh Water Def. Error - the definition of the fresh water parameters are not correct, Saline Water Def. Error - the definition of the saline water parameters are incorrect, Percentage Error - the percentage of the fresh water plus the percentage of the saline water is not 100, EC Def. Error - the definition of the EC parameters are incorrect, OK - the program definition is correct but currently it is not operating, Mixing - the program is correct and currently it is operating.
- Data - Average EC - The current average of the EC level along the current irrigation cycle. Note that at the end of the irrigation this parameter continues to display the last EC level value.
- Data - Fresh Water Source Automation - The current automation level of the fresh water source; this parameter is also used for shortening the time it takes the system to reach the required level at the beginning of the next irrigation cycle. (See the chapter of the mixing junction setup for details.)
- Data - Saline Water Source Automation - The current automation level of the saline water source; this parameter is also used for shortening the time it takes the system to reach the required level at the beginning of the next irrigation cycle. (See the chapter of the mixing junction setup for details.)

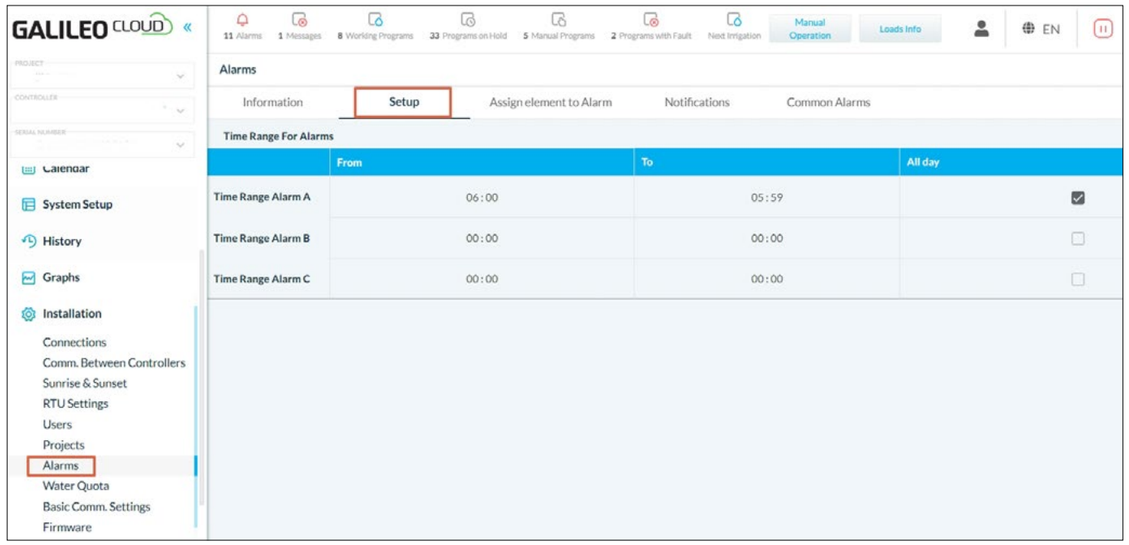
K.23. Setup - Define Alarms Setup

Define Alarms Setup

Entering the Define Alarms Setup tab of the Setup entry of the Galileo system, is done by clicking on the SETUP -> ALARMS-> Setup entry of the Galileo main menu.

This screen has 5 tabs: Information, Setup, Assign an Alarm to Alarm-Management Program, Notifications, and Common Alarms

The Setup Tab:



Very Important:

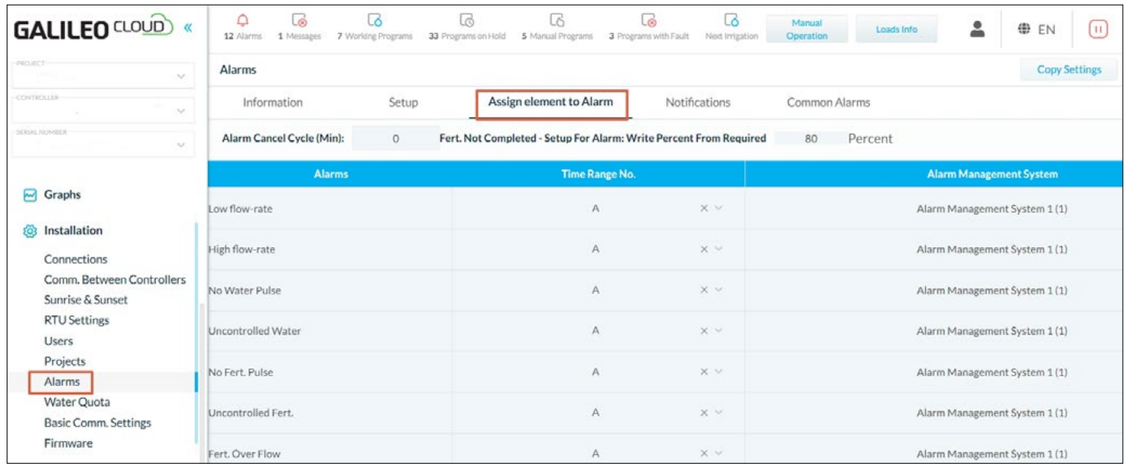
For managing and operating alarms, the Galileo system distinguishes between four different software features:

1. Alarms - These are the messages that the system issues when some fault happens in physical elements of the irrigation system, or in some software elements, e.g., "No Water Pulse", "Irrigation Program Fault", etc. The alarm messages include Fault messages (something went wrong and the system stopped it), and Alarm only messages (an indication that something went wrong but it was not stopped by the system). When an Alarm occurs, the Galileo system displays the alarm message in the operation, setup, logs and the dashboard screens.
2. Alarm Management System - These are 8 different systems (programs), that allow the user to manage the distribution of the Alarms to other people. The user can define which Alarms will be assigned to each one of the 8 Alarm Management Systems, as well as what task each such system fulfills. It is important to understand that the Alarm Management Systems cannot prevent the Galileo system from issuing alarms (as described in section 1 above), these systems deal only with the distribution of the alarms to the outside world.
3. Alarms Time Ranges - These are three-time ranges that the user can define for the management of alarms. The ranges can be used for setting different time frames for distributing alarms, such as during nights or day times. It is important to understand that the Time Ranges cannot prevent the system from issuing alarms (as described in section 1 above), they deal only with the distribution timing of the alarms to the outside world.
4. Alarm Outputs - These are physical outputs of the controller, that can be assigned to the Alarm Management Programs. These outputs can be used for switching alarm bells, alarm lamps, operating pagers or operating any other device that the user may connect them to. **Very Important note:** the alarm outputs are of Normally Close type; they are ON when no alarm exists and the goes OFF when alarm happens. This arrangement allows operating an independently powered alarm device to set an alarm when the controllers power supply is off.

- Time Range for Alarms - Time Range Alarm A - Set the first required time range. There are two parameters: "From" - this is the beginning of the time frame, and "To" - the end of the time frame. The box to the right of the To box allows the user to select the whole day as the time frame for this range. Please note that for the Alarm Management Systems the Galileo system day starts at 06:00 and ends at 05:59.

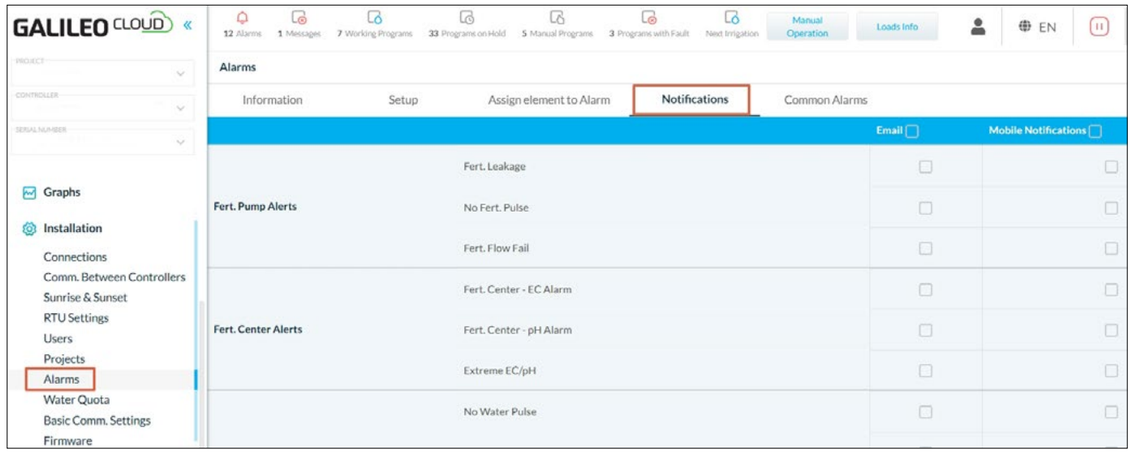
- Time Range for Alarms - Time Range Alarm C - Set the first required time range. There are two parameters: "From" - this is the beginning of the time frame, and "To" - the end of the time frame. The box to the right of the To box allows the user to select the whole day as the time frame for this range. Please note that for the Alarm Management Systems the Galileo system day starts at 06:00 and ends at 05:59.
- Fert. Not Completed - Setup for Alarm - Percentage Deviation - In order to prevent unnecessary alarms due to very little amount of fertilizer that was not completed during fertigation, the user can set a limit for this alarm. Set the deviation percentage from the programed fertilizer amount that above it the system issues the Fert Not Completed Alarm.

The Assign an Alarm to Alarm-Management Program Tab:



- Alarm Cancel Cycle (Min.) - If required, set the time interval for the automatic alarm canceling. Please note the automatic alarm canceling can be dangerous, although the system does not allow automatic canceling of all the alarm types, the user is required to use caution with this parameter.
- Alarms - This column displays all the possible alarm messages of the system, each in a separated line.
- Alarm Management System - This column is used for assigning one of the 8 Alarm Management Systems to each one of the alarms. When clicking on this parameter, a window displaying the 8 Alarm Management Systems appears and allows the user to select one of the 8 management systems for this Alarm.
- Time Range No. - Select one of the 3 (A, B, C) time ranges for the Alarm Management System to be Active. Click on the X icon to reset the selected time frame.

The Notifications Tab:



- This screen displays all of the system's alarm messages, grouped by their types. For each such message the user can select up to two notification options: Receiving an E-mail, and/or receiving a push notification to his

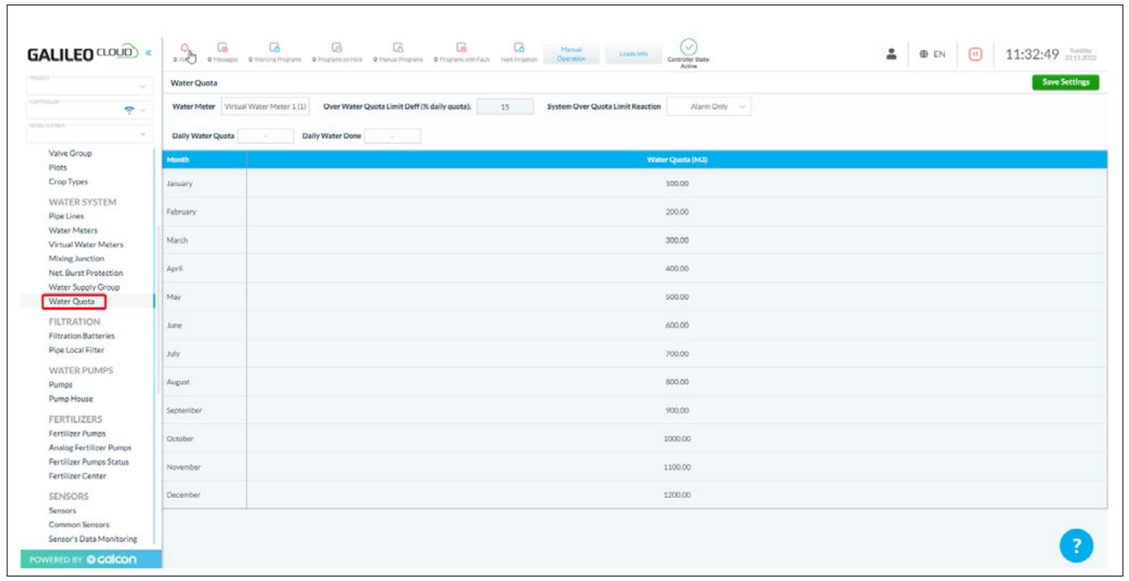
cellular phone. The default for all the messages is E-mail and Cellular Push. The Box above each selection column enables the user to select or deselect all the alarm messages together.

- Please note that the last group is the Logic Condition group. In this group the user can select whether to receive a notification when a logic condition that is set to send messages to the event log switches from Off to On or from On to Off.

K.24. Setup - Define Water Quota

Define Water Quota

Entering the Define Water Quota Setup tab of the Setup entry of the Galileo system, is done by clicking on the SETUP -> WATER QUOTA-> Setup entry of the Galileo main menu.



- The table of this screen enables the user to set a daily water quota to the area controlled by the Galileo system.
- Enter the required daily quota for each month.
- A line above the table displays the parameters that control the system operation and its required reaction in case of over quota water usage.:
  Water meter - Set a water meter (physical or virtual) that is used to measure the daily quota.

Daily over quota limit (in % of the daily quota) - Enter the deviation from the daily quota that above it the system reacts.

System Reaction - Set the system reaction to a deviation from the daily water quota, the options are: None - do nothing, Alarm Only - do not stop the irrigation and only issue an alarm message, Pause the Irrigation Today - issue an alarm and stop the irrigation for today.

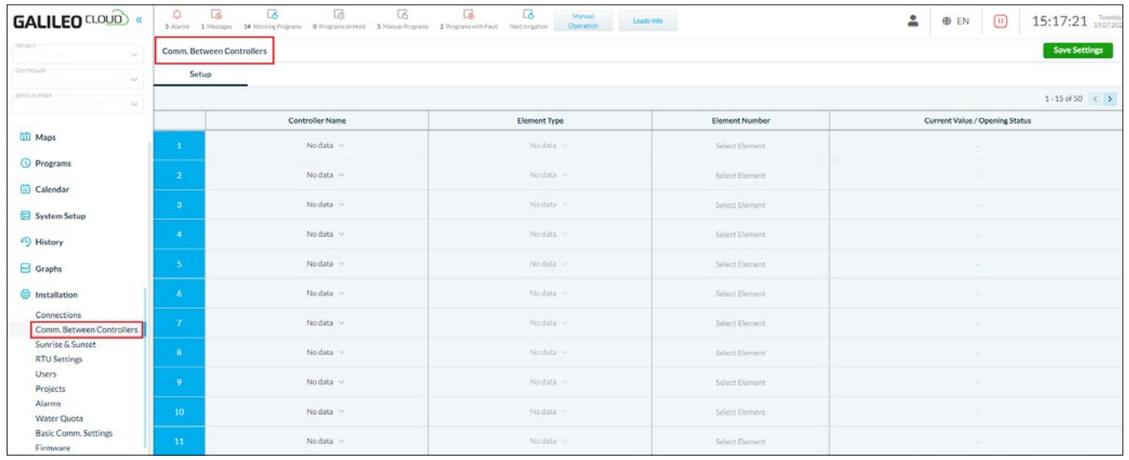
- The line above the table displays the daily water quota, and the real time amount of water irrigated today.

K.25. Communication Between Controllers

One of the advanced features of the Galileo system is its ability to exchange data between controllers that are installed at the same project, this feature is used for performing irrigation tasks according to information originated in other controllers of the project.

For exchanging data between controllers, the user should use the Data Exchange Table.

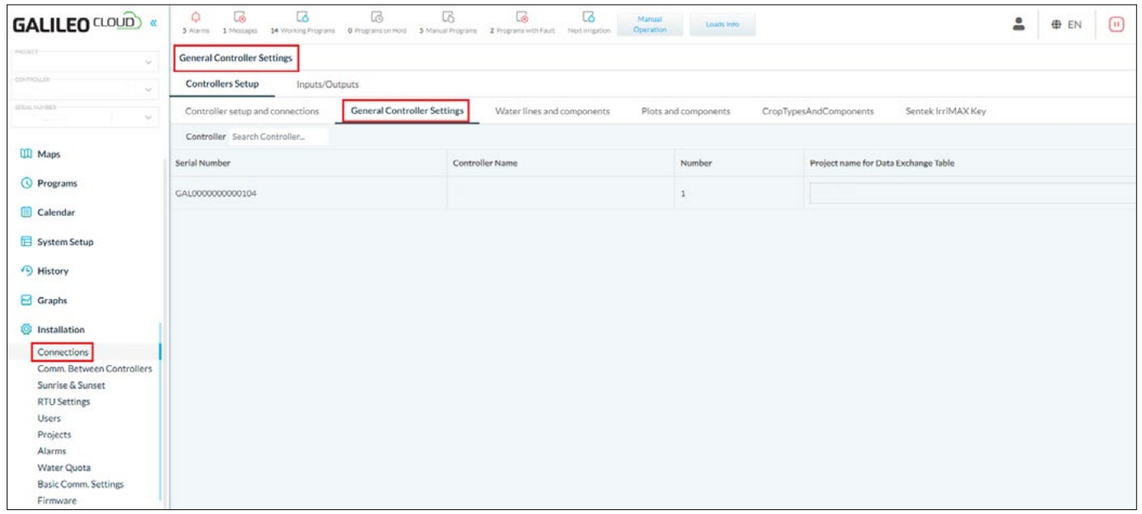
Entering the Exchange Data Between Controllers tab of the Setup entry of the Galileo system, is done by clicking on the SETUP -> EXCHANGE DATA BETWEEN CONTROLLERS -> entry of the Galileo main menu.



Important Note - Each project has only one table for setting the data to be shared between controllers.

- The exchange data between controllers table has us to 50 records, where each on of them is used for transferring a single data item between controllers.
- Controller Name - Select the name of the controller from which the data item can be shared with other controllers of the same project.
- Element type - Select the type of the element to be shared, the options are: Condition Input - a hardware input that is defined as condition input, Field Valve, Pipe Line, Irrigation Program, Fertilizer Pump, Water Pump, Auxiliary Output, Analog Sensor, Filter Flush Program, Logic Condition, Water Meter, General Counter, Pipe Requested Flow - the calculated flow-rate that currently should be irrigated by this pipeline, and Alarm System Management.
- Element Number - Select the number of the element which its type was selected in the previous column.
- Element Current Value or Opening Status - This is the real time information of the selected element. Important - For elements of output type, such as valve, pipeline, fertilizer pump, etc., the status shown in this column can be only, Open (1) or Closed (0) regardless of other statuses such as alarms or faults. For elements of sensor type, such as flow-rate, sensor reading, etc., the status shown in this column is the real time value (the reading) of the element.

Please Note: Since each controller can be used by more than a single project, but can exchange data within controllers of only a single project, the user should define in which project the controller can exchange data. This is done at the General Controller Setting Tab of the SETUP -> CONNECTIONS entry of the Galileo main menu.



In the "Project Name for Data Exchange Table" column, select the project name in which this controller can exchange

data with other controllers of the same project. Note that the controller can exchange data only in a single project.

Using elements defined in the Data Exchange Table:

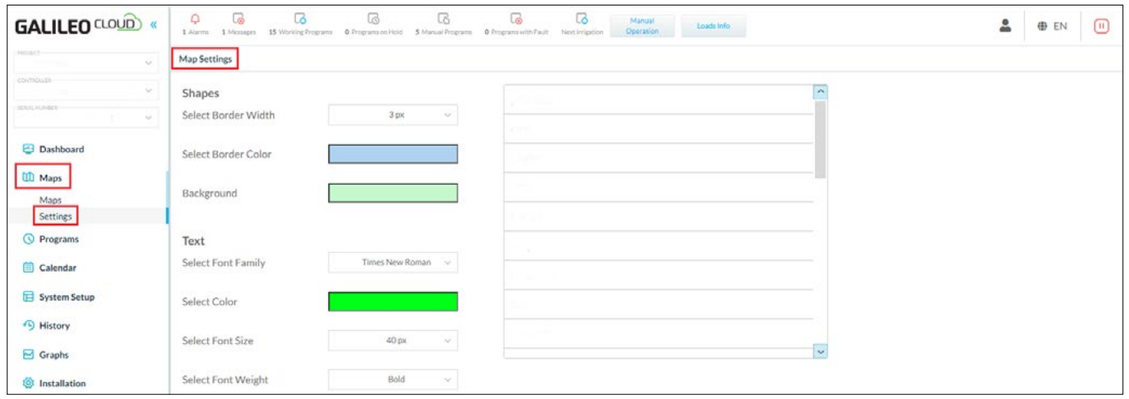
In the Galileo system there are 5 screens in which data from other controllers can be used:

1. Logic Condition Screen - The Logic Condition feature of the Galileo system can use elements of any type that is defined in the Data Exchange Table of the project. In such case, select "Data Exchange Element" in the Element Type column of the Logic Condition Programing Screen for displaying the elements defined in the Data Exchange Table.
2. Network Burst Protection - The Network Burst Protection feature of the Galileo system can use in its "Flow from Other Controllers" parameter, only elements of the type Water Meter, that are defined in the Data Exchange Table of the project.
3. Pump House - The Pump House feature of the Galileo system can use in its "Required Flow from Other Controllers" parameter, only elements of the type Pipe Required Flow, that are defined in the Data Exchange Table of the project.
4. Common Sensors - The Common Sensors Tab of the Galileo system is used for selecting sensors, out of the defined sensors at the Data Exchange Table, to be used in the various programs of the current controller.
5. Alarms management Systems - The Alarms Management Systems (1-8) of the Galileo system can use in its definition table any element that is already defined in the Data Exchange Table.

K.26. Maps – Setting the Maps

The process of setting a map has few steps:

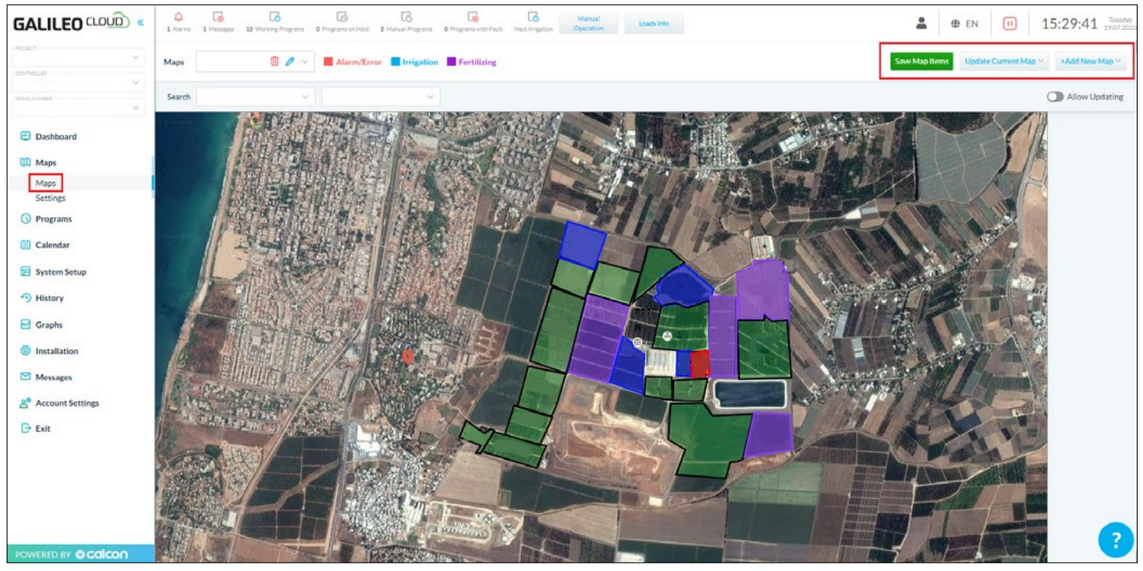
First Step: Set up the map's elements defaults by entering to the Maps -> Settings tab of the Galileo Main Menu.



In this screen the user defines the:

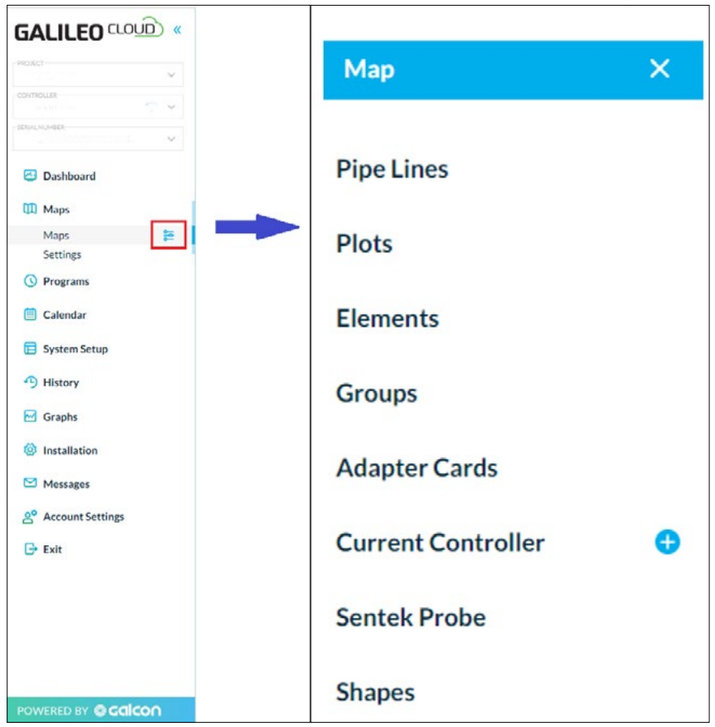
- Border's Width, Border's Color, and Color of the map's Shapes.
- The Font, Color, and Size of the map's Text
- The Main Map – select a map from the maps list at the right side of the screen to be the main map, so when entering to the Maps main menu entry of the Galileo, this map will be displayed. The user can move maps along the list in order to arrange the order of the maps according to his farm layout.

Second Step: Set the map and its elements by entering the Maps -> Maps tab of the Galileo Main Menu.



In this screen the user can set the following:

- Upload a map – press the Add Map button, select the source of the map and upload it. The options are: a picture of a map stored in your computer, a Google map, and a color background to be used for the map screen.
- Select Map - select the required Map from the dropdown list at the left side of the screen (the Main Map is the first entry of the list).
- Add Shapes - click on the icon on the left of the Maps entry of the menu to open the Shapes List. Here you can draw shapes (such as Plots or Pipe Line) on the map and assign a map and a controller element to the shape in the selection list at the right side of the map (see the following screenshot).



- Once the plot and the map are saved, clicking on a plot on the map opens the assigned map of the plot. In this

way it is possible to draw a general map of the whole farm with its plots and jump to each plot's specific map by clicking on it on the main map.

- For Line Shapes assign a pipe line element of the controller.
- Add predefined controller's elements to the map by selecting them from the list, placing them on the map and assigning them with the correct details. The menu on the right side of the screen allows the user to position the real time information of the element at the: Top, Right, Left, and Bottom sides of the map's element icon. An option to display the real-time information of an element as a tooltip and not as a permanent label is also possible (separately per each element).
- The color of the elements changes according to their real-time status: Red = Fault, Blue = Irrigating, Purple = Fertilizing.
- Moving elements and Shapes on the map can be done by dragging them, selecting several elements for dragging can be done by selecting them while the Shift Key is pressed.
- Please note the Edit Map button on the screen above the map – the map and its components cannot be amended unless the Edit Map button is pressed. Remember to save the changes by pressing the Save Map button.

K.27. Setup - Set the Controller to Active Mode

Once the setup process of the new controller is completed as detailed in chapter K section 1 - 23 it is the time to activate the controller.

Very Important Note: - Activating the controller, as described below, enters the system immediately to operation. Before doing so, make sure that all the people at the fields controlled by this controller are aware of the action that going to be performed. Make sure that no people or equipment are in location that can be affected by the entry of the controller to action!

- Set the controller to active mode in the first tab of the wizard.

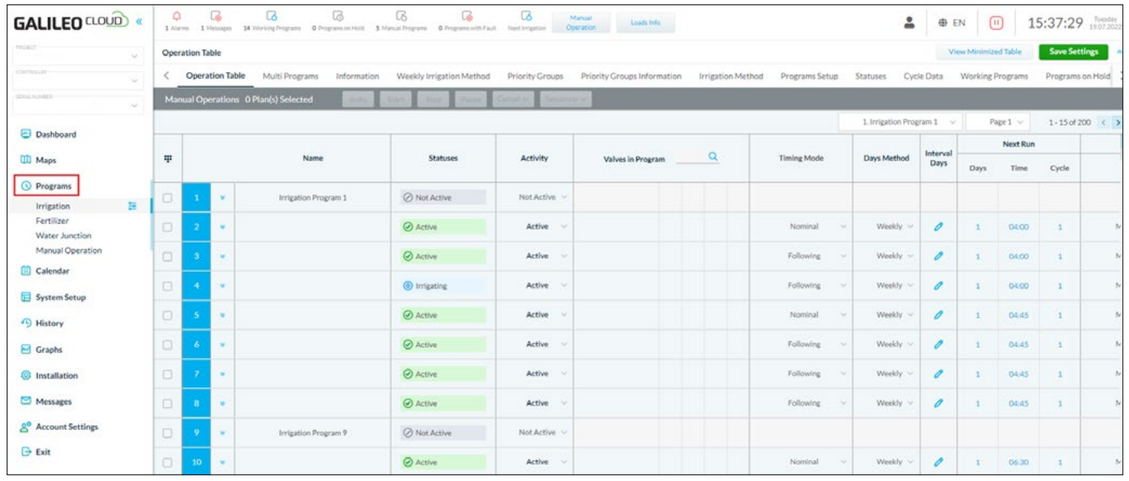
L. Operation

This Chapter describes the processes related to correct operation of the Galileo open field system.

Very important note: Successful operation of the Galileo system depends on the proper setup process of the system. Therefore, make sure to follow the stages described in the Configuration Chapter (Chapter K) of this document. In some processes, such as when entering irrigation programs, some of the screens are described in both the Operation and the Configuration chapters. In such cases, each such screen is divided into Setup Tabs and Information tabs. The description of the Setup Tabs appears in full at the Configuration chapter and briefly in the Operation Chapter, while the Information Tabs appear only in the Operation Chapter.

- Before entering programs to the Galileo Cloud system, make sure that you are familiar with the system's Control Philosophy chapter of this document.
- Operation programs, such as irrigation and fertigation, should be entered and set to the system, only after completing the installation and configuration stages of the hardware and the communication components of the system. Please refer to the "Configuration" chapter of this document for details.
- Setting or changing operation programs via the Galileo Cloud web screens, should be downloaded to the Galileo Controllers before they take effect. Make sure to save and synchronize yours on-screen programs with the Galileo Controller by using the "Save" feature of each such screen.

The following is Galcon's recommended order of setting the operation programs of the system through the Galileo Cloud web site Programs' screens (see the following picture):



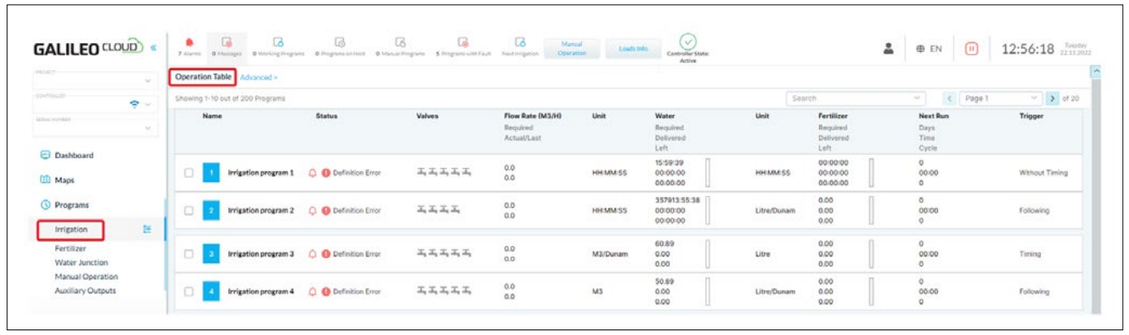
When entering programs please follow this order:

- Irrigation programs
- Fertilizer
- Manual Operations
- Filter flushing
- Alarm Setting
- Conditions

L.1. Entering Irrigation Programs:

When selecting the controller at the main entry screen of the system, or when clicking on the Irrigation entry on the system's main menu the following screen appears:

When selecting the Irrigation entry under the Programs item of the Galileo Cloud main menu, a screen with four major sections opens (Please see the following picture):



Important note: upon entry to this screen only its operation table tab appears. Click on the "Advanced" icon next to the "Operation Table" icon on the top line of the screen in order to display all the tabs of the irrigation programs entry (please see the picture at the bottom of this page). The screen that shows all its tabs has four major sections:

1. The Status menu line - contains entry points to the major status screens of the system; All programs, Working programs, Programs on Hold, Manual Programs, and Programs with Faults.
2. The Programs menu line - contains entry points to all the programing tables of the irrigation system. The most important and therefore the most frequently used entries are the Operation Table and the Multi Programs.
3. The Manual Operations menu line - enables the user to manually control the selected programs.

4. The Tables Display Area - according to the selected item at the 1, 2, 3, menu lines, this area opens and displays the designated table of the selected item.

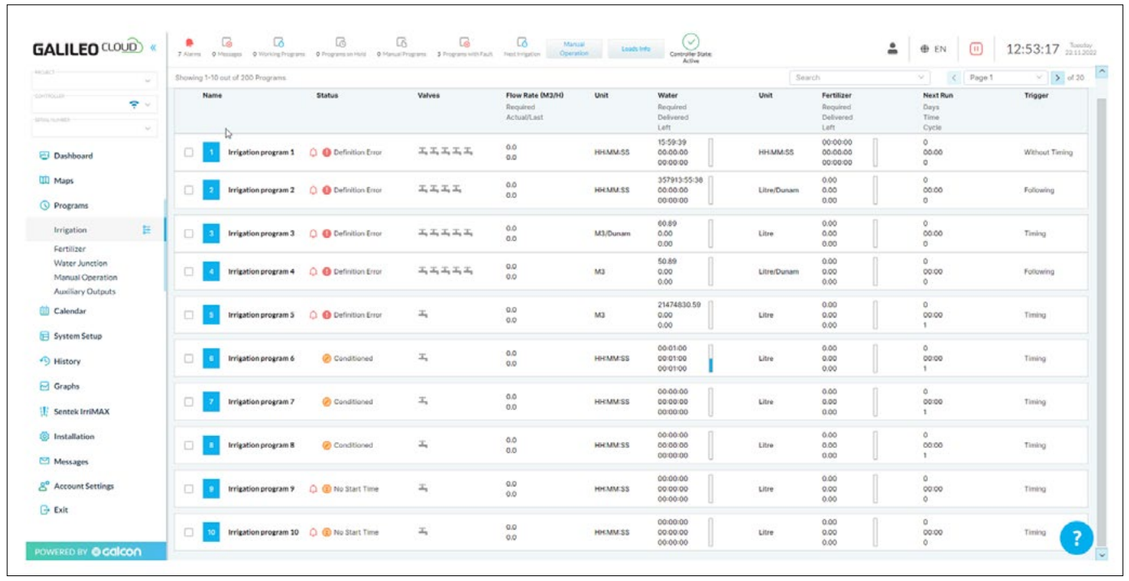
In order to edit the operation parameters of a specific program select its row within the operation table; this opens a window to the right of the selected program showing its operation parameters.

The Multi Programs Tab:

This table contains the settings of all the system's irrigation programs; it is used as the main table for entering the farm's irrigation programs:

Very important note: For the full description of the Multi Programs table please refer to the Irrigation Programs Setup screens found on chapter K of this document. The following pages contain a short discretion only of the Multi Program Table.

Each column of the table displays the information of a single irrigation program as selected at the upper right corner of the table (1-200). The rows of the table display the program parameters of the irrigation programs and allow the user to set the required value for each such parameter. The parameters include the following:



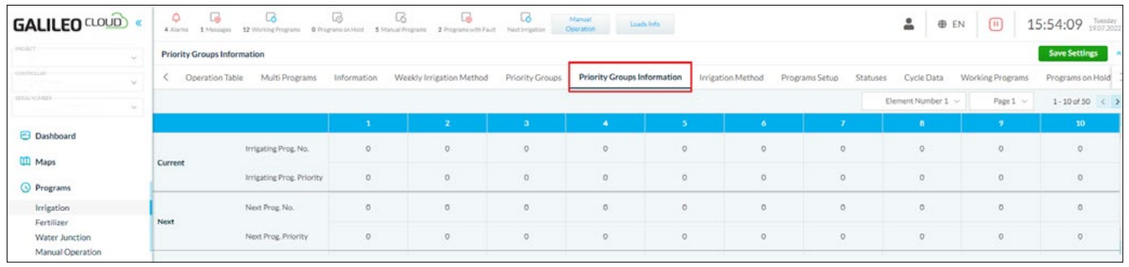
- Program Name: Set the specific name to be assigned to this program
- Program Setup: Set the operation status of the program - Not Active, Active, or Paused.
- Manual Override: Set the required manual override option for the program - Auto Prog, Start Prog, Stop Prog, Pause Prog, Cancel the program for today, Cancel Program, Start Sequence, Stop Sequence, Cancel Paused Program, Pause Sequence, Cancel Paused Sequence, Cancel Sequence today, Cancel Sequence, and Auto Sequence.
- Valves in Program: Set the valves to be irrigated by this program (up to 5 valves, A to E) and the method of finishing method of the valve (Parallel or separated).
- Next Irrigation: Set the Next Open Time, Days to Next Open, and Cycles Remaining. These are real time data parameters that can be changed by the user.
- Irrigation Timing: Set the Timing Method (Nominal, Following, Sunrise, Sunset, Opn+Prot, and Time Less), Nominal Start Time, Interval Days, Irrigation Days Method (Cyclic or Weekly), Cycles per Day, Cycle Interval (Min.), and End Time (HH:MM).
- Water Data: Set the Water Unit (MM:SS, M^3, M^3/Hec, Evap, and m"m/Hec), Water Program Amount (time or volume), Water remaining, and Water Multiply for Current Irrigation (%).
- Fertilizing: Set the Local Fertilizer Pump Number, Local Fert Unit (Liter, MM:SS, L/Hec, L/m^3, or Related), Local Fert Amount, Fert Center Number, Fert Center Prog Number, Water before, Water After.

- Initiation: Set the restart option (Off, Program, or Sequence).

This table contains the settings of all the system's irrigation programs; it is used as the main table for entering the farm's irrigation programs. Each row of the table displays the parameters of a single irrigation program and allows the user to set the required value for each such parameter. Each column of the table displays a single setting parameter of the irrigation program as selected at the upper right corner of the table (1-200). For the available parameters please see the description of the Multi Programs Table.

The real time data of a program can be displayed by clicking on the "Open" icon next to its number on the table.

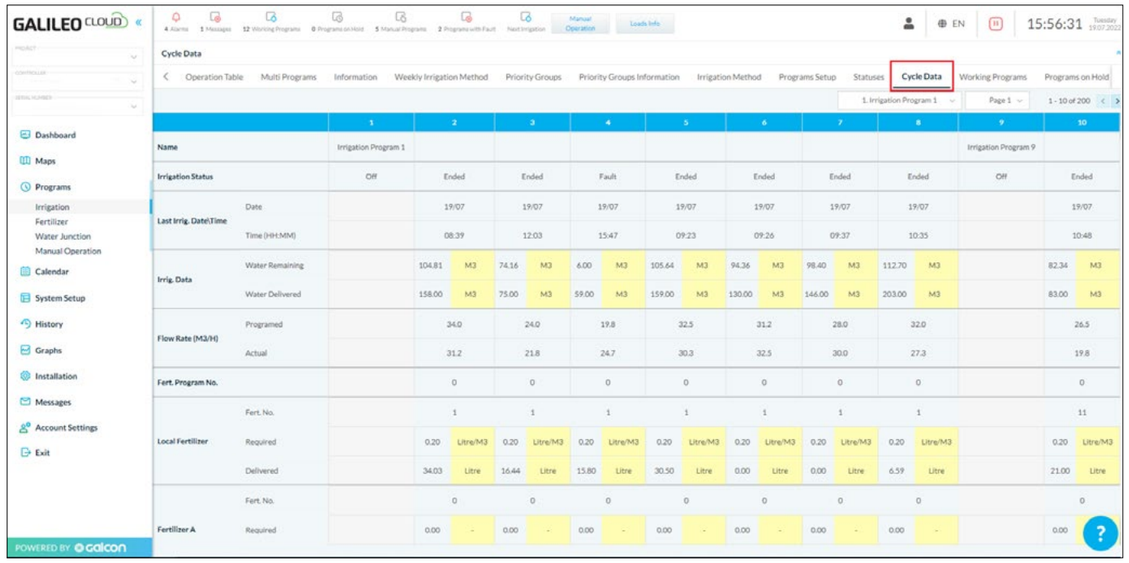
The Priority Group Information tab:



This screen displays the current information of the 50 priority groups of the Galileo System:

- Current - Irrigating program number - The number of the currently irrigation program of this group.
- Current - Irrigating Program Priority - The priority within the group of the currently irrigating program.
- Next - Next Program Number - The number of the next program to irrigate.
- Next - Next Program Priority - The priority within the group of the next program to irrigate.
- Change Program Request - This parameter shows whether there is a request to change the irrigation program due to the start of a higher priority program. The options are Yes or No

The Cycle Data tab:



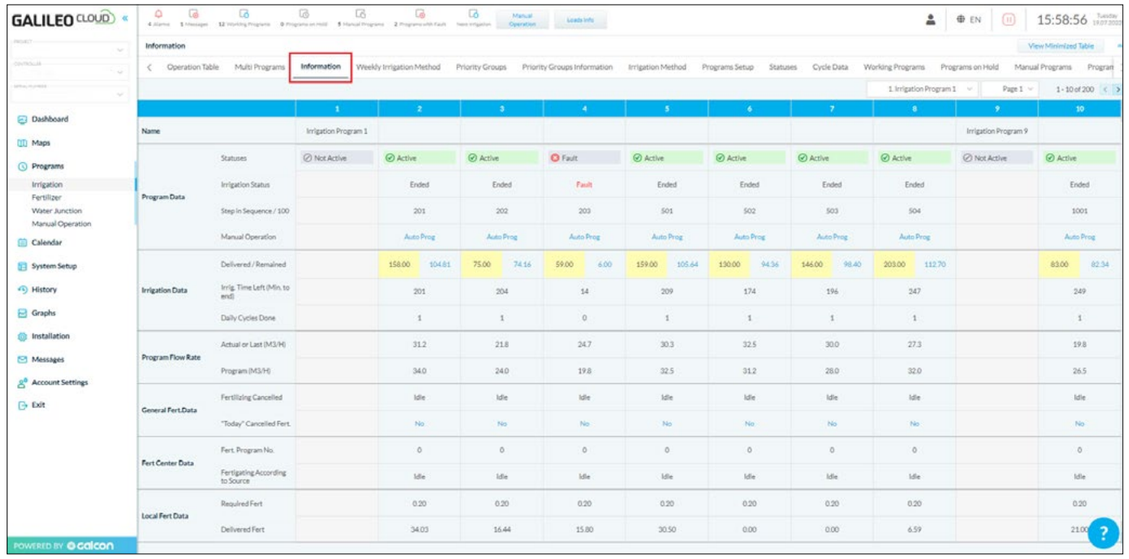
This screen displays real time and historic information, of the system's irrigation programs, and it is organized in pages of 10 programs each:

Please note that due to the arrangement of this screen, it is important to look also on the Working Programs Tab, for receiving real time information on the currently operating programs.

- Name - The name of the irrigation program.

- Irrigation Status - The current status of the program's irrigation, the options are: Off - the irrigation is currently Off, Ended - the irrigation ended, Not Ended - the irrigation was not ended Probably due to operation priorities), Fault - the irrigation of this program is in fault, In Queue - the irrigation is in the queue, In Queue + Alarm - the irrigation is in queue and it has also an alarm message, Irrigating- the irrigation is in progress, Fertigating - the irrigation and the fertigation are in progress, Irrigating + Alarm - the irrigation is in progress but it also has an alarm message, Fertigating + Alarm - the fertigation is in progress but it also has an alarm message.
- Last Irrigation Date/Time - Irrigation Date (MM:DD) - The date of the last irrigation.
- Last Irrigation Date/Time - Irrigation Time (HH:MM) - The time of the last irrigation.
- Irrigation Data - Water remaining - The amount of water in M^3 or in MM:SS remain till the end of the irrigation.
- Irrigation Data - Water delivered - The amount of water in M^3 or in MM:SS delivered since the beginning of the irrigation cycle.
- Flow Rate (M^3/H) - Programed Flow Rate - The calculated flow rate of this cycle, based on the programed flow rates of the valves participating in the irrigation program.
- Flow rate (M^3/H) - Actual Flow Rate - The actual real time flow rate of this irrigation cycle.
- Fertilizing Program Number - The number of the basic fertilizing program for this cycle as entered in the irrigation program.
- Local Fert Number - The name and the number of the local fertilizer pump.
- Local Fert. - Required - The required fertilizer amount for the local fertilizer pump.
- Local Fert - Delivered - The amount of fertilizer delivered by the local fertilizer pump.
- Fertilizer A Number - The name and number of the first fertilizer pump of the fertilizer center servicing this irrigation program.
- Fertilizer A. - Required - The required fertilizer amount for the first fertilizer pump of the fertilizer center servicing this irrigation program.
- Fertilizer A - Delivered- The fertilizer amount delivered by the first fertilizer pump of the fertilizer center servicing this irrigation program.
- Fertilizer E Number - The name and number of the fifth fertilizer pump of the fertilizer center servicing this irrigation program.
- Fertilizer E. - Required - The required fertilizer amount for the first fertilizer pump of the fertilizer center servicing this irrigation program.
- Fertilizer E - Delivered- The fertilizer amount delivered by the first fertilizer pump of the fertilizer center servicing this irrigation program.
- Average EC - The average reading of the EC sensor at this irrigation cycle.
- Average pH - The average reading of the pH sensor at this irrigation cycle.
- Irrigation Valve A - Number - The number of the first valve of this program.
- Irrigation Valve A - Remaining - The amount of water remaining for this valve in the current irrigation.
- Irrigation Valve E - Number - The number of the fifth valve of this program.
- Irrigation Valve E - Remaining - The amount of water remaining for this valve in the current irrigation.

The Information tab:



This screen displays the real time information of the system's irrigation programs, and it is organized in pages of 10 programs each:

- Name - The name of the irrigation program.
- Program Data - Operation Status - The status of the program, the options are: Not Active - the program is not defined or defined but not active, Definition Error - the definition of the program is incorrect, No Start Time - this program has no operation timing; it can be started by a manual start command, Conditioned - this program may be started by a condition, Active - the program is correctly defined; it has start timings and it is not conditioned, Active + Alarm - the program is active but it has an alarm; it can still irrigate, Paused - the program is in pause mode, Fault - the program is in fault mode; it cannot irrigate unless the fault status is cleared and canceled, In Queue - the program is started but cannot irrigate due to the operation of other high priority program, In Queue + Alarm - the program is in Queue but it has an alarm, Irrigating - the program is currently irrigating, Fertigating - the program is currently irrigating and fertilizing, Irrigating + Alarm- the program is currently irrigating but has an alarm, Fertigating.
- Program Data - Irrigation status - The status if this program's irrigation, the options are: Off - the irrigation is currently Off, Ended - the irrigation ended, Not Ended - the irrigation was not ended Probably due to operation priorities), Fault - the irrigation of this program is in fault, In Queue - the irrigation is in the queue, In Queue + Alarm - the irrigation is in queue and it has also an alarm message, Irrigating- the irrigation is in progress, Fertigating - the irrigation and the fertigation are in progress, Irrigating + Alarm - the irrigation is in progress but it also has an alarm message, Fertigating + Alarm - the fertigation is in progress but it also has an alarm message.
- Program Data - Step in Sequence - The number of the first program of the sequence followed by the number of the current step of the sequence.
- Program Data - Manual Operation - An option for performing a manual operation on this program, the options are: Auto Prog. - set the program to automatic operation mode (no manual overriding), Start Prog. - manually start the program; the status shown in this parameter remains "Start Prog." until the program finishes its irrigation and then the parameter returns to "Auto Prog.", Start Program W/O Fert. - start the program without operating the fertilization, Stop Prog. - manually stop the program; the program immediately stops and the status shown in this parameter returns to "Auto Prog.", Pause Prog. - pause the operation of the program; it remains in this status until the user switches it back to "Auto Prog.", Resume Paused Program - set the paused program back to "Auto Prog." Status, Cancel Program Today - cancel the operation of the program for today (midnight to midnight) the program returns to "Auto Prog." at midnight, Cancel Program - cancel the operation of this program; it remains canceled until the user switches it back to "Auto Prog.", Start Sequence - start a sequence of programs that are listed as sequence from this program on; each one of these programs receives a manual start command and enters the

operation queue, Start Seq. W/O Fert. - start this program sequence without operating the fertilization of the programs of the sequence, Stop Sequence - stop the operation of the program and all its following programs in the sequence, Pause Sequence - pause the sequence operation; the current program and each one of the following programs of the sequence receive manual Pause command, Resume Paused Sequence - for the current program and all the following programs of the sequence set the programs back to "Auto Prog." Status, Cancel Sequence Today - cancel the operation of the current program and the following programs of the sequence for today (midnight to midnight) the programs return to "Auto Prog." at midnight, Cancel Sequence - cancel the operation of this sequence; it remains canceled until the user switches it back to "Auto Prog.", Auto Sequence - switch the sequence to "Auto Prog." Mode.

- Irrigation Data - Water Remaining - The amount of water in M^3 or in MM:SS remain till the end of the irrigation.
- Irrigation Data - Water delivered - The amount of water in M^3 or in MM:SS delivered since the beginning of the irrigation cycle.
- Irrigation Data - Minutes to End (Min.) - The calculated time left till the end of this irrigation cycle; In irrigation by m^3 the system calculates this number according to the water amount and the current flow rate.
- Irrigation Data - Daily Cycles Done - The number of cycles this program performed since the beginning of the current day.
- Program Flow Rate (M^3/H) - Programed - The calculated flow rate of this cycle, based on the programed flow rates of the valves participating in the irrigation program.
- Program Flow rate (M^3/H) - Actual - The actual real time flow rate of this irrigation cycle.
- General Fert. Data - Fertilizing Cancelled - This parameter displays whether the fertilizing operation of this program is cancelled, the options are: Yes - the fertilizing is canceled, No - the fertilizing is active. Please note that the commands that can cancel the fertigation are: Permanent Cancel Fert, Cancel Fert. Today, Start Program Without Fert., Cancel Fert. by the Plot.
- General Fert. Data - "Today" Canceled Fert. - An option to cancel the fertilizing of this program for today, the options are: No and Cancel. Once the user cancels the fertilization this parameter continues to display the status "Cancel" till the end of the day.
- Fertilizer Center Data - Fert. Program Number - The number of the fertilizing program of the fertilizer center.
- Fertilizer Center Data - Fertigating According to Water Source - In case the fertilizing center assigned to this irrigation program is operates a water source, this parameter displays the number of that water source, the options are: No - no water source is defined to the fertilizer center of this irrigation program, Water Source 1, Water Source 2, Water Source 3, or Water Source 4.
- Local Fert. Data - Required Fertilizer - The amount of fertilizer to be applied by the local fertilizer pump.
- Local Fert. Data - Delivered Fertilizer - The amount of fertilizer delivered by the local fertilizer pump in this irrigation cycle.
- Next Irrigation - Days to Next Start - The system displays the number of days left till the next irrigation day of this program. This is an editable real time value, so if needed, the user can change the number of days left.
- Next Irrigation - Next Start Time - The system displays the next start time of the program; in case of a program that has cycles, this is the planed start time of the next cycle. This is an editable real time value, so if needed, the user can change the next start time.
- Next Irrigation - Remaining Cycles - For a program that include cycles, the system displays the number of cycles remaining till the end of this program's operation.
- Queue Status - Time in Queue (Min.) - This program was started but it is not irrigating, due to another high priority program. This parameter displays the time in minutes this program is in the queue.
- Queue Status - Reason - The reason why this program waits in the queue, the options are: None, Priority - the program is in lower priority than the currently irrigating program, Sequence - this program is part of an irrigation sequence and currently another program of this sequence is irrigating, Water Meter - the water meter of this program is currently in use by other programs, Local Fert. Pump - the local Fert. pump of this program is currently in use by other programs, Fert. Center - the fertilizer center to be used by this program is currently used by other programs, Irrigation Valve - a valve to be irrigated by this program is currently irrigating by another program, Fertilizer type - the line to be irrigated by this program is currently discharges a different fertilizer type than the fertilizer type to be used by this program, Out of Time Range - this program has an operation time frame range and it is currently out of this range, Pipe Flow Limit - the pipe line to be irrigated by this program is currently almost in its maximal capacity; this program may cause it to exceed its maximal flow rate capacity, Other Mixing Program - the mixing junction of this program is currently in use for other program.
- Queue Stats - Priority Program Number - The number of the program that is currently in higher priority.
- Cycle Data - Last Cycle Water Delivered (M^3) - The amount of water delivered in the last irrigation. Note that the system accumulates the water amount delivered in the last irrigation cycle even if that irrigation was by time and not by volume.
- Cycle Data - Last Cycle Duration (MM:SS) - The duration length of the last irrigation cycle. Note that the system measures the length of the last cycle even if the irrigation was by volume and not by time.
- Cycle Data - Average EC - The average reading of the EC sensor at this irrigation cycle.
- Cycle Data - Average pH - The average reading of the pH sensor at this irrigation cycle.
- Cycle Data - Last Irrigation Date/Time - Irrigation Time (HH:MM) - The time of the last irrigation.
- Cycle Data - Last Irrigation Date/Time - Irrigation Date (MM:DD) - The date of the last irrigation.
- Cycle Data - Sensor Accumulation Until Start - The accumulated data of the sensor since the beginning of the previous cycle until the beginning of the last irrigation cycle.
- Current Alarms - No Water Pulse - The irrigation started but no pulse was received from the assigned water meter, the options are: OK, Alarm - the system issues an alarm only, or Fault - the system issues an alarm and sets the program to fault mode.
- Current Alarms - Water Flow Rate - The options are: OK, Under Flow Alarm - the flow rate of the program is too low; the system issues an alarm only, or Over Flow Alarm - the flow rate of the program is too high; the system issues an alarm only.
- Current Alarms - Fertilizing Faults - The Options are: OK, No Fert. Pulse Alarm - the fertigation started but no pulse was received from at least one of the fertilizer pumps; the system issues an alarm message only, Fert. Flow Rate Alarm - the fertilizer flow rate is incorrect; the system issues an alarm message only, EC Alarm - the EC level is too high or too low and the system issues an alarm message; in high EC alarm the fertilization is stopped but the irrigation continues, pH Alarm - the pH level is too high or too low and the system issues an alarm message; in low pH the fertilization is stopped but the irrigation continues (for OH pump the pump is stopped in high pH alarm), EC Fault - the EC level is too high or too low; it is in fault and the irrigation program enters also to fault mode, pH fault - the pH level is too high or too low; it is in fault and the irrigation program enters also to fault mode.
- Current Alarms - Fert Not Completed Alarm - The fertigation process is not completed; the system issues an alarm message, the options are: OK, or Alarm.
- Current Alarms - Fault due to logic condition, the options are: OK, Alarm - the program is set to alarm mode due to a logic condition operation, or Fault - the program is set to fault mode due to a logic condition operation.
- Current Alarms - Irrigation Quantity Limit - The Galileo controller has an option to set a maximal limit for the irrigation duration, either in volume or in time, for protecting the farmer from incidentally entering too high number to the water amount parameter. The system checks the water amount number upon entering and saving the irrigation program; if the number entered exceeds the maximum, the system issues an alarm. In case where in spite the alarm, the user starts such irrigation program, the irrigation stops once the delivered water amount reaches the maximal limit. The options are: OK, or Limit Alarm.
- Current Alarms - Cycle Not Completed - This works for sequential programs and it indicates that some of the programs in the sequence did not complete and the system skip them, the options are: Completed, or Not Completed.
- Conditions status - Sensor Accumulation - The reading accumulation of the sensor used for starting this program.
- Conditions status - Start Condition - The Status of the Start Program Condition that affects this program, the options are: Idle - start condition is not defined for this program or is defined but currently it is not starting the program, On.
- Conditions status - Operation Condition - The Status of the Operation Condition that affects this program, the options are: Idle - operation condition is not defined for this program or is defined but currently it is not operating the program, On - the program is currently operated by an Operation condition. (See the condition definition chapter of this document for detailed information on the Operation Condition.)
- Conditions status - Pause Condition - The Status of the Pause Condition that affects this program, the options are:

Idle - pause condition is not defined for this program or is defined but currently it is not pausing the program,

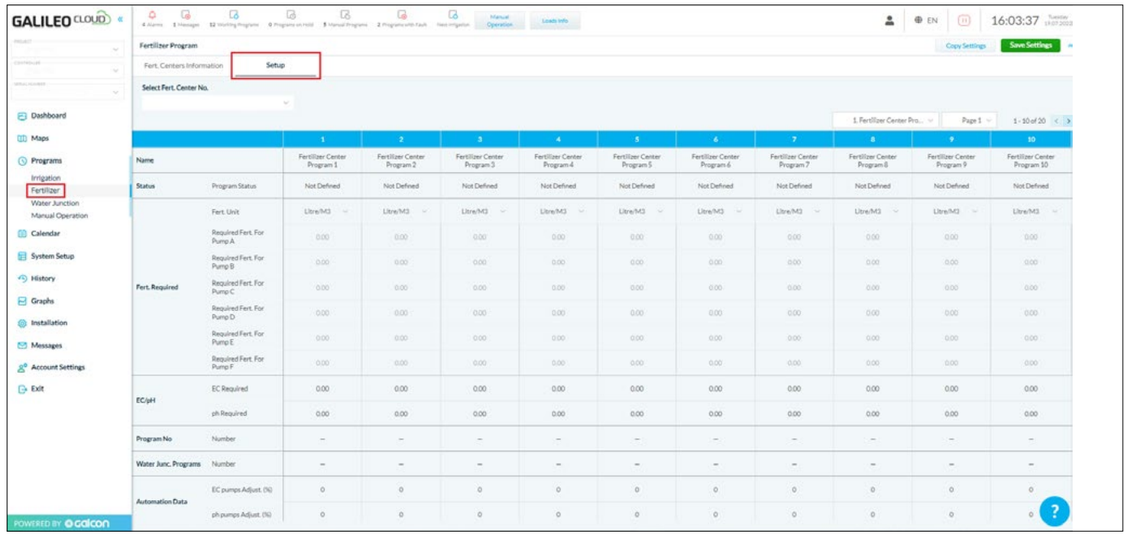
- Paused by Time – the program is paused due to a predefined pause timing (every day from start pause time to stop pause time), Limited Paused – paused for specified number of minutes as a result of manual pause command, Paused Manually – paused manually (will remain paused until stopping the manual command, Paused by Plot the irrigation program is paused by a pause parameter set in the plot irrigated by it, Paused by Pipeline – Paused by parameters set at the pipe line, Paused by local Logic Condition – the program is paused by a logic condition set at the program itself, Paused by external logic condition – paused by a logic condition originated from the logic conditions process, Fault By External Logic Controller – the irrigation program entered into fault -due to a logic condition originated in another controller, Paused by Limited Water Flow – the program is paused due to insufficient water flow.
- Conditions status - Pause Condition - The Status of the Pause Condition that affects this program, the options are: Idle - pause condition is not defined for this program or is defined but currently it is not pausing the program, On - the program is paused by a paise condition.
- Conditions status - Stop Condition - The Status of the Stop Condition that affects this program, the options are: Idle - stop condition is not defined for this program or is defined but currently it is not stopping the program, On - the program is stopped by a stop condition.
- Conditions status - Line Paused - Line pause is a status where the irrigation program is paused due to a pause on the pipeline that is irrigated by this program, the options are: Idle - line pause condition is not defined for this program or is defined but currently it is not pausing the program, On - the program is paused by a line pause condition.
- Water Multiply - Water multiply for current Irrigation (%) - In case there is a need to multiply the amount of water of this program, for the current irrigation only, enter the percentage required. This is an editable real time value, so if needed, the user can change the number on the fly. Once the current irrigation ends this parameter is automatically set to zero (no multiplying of the basic water amount). Please note that in irrigation program with daily cycles this parameter affects only the current cycle.
- Water Multiply - Water Multiply Reason - The reason for the current water multiply, the options are: No Water Multiply - no water multiply is defined for this irrigation program, Current Cycle Water Multiply - the reason that caused the water multiply of this program is a manual change by the user for this cycle only, Permanent Water Multiply - the water multiplication is due to the permanent water multiply as set on the program setup, Irrigation Method Water Multiply - the water multiplication is due to the setup at the irrigation method screen; multiplying in time range or in cycle number, Water Multiply According to Water Source - the water multiplication is due to a definition in the water source setup screen, Today Water Multiply According to Plot - the water multiplication is due to a manual setting entered for today only, in the plot setup screen, Permanent Water Multiply according to Plot - the water multiplication is due to a setting entered in the plot setup screen.
- Water Multiply - Current Multiply Value (%) - The current Water Multiply percentage value according to which the program currently working.
- Miscellanies Data - Program's Valves Area - The total area of the valves irrigated by this program.
- Miscellanies Data - Program Setup Status - The current status of the program's setup, the options are: Not defined, Setup OK, Invalid Valve Number, Valve Definition Error, Water Unit Definition Error, Invalid Water Meter Number, Evaporation definition Error, Valve Area Not defined, Water Meter Route Error - the selected water meter exists on another irrigation line, Fert Pump Route Error - the selected fertilizer pump exists on another irrigation line, Fert Center Route Error - the selected fertilizer center exists on another irrigation line, Invalid Local Fert Pump, Local Fert Definition Error, Non Local Fert Pump - the fertilizer pump selected as a local pump already exists in a fertilizer center, Local Fert Amount Error - the fertilizer amount of the local fertilizer pump is incorrect, Local Fert Unit Definition Error - the fertilizing unit of the local Fert pump is incorrect, Fert Pump Invalid Water Meter Number - the number of the water meter set for the fertilizer pump operation is invalid, Fert Pump Water Meter Definition Error - the definition of the water meter is incorrect, No Area For Local Fert - the area for fertilizing according to Area is missing, No Area For Fert Center - the area for fertilizing according to Area is missing for the fertilizer center, Error in Sequence - an irrigation program participating in the sequence is in error, Invalid Valve Group Number, Valve Group definition Error, Missing Water Flow Definition - some of this program's valves have not flow-rate definition, Double Valve - a valve appears more than once in the program's valves setup, No start time.
- Temporary Commands - Pause Time (HH:MM) - Set the program to pause for the duration entered in this parameter. The program enters to pause immediately and resumes operation when the pause duration ends.
- Temporary Commands - Pause Start Delay (Min.) - This parameter is used in cases where the user wants to delay the beginning of the pause, the pause begins once this parameter countdown ends.
- Temporary Commands - Restart - Restart the program or the sequence.
- Temporary Commands - Cancel Alarm - Cancel the existing alarm of this program.

L.2. Entering Fertilizers Programs:

This Chapter describes the process of setting fertilizer Centers' programs.

Important notes:

- Before entering programs to the Galileo Cloud system, make sure that you are familiar with the system's Control Philosophy chapter of this document.
- Fertilizer programs should be entered and set to the system, only after completing the installation and configuration stages of the hardware and the communication components of the system. Please refer to the "Configuration" chapter of this document for details.
- Setting or changing programs via the Galileo Cloud web screens, should be downloaded to the Galileo Controllers before they take effect. Make sure to save and synchronize yours on-screen programs with the Galileo Controller by using the "Save" feature of each such screen.
- At the top of the Fertilizer Programs screen the user can select between two tabs: Setup and Information.



The setup tab allows the user to select the required fertilizer center (1-8) while the upper right corner of the screen allows the user to select the fertilizers programs (1-10 and 11-20).

The Setup Table:

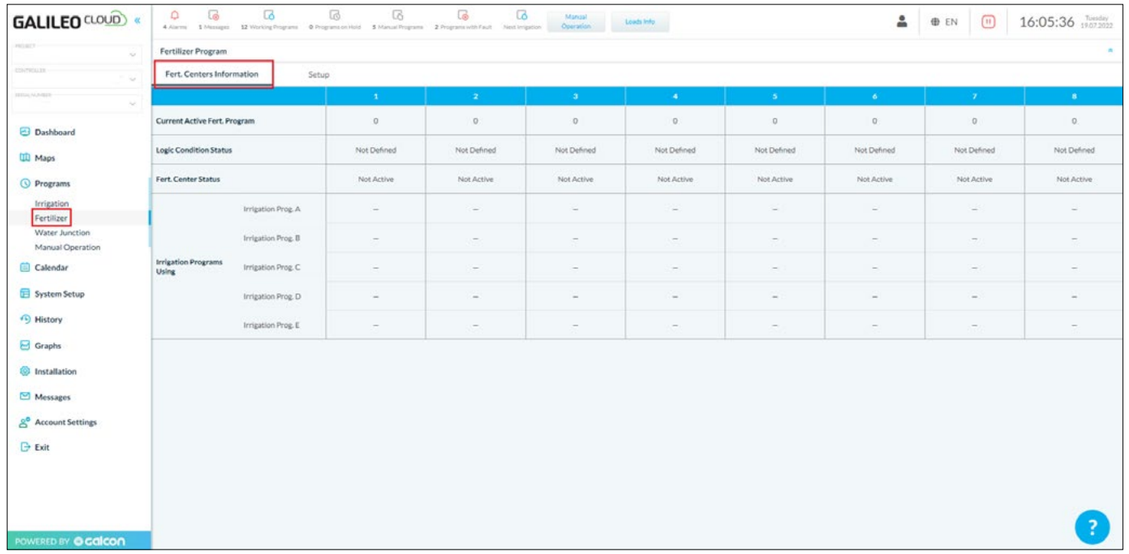
For each fertilizer Center the user can set the following parameters:

- Program Name: Set the specific name to be assigned to this program.
- Status: Set the operation status of the program - Not Active, Active, or Paused.
- Fert Required: Set the fertilizer unit, (Liter, MM:SS, L/Hec, L/m³, or Related), The amount of Fert in Pumps A, B, C, D, E, and F.
- EC/pH: Set the EC Required and the pH required levels.
- Water Mixing Junction Program: set the number of the related mixing junction.
- Fert Selector: Set the number of the Fert Selector.
- Automation Data: Set the percentage of the EC and the pH adjustment for the pumps on Auto program.
- Secondary Fert Programs: Set the numbers of the fertilizer programs to be used as secondary Programs A, B, and

C when the water source quality changes. Important: make sure that the secondary programs are properly set on the water source parameters before setting them in this screen.

The Information Table:

For each fertilizer Center (1-8) this table displays the following parameters:

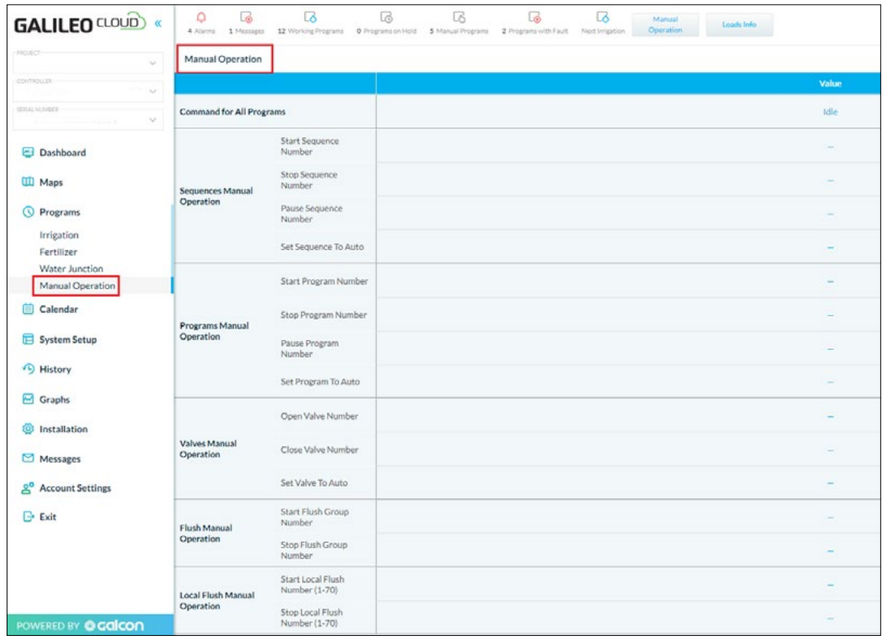


For each one of the 8 fertilizer centers the table displays the following:

- Current Active Program: The currently active program of this fertilizer center.
- Status: The status of the fertilizer center and the status of the program.
- Automation Data: The adjustment percentage of the EC and pH while in automatic mode.
- Irrigation Programs Using: The number of the irrigation programs using this fertilizer center.

L.3. Manual Operations:

This Chapter describes the manual operations that the user can impose on the programs.



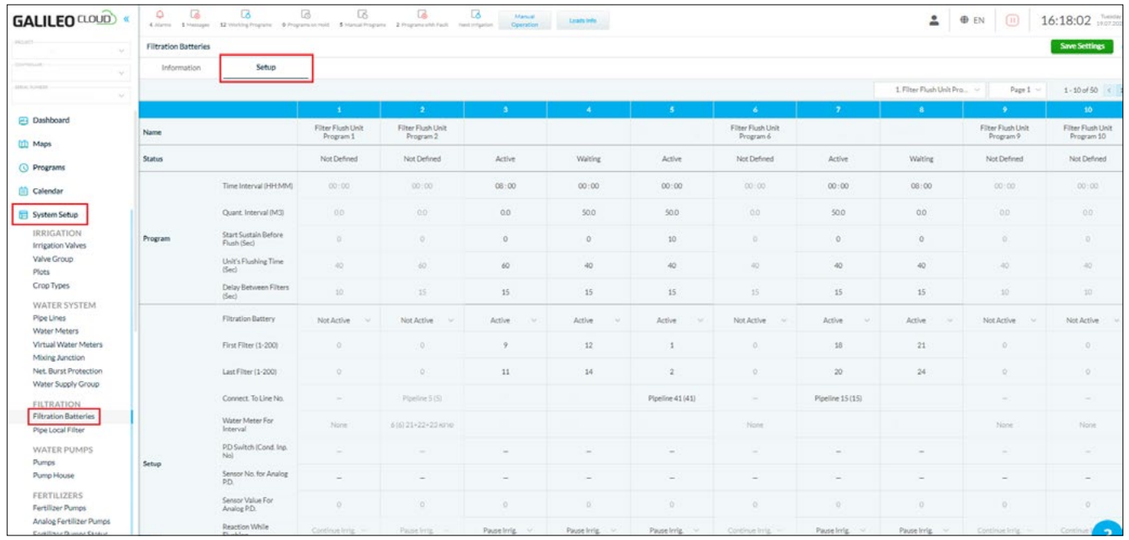
- Command for All Programs: an option to perform the required manual operation command on all the programs at once.
- Sequence Manual Operation: Select the required operation and the sequence number; Start, stop, pause, and set to Auto.
- Program Manual Operation: Select the required operation and the program number; Start, stop, pause, and set to Auto.
- Valve Manual Operation: Select the required operation and the valve number; Open, Close, and set to Auto.
- Flush Manual Operation: Select the required operation and the flush group number; Start and Stop.
- Local Flush Manual Operation: Select the required operation and the flush valve number; Start and Stop.

L.4. Filter Flush

This Chapter describes the process of setting the filtration batteries' programs.

Important notes:

- Before entering programs to the Galileo Cloud system, make sure that you are familiar with the system's Control Philosophy chapter of this document.
- Filtering programs should be entered and set to the system, only after completing the installation and configuration stages of the hardware and the communication components of the system. Please refer to the "Configuration" chapter of this document for details.
- Setting or changing programs via the Galileo Cloud web screens, should be downloaded to the Galileo Controllers before they take effect. Make sure to save and synchronize yours on-screen programs with the Galileo Controller by using the "Save" feature of each such screen.



At the top of the Filter Flush Programs screen the user can select between two tabs: Setup and Information.

The setup tab allows the user to select the required filter flushing battery, while the information tab displays real-time information.

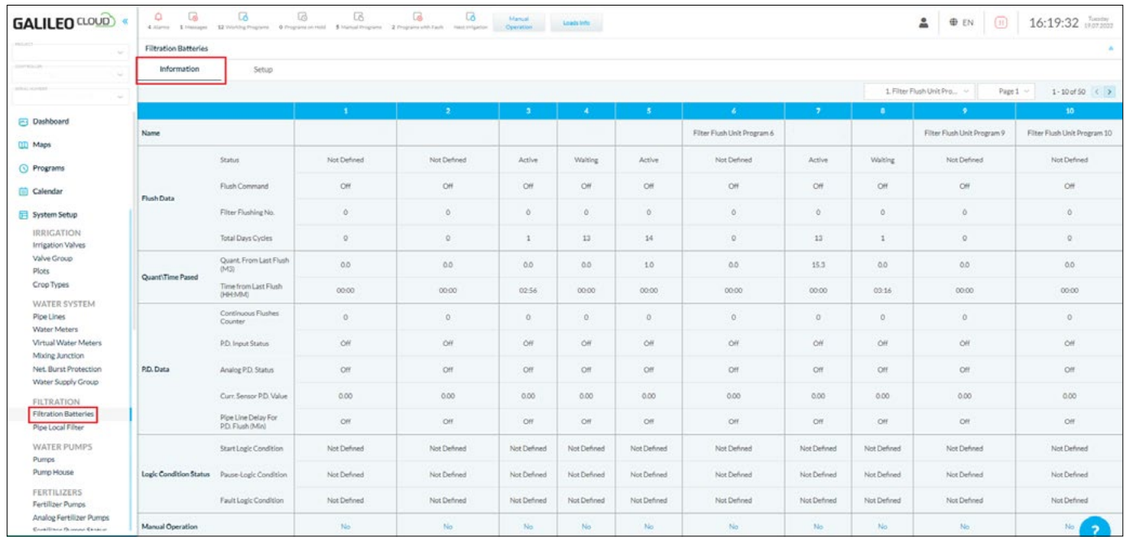
The Setup Table:

For each filtration battery the user can set the following parameters:

- Name: Set the specific name to be assigned to this filtration battery.
- Status: Set the operation status of the program - Not Active, Active, Waiting, or Paused.
- Operation Definition: Set the required Time Interval, Quantity Interval, Start Sustain Before Flush, Flushing Time, and Delay Between Filters.
- Setup: Set the Activity status of the Group, the number of the First Filter, the number of the Last Filter, the Line to which this filtration battery belongs, the Water Meter for interval, The type of the DP Switch, the Irrigation While Flushing parameter, the Fault Reaction, the Fill Delay for Flushing, and the maximal number of Continuous Flushes.
- Manual Override: Set the override status of the filtration battery.

The Information Table:

For each filtration battery (1-10) this table displays the following parameters:

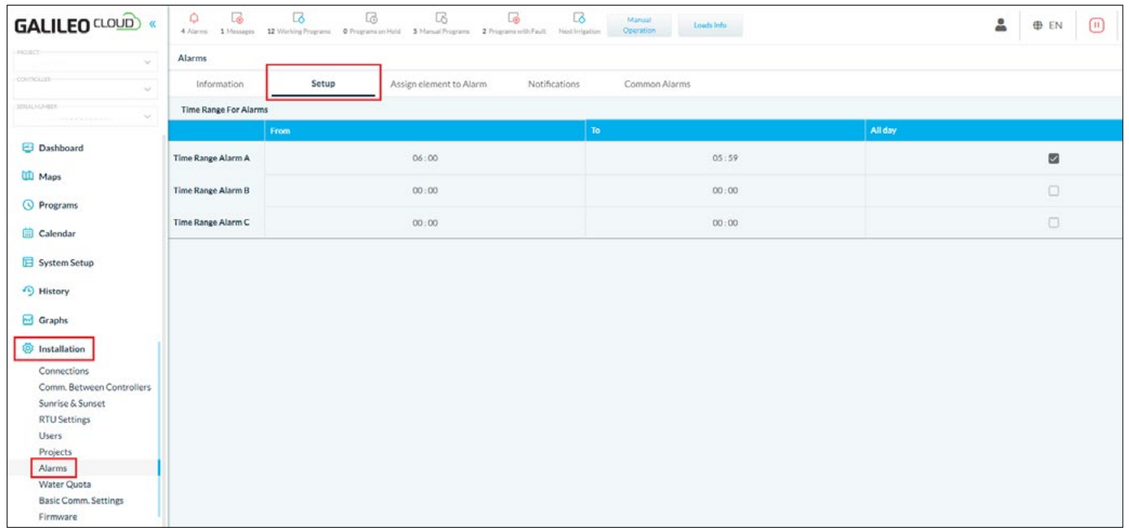


For each one of the 10 filtration batteries the table displays the following:

- Name: The name assigned to the flushing battery.
- Flush Data: The status of the battery, the Flush Command, the Filter Running, and the number of flushes per day.
- Quantity / Time Passed: The quantity from last flush and the time from last flush.
- DP Data: The number of continuous Flushes and the status of the DP Input.
- Logic Condition: The Start Logic Condition, The Pause Logic Condition, and the Fault Logic Condition.
- Filling Delay: The status of the filling delay.
- Manual Override: The override status of the filtration battery.

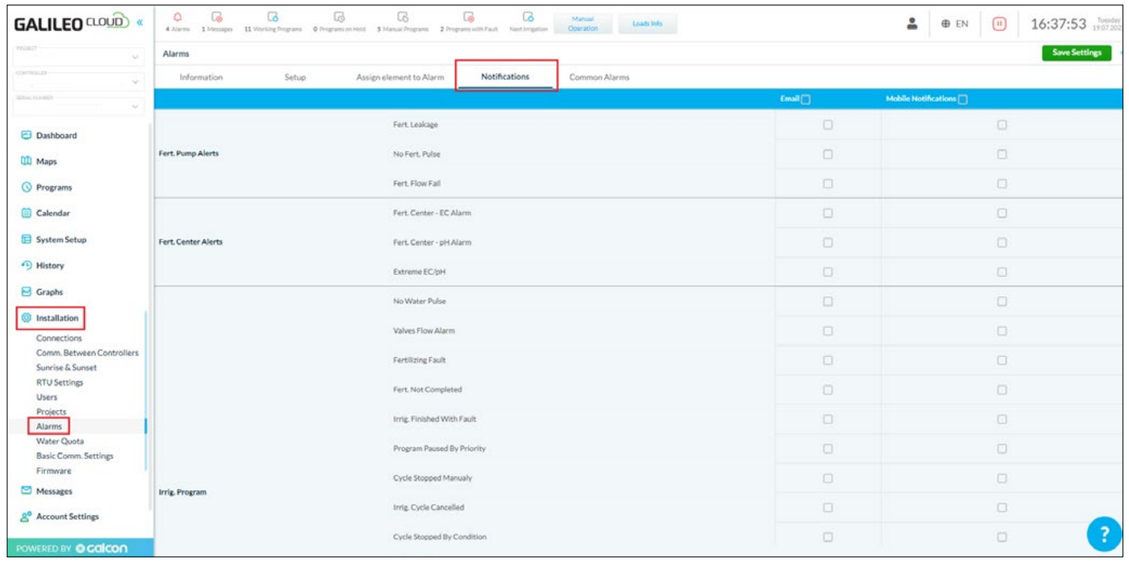
L.5. Alarm Setting:

This Chapter describes the process of setting the alarms that the system generates (once occurred).

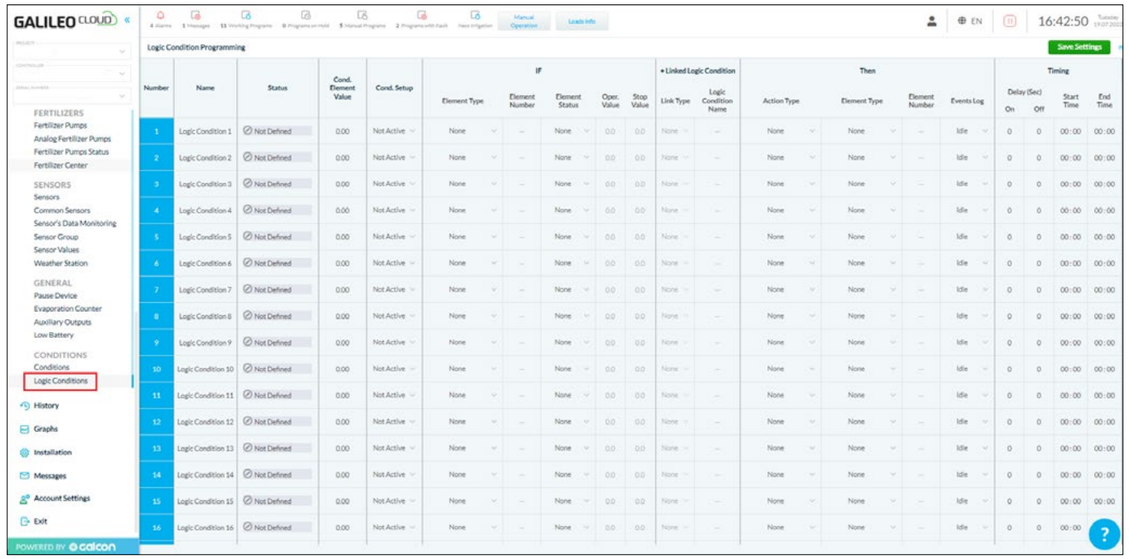


The Tabs menu line of this screen includes the following screens:

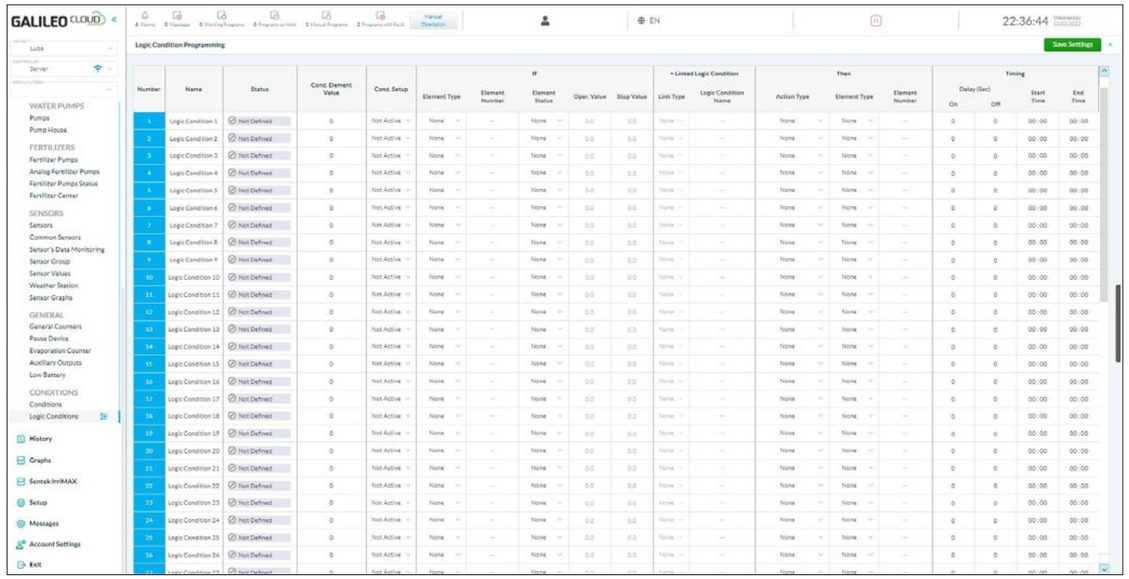
- Setup: Used for setting the time range for generating alarms and for setting the Fertilizer not finished alarm.
- Assign element to Alarm: used for setting time range for each specific alarm, and its alarm control.
- Information: current Alarms Status.
- Notification: Selecting the alarms to be sent by e-mail. Please note: these notifications will be sent to the e-mail address of the user who configured this list.



This Chapter describes the process of setting logic conditions to the Galileo Cloud operation.



Please refer to the Control Philosophy chapter for details on setting logic conditions.



M. Monitoring

The Galileo Cloud system provides the user with ample of easy to access options for:

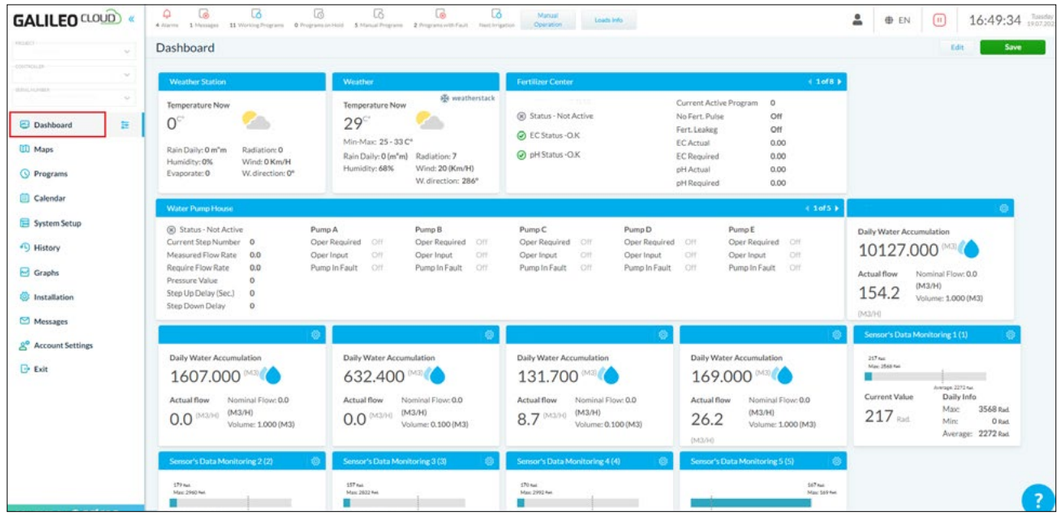
- Monitoring and controlling the system performance in real time
- Constructing reports and charts based on accumulated data and system logs
- Analyzing various aspects of the farm operation

M.1. The Dashboard

The dashboard appears on the Main Display Area of the system's home screen (see the user interface chapter of this document), and displays various widgets chosen by the user. Each widget is a small unique window opens on the dashboard and displays real-time data of a specific aspect of the system. The user can set his preferred widgets on the dashboard by selecting them from the sub-menu of the dashboard found at the system's main menu.

The Save button of the Dashboard saves its layout per user, so each user can organize the dashboard according to his preferences. Please make sure to save your dashboard layout by clicking on the "Save" button, otherwise the screen will be empty upon your next entry to the system.

It is possible to change the locations on screen of the widgets; use the pencil icon (next to the Save icon) to unlock the widgets position status.
Note that the dashboard screen has a connectivity from widget to element; this is a jump function that once the widget is clicked on, the system jumps to the related system screen of the widget element.
The following picture illustrates a dashboard with widgets:



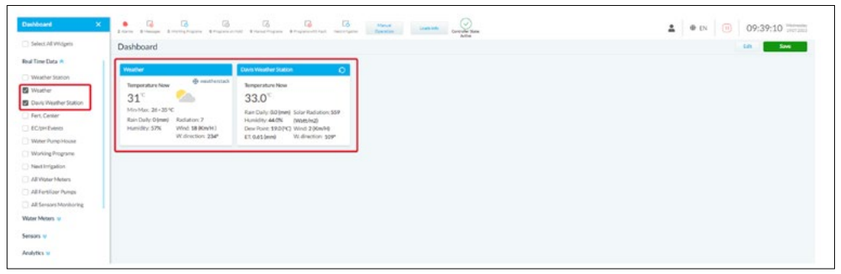
The following picture displays the widgets that can be placed on the dashboard. Click on the empty square at the left of the required widget to place it on the dashboard:

Two types of widgets can be displayed on the Dashboard: Real Time Data and Analytics:

Real Time Data widgets:

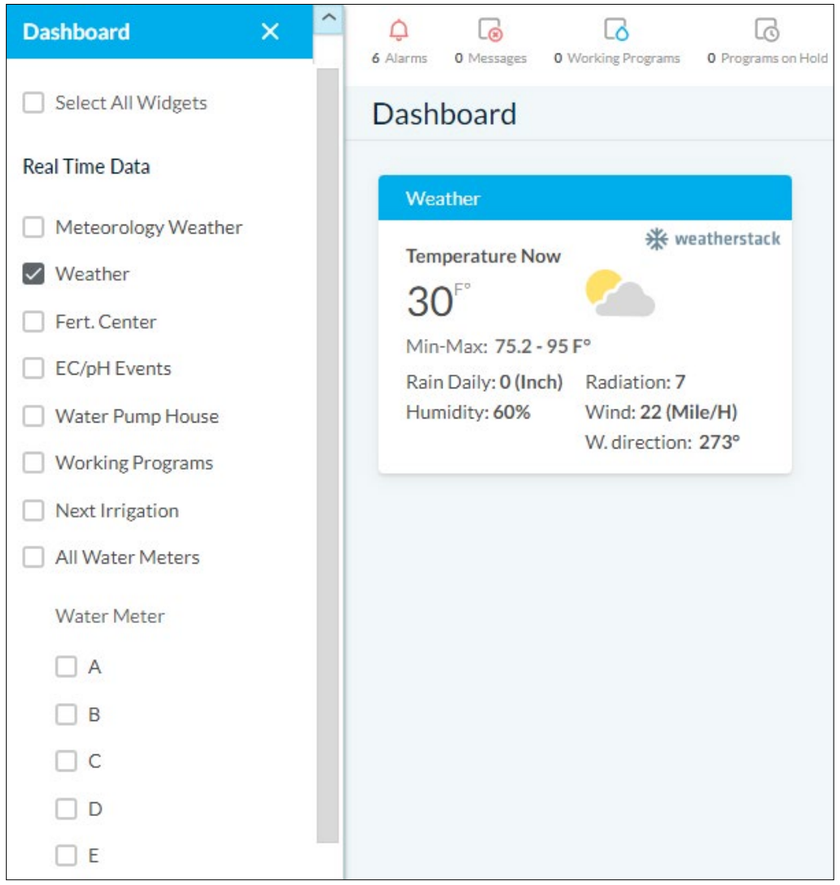
The Meteorology Weather widget:

This widget displays real time weather data originated at the Galileo Cloud local weather station:

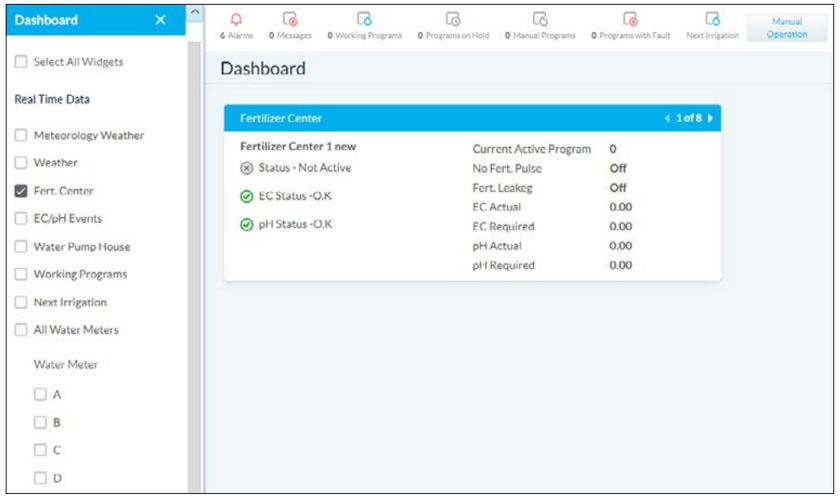


The Weather widget:

This widget displays the real time weather of the farm's region as collected from Google Weather site:

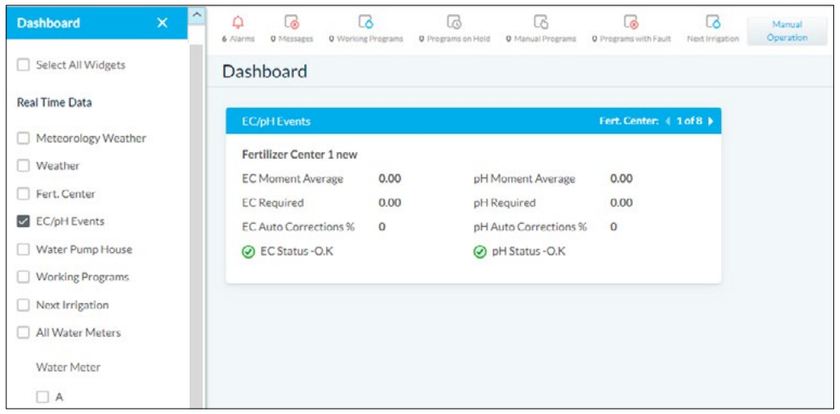


The Fert. Center widget:
This widget displays the real time status and data of the Galileo Cloud Fertigation Center:



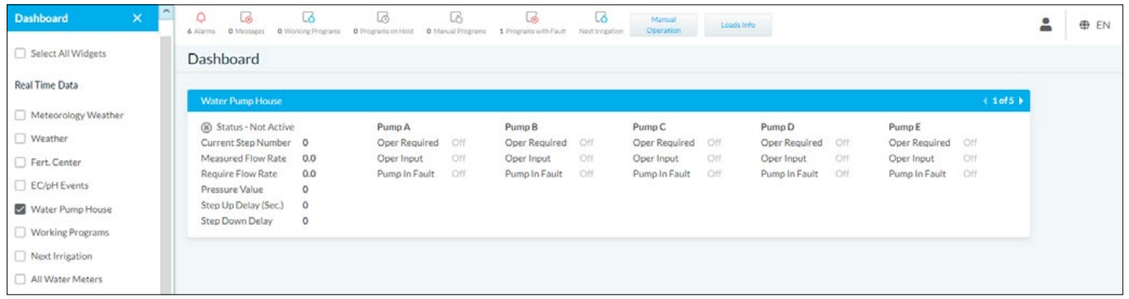
This widget can display up to 8 fertigation centers, select the required one at the top right corner of the widget's window.

The EC/pH Events Widget:
This widget displays the events log of the EC and pH sensors of the Galileo Cloud Fertigation Center:



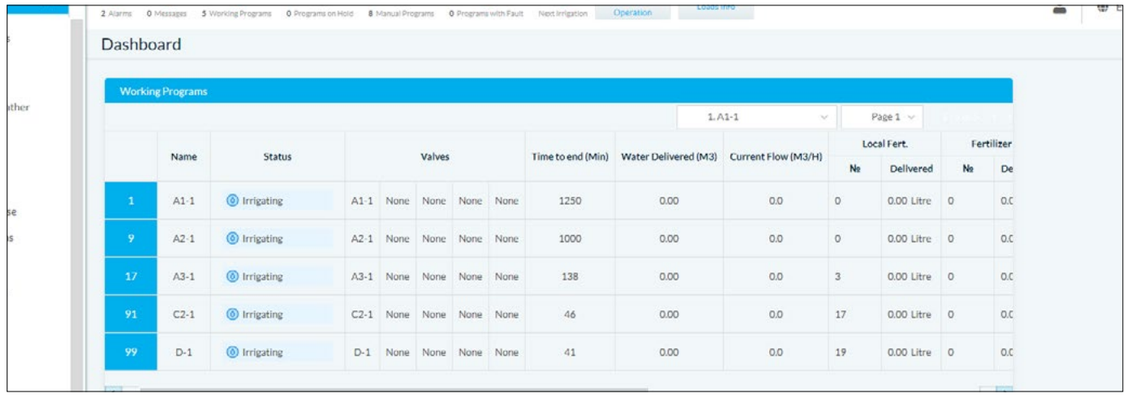
This widget can display up to 8 fertigation centers' EC/pH events screens, select the required one at the top right corner of the widget's window.

The Water Pump House Widget:
This widget displays the current status of the system's pumping stations:



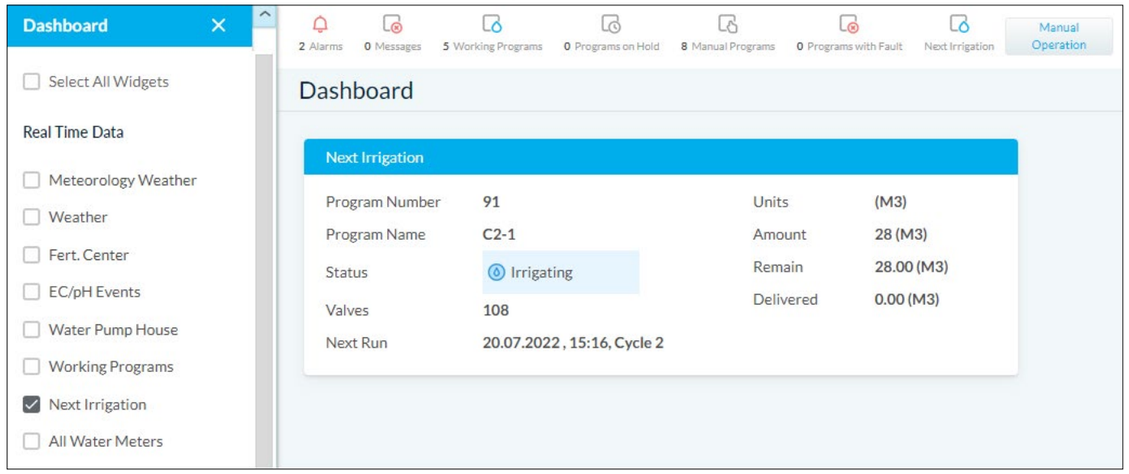
This widget can display up to 5 pumping stations; scroll through the list for selecting the required station to be displayed. For each pumping station this widget displays its real time data, together with the status of its up to 5 participating pumps.

The Working Programs Widget:
This widget displays the status of the system's currently working Irrigation and fertigation programs, together with the numbers of the valves that are currently operated by the programs



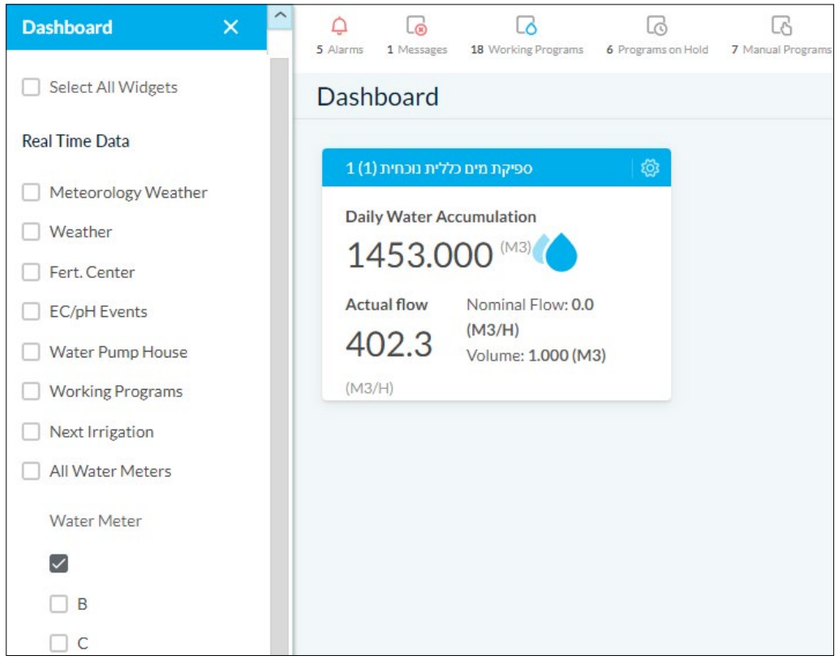
This widget displays all of the system's programs; in case of a system with large number of programs, select the required page of programs from the top right corner of the widget's window.

The Next Irrigation Widget:
This widget displays details on the next irrigation program to be performed by the system's:



The Water Meter Widgets:
These widgets display details on up to 5 water meters: For each meter this widget's headline displays the number of

the meter (A-E) together with the meter's assigned name. This widget displays: the accumulated water of the meter since the beginning of the current day, the actual real-time flow-rate of the meter, and the planed flow-rate (summery of all the planed flow-rates of the valves using this meter).



For selecting the water meters to be displayed on the dashboard click on the Settings icon next to the Dashboard entry at the system's main menu and select the meters to be displayed.

All Fertilizer pumps Widget:

All Fertilizer Pumps

Fert. Pumps	Name	Actual Flow	Daily Accumulation	Status
1	Fertilizer Pump 1 -	- (Litre/H)	- (Litre)	-
2	Fertilizer Pump 2	- (Litre/H)	- (Litre)	-

This widget displays all the system's configured fertilizer pumps; for each pump the widget displays the pump's number, name, its actual flow rate, its daily accumulation, and its status.

All Sensors Monitoring Widget:

All Sensors Monitoring

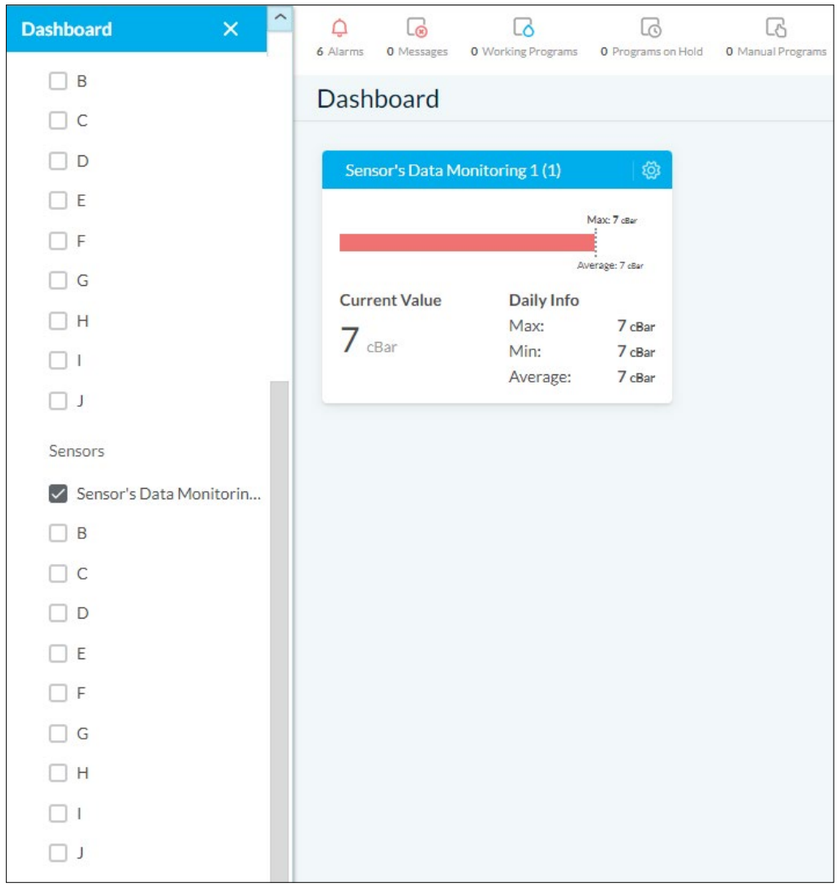
Sensors Monitoring	Name	Unit	Current Reading	Avg. Reading	Min. Reading	Max. Reading
1	Sensor's Data Monitoring 1	EC	No Value	0.00	0.00	0.00
2	Sensor's Data Monitoring 2	EC	No Value	0.00	0.00	0.00
3	Sensor's Data Monitoring 3	EC	No Value	0.00	0.00	0.00
4	Sensor's Data Monitoring 4	EC	No Value	0.00	0.00	0.00

This widget displays the real time data of all the system's sensors that are selected by the user to be monitored as found at the "Sensors Data Monitoring" screen, under the system's main menu "Sensors" entry.

For each monitored sensor this widget displays its number, name, engineering unit, current reading, average reading, its minimal reading, and its maximal reading.

The Sensors Widgets:

These widgets display details on up to 5 system sensors: For each Sensor this widget's headline displays the number of the sensor (A-E) together with the sensor's assigned name. This widget displays: the current reading of the sensor, the daily Maximum, Minimum, and Average readings.

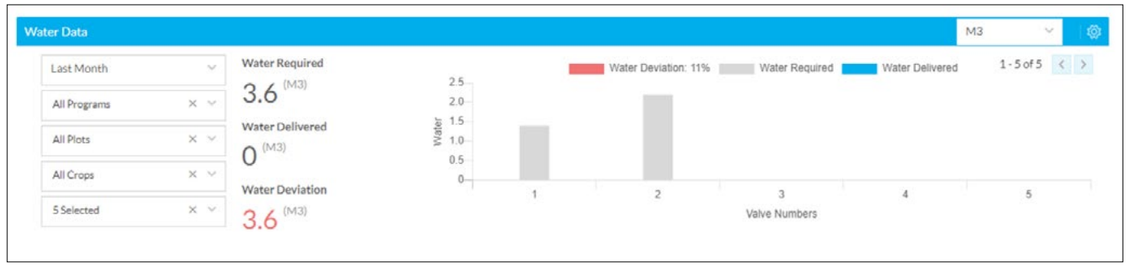


For selecting the sensors to be displayed on the dashboard click on the Settings icon next to the Dashboard entry at the system's main menu and select the sensors to be displayed.

Analytic widgets:

The Water Data widget:

This widget displays the water data items:



At the left side of the widget window the user can select the following:

- Data range to be displayed: Yesterday, Last 7 days, Last month, or Custom Days.
- The programs to be displayed
- The Plots
- The crop Types
- The valves to be displayed

The upper line of the window allows the user to select the type of the water accumulation to be displayed: Volume or Time.

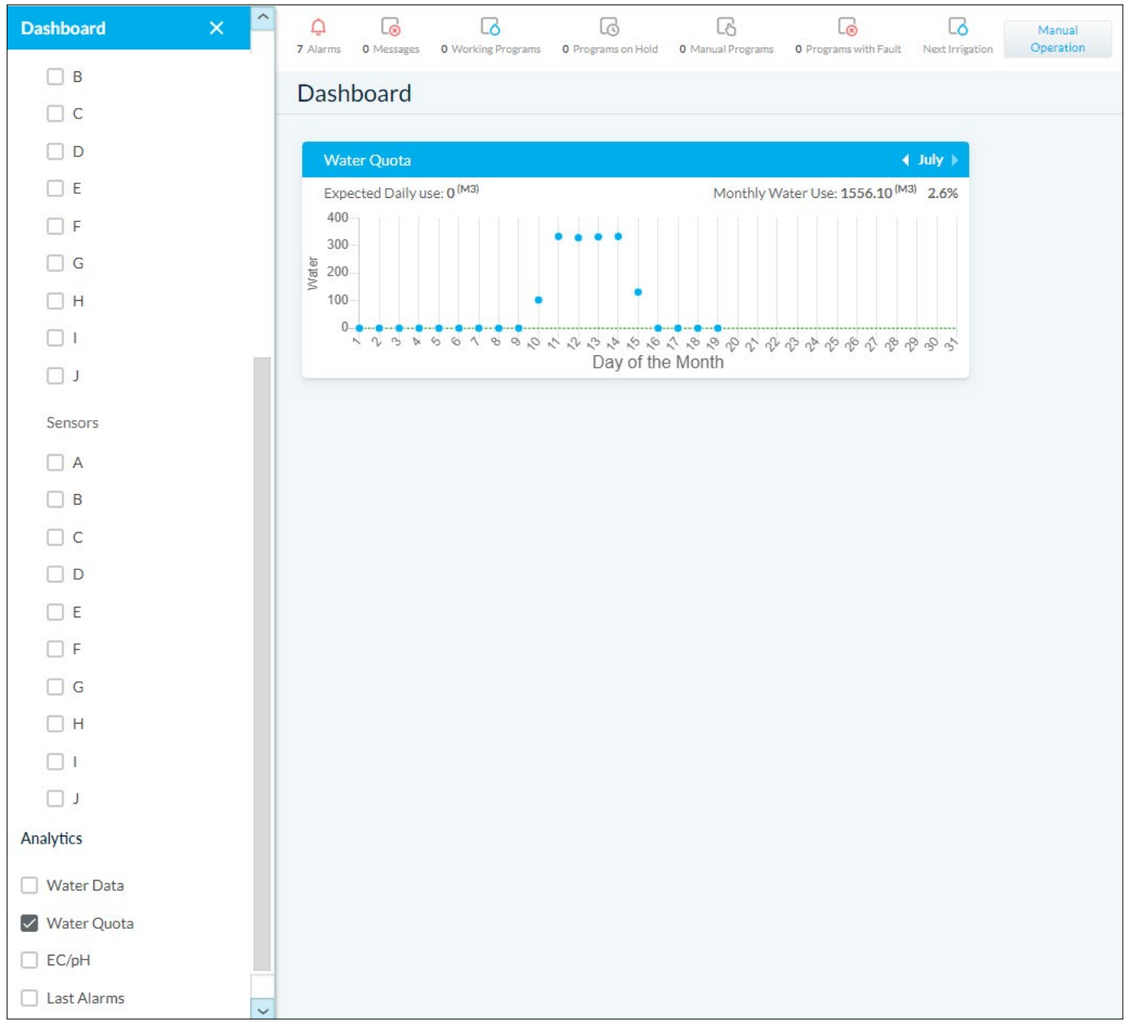
A setting Icon on the top right of the screen allows the user to set Water Difference (Percentage of the basic irrigation quantity).

The middle of this widget window displays the total accumulation of water delivered against the Water Required.

The right side of the window displays a chart of the water per the irrigation valves with data on the delivers against the required quantities. The arrows at the upper right side of the chart allows the user to move between the valves displayed.

The Water Quota widget:

This widget displays the monthly water quota chart:

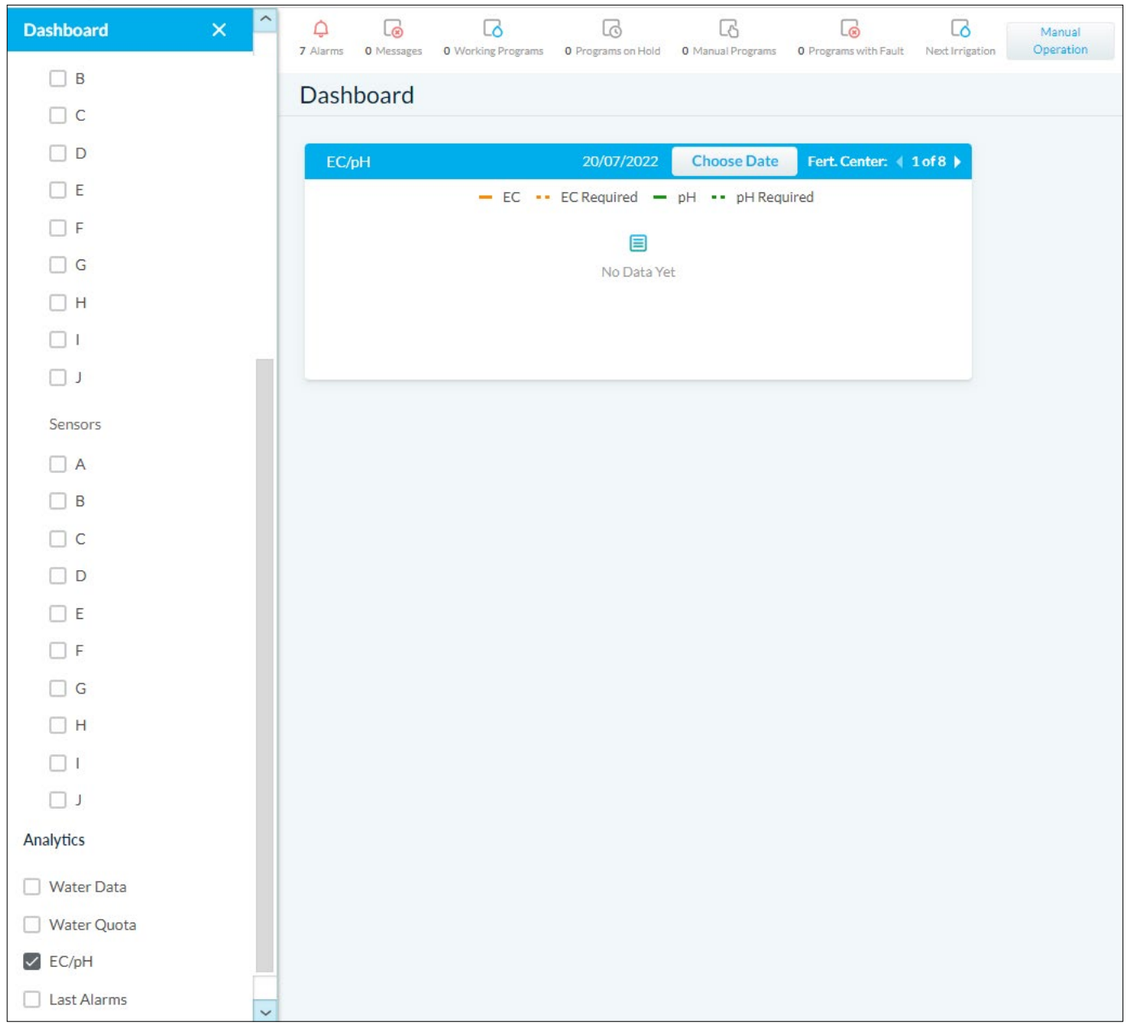


The chart displays the days of the selected month against the water, by Expected Daily use and Actual daily usage.

The upper line of the window allows the user to select the required month.

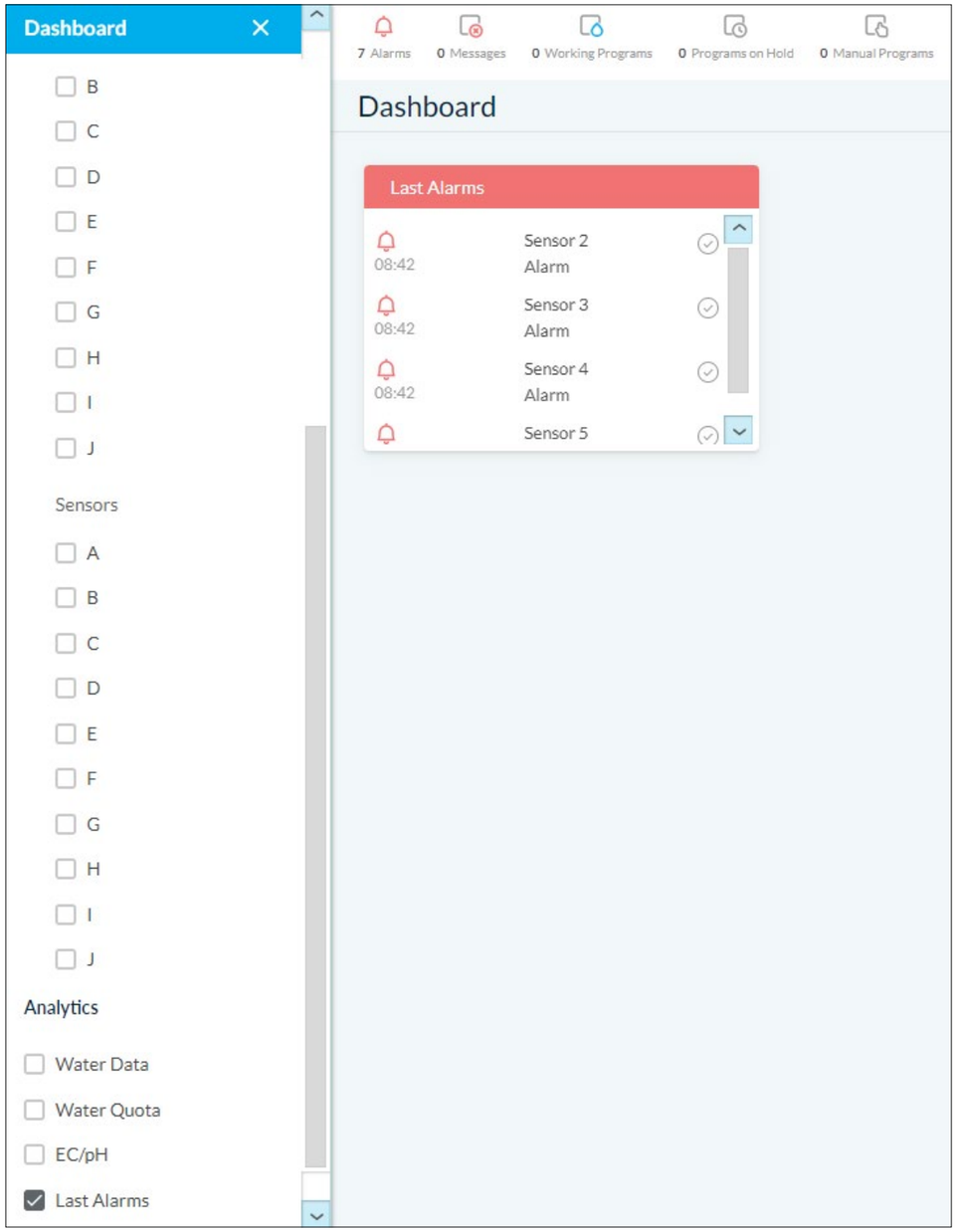
Please note that the required monthly water quota can be set by the user through the Water quota tab at the Setup entry of the main menu.

The EC/pH widget:
This widget displays the EC/pH chart:



The chart displays the levels of the required EC and pH against the Actual EC and pH per a selected day.

Last Alarms widget:
This widget displays a list of the last alarms log occurred at the system:

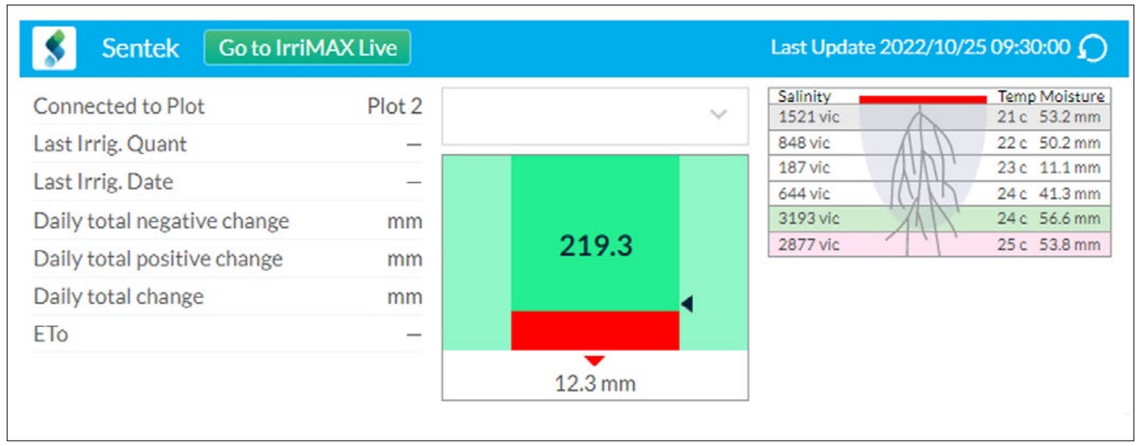


In order to cancel an existing alarm through this widget, click on the "V" icon next to its line on the list.

Sentek widget:

This widget displays the information that the Galileo system receives from the Sentek system.

Important: in order for the system to display the Sentek data the user has to configure first the Sentek probes at the plot's setup screen.



In the middle section of this screen the user can select the required Sentek probe from the dropdown list. Once selected the left side of the screen displays data that is received from the Sentek system regarding the selected probe. The top line of this list section displays the plot name that is monitored by this probe and the next two lines display the last irrigation quantity and the last irrigation date. The rest of the lines display data received from the Sentek system. For explanation on the data presented' please refer to the Sentek user manual.

In the middle of the screen (if configured in the Sentek system) the widget displays the threshold parameters as entered by the user.

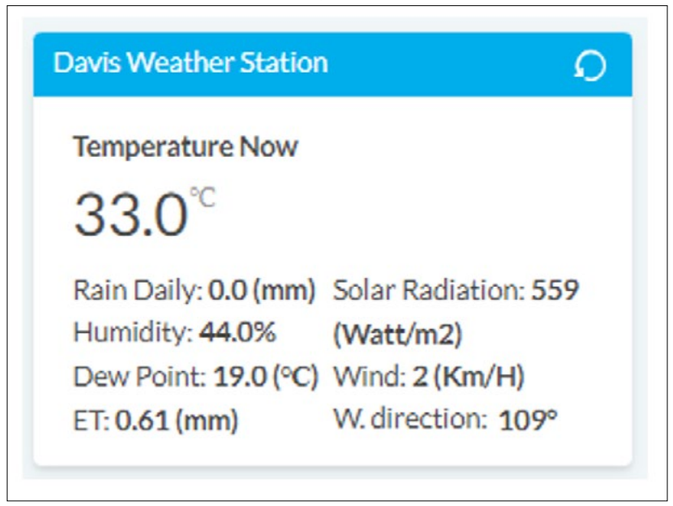
In the right side of the screen the widget displays the Sentek 's plant roots diagram data.

In order to get more details, click on the "Go to IrriMax Live" button on the widget's headline; the system opens a window with a real-time link to the Sentek system.

Davis widget:

This widget displays the information that the Galileo system receives from the Davis Weather Station.

Important: in order for the system to display the Davis data, the user has to configure first the weather station in the installation menu of the Galileo system.

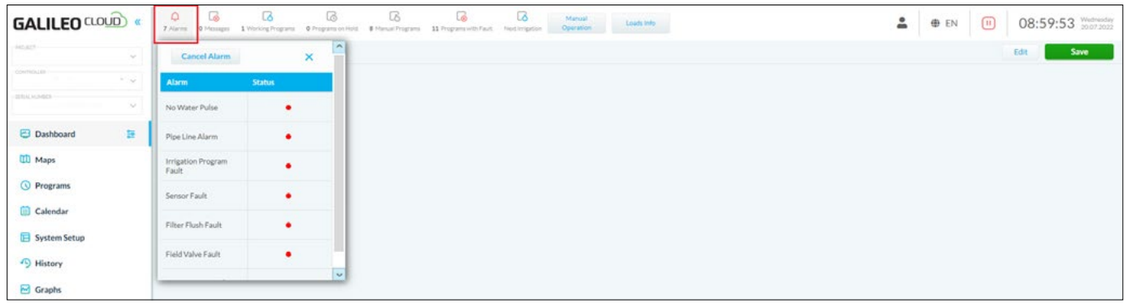


M.2. The Monitoring Menu

This menu is the horizontal line above the Main Display Ares, its various icons are the entry points to the most important real-time monitoring components of the system, such as Alarms, Working Programs, Programs on hold, Programs with fault, etc. Clicking on each such icon opens a window on the screen's Main Display Area with real-time information on the selected icon. (see the user interface chapter of this document)

The Alarms Window:

This window displays a list of the current alarms of the system:



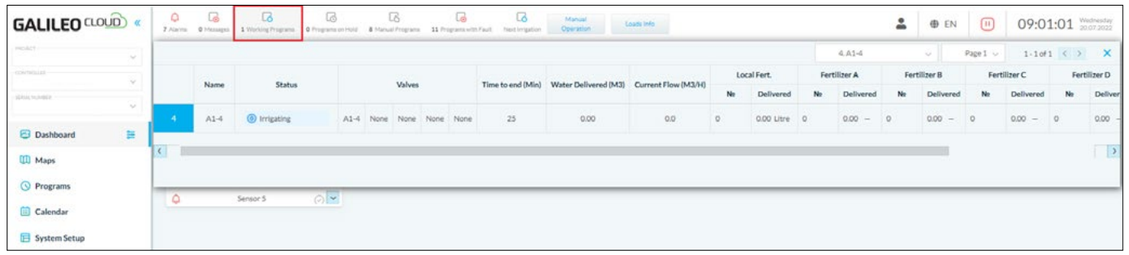
The status of each existing alarm is displayed in red color.

A "Cancel Alarms" button allows the user to Cancel all the existing system alarms and recalculates their status.

Please note that the Event Log entry of the main menu displays the details of the alarm.

The Working Programs Window:

This window displays a real time list of the currently working programs:

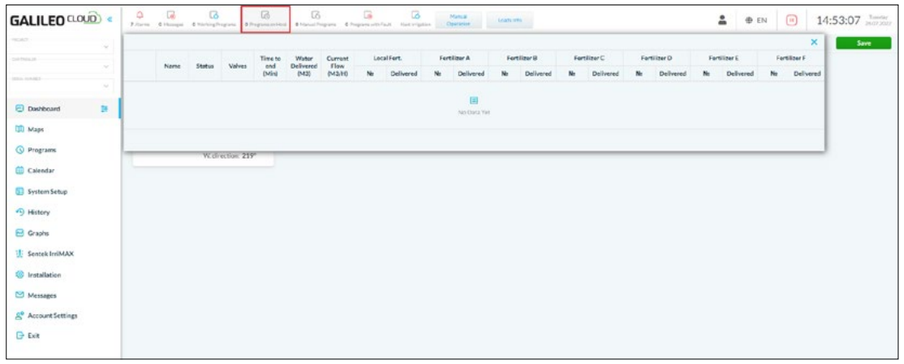


The table of this window displays the following columns:

The number of the program, the name of the program, the valves operated by the program (up to 5 valves per program), the time left till the end of this program operation, the amount of water delivered so far, the current flow-rate and the amount of fertilizer delivered by the local fertilizer pump.

The Programs on Hold Window:

This window displays a real time list of the currently on hold programs:

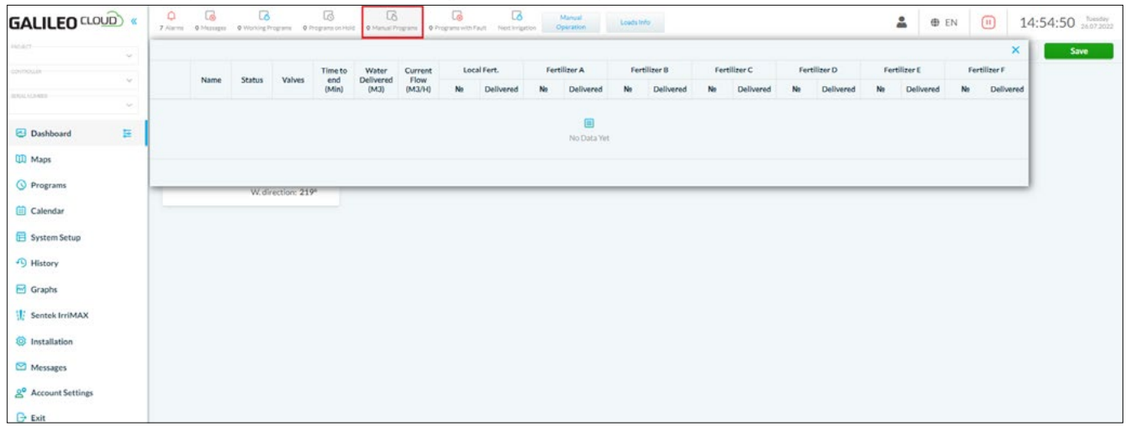


It is possible to resume the operation of a manually paused program from this screen.

Please note that in the system's Programs > Irrigation menu it is possible to set a program to manual override mode through the Operation Table or the Multi Programs tabs.

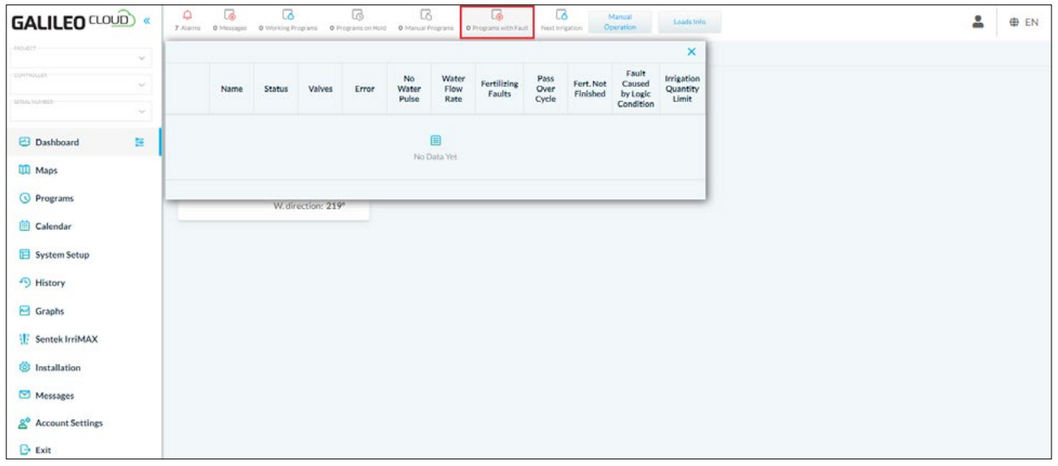
The Manual Programs Window:

This window displays a real time list of the programs started by a manual start command:



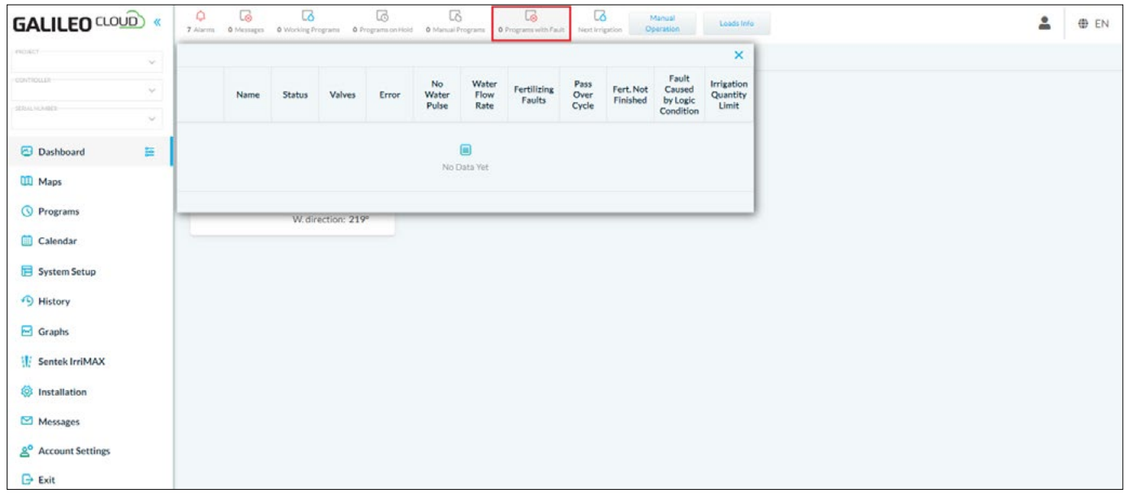
The Programs with Faults Window:

This window displays a real time list of the currently faulty programs:



The table of this window displays the following columns:

The number of the program, the name of the program, the valves operated by this program and the faults details.



M.3. The Monitoring Map

The Map is an essential monitoring feature of the Galileo Cloud system; please refer to the User Interface and the Configuration chapters of this document, for information on setting and selecting maps.

The map displays a layer of Galileo Cloud system elements on a real-world map. While displayed on the Main Display Area of the system the map displays the real-time status of these elements; the statuses are color coded:

- Black - element shapes are first entered in black color; however, it is possible to change their color.
- Blue - icons are entered in blue color.
- Yellow - shapes and icons turn yellow when they are in fertigation mode.
- Red - shapes and icons turn red when they are in fault mode.
- Green - shapes and icons turn green when they are in irrigation mode.

M.4. The Logs

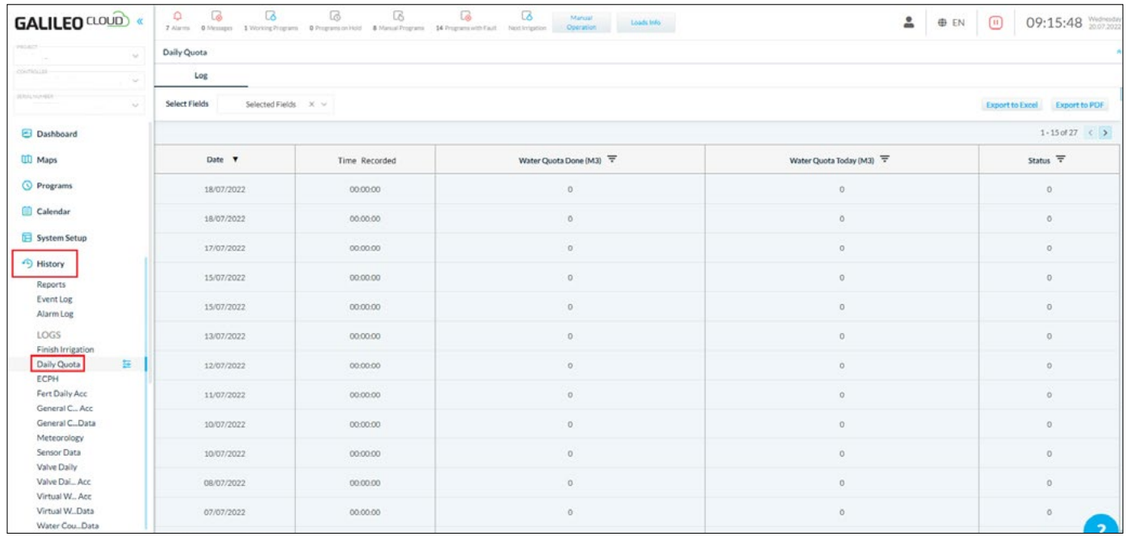
Galileo Cloud system includes various types of logs that enable the user set, collect and display system information in tables and charts. Several Logs' entries are found in the systems main menu.

Under the Logs entry the following loges are found:

Important: this chapter describes the usage of the loges for monitoring the Galileo Cloud system, please refer to the configuration chapter for details on configuring the logs.

Daily Water Quota Log:

This log presents the daily water quota data of the various system valves:



The user can select the data columns to be included in the table from a drop-down list at the upper left side of the screen:

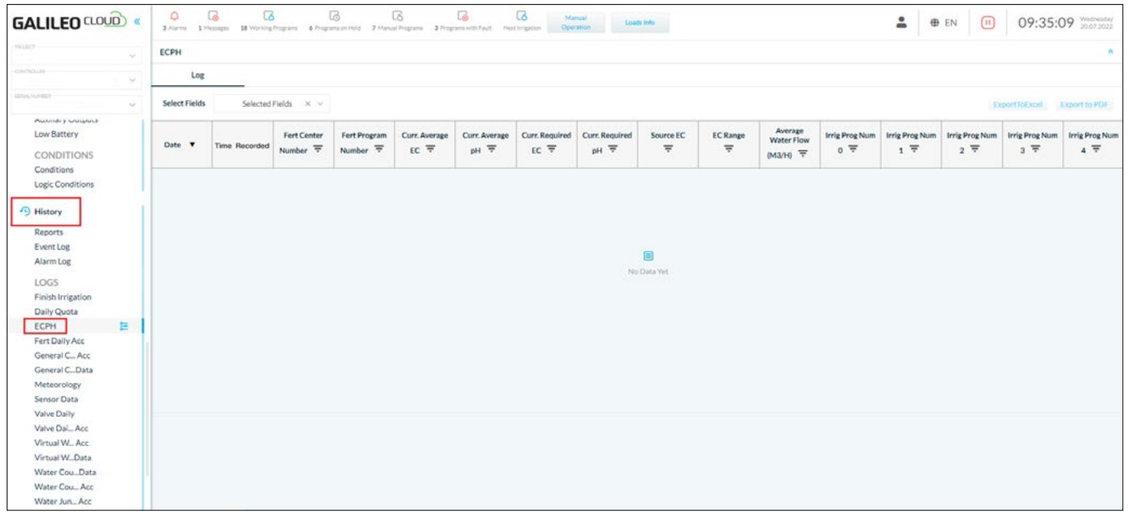
- Water Quota Done during the date range of this log
- Water Quota today
- Status

The number of valves displayed in the table can be selected on the upper right side of the screen.

The dates range of the information to be displayed on this log, can be selected by pressing the configuration icon located to the right of this log entry at the system's main menu.

EC/pH Log:

This log presents the EC/pH data according to the dates range and the columns selected by the user according to the assigned logging time interval:



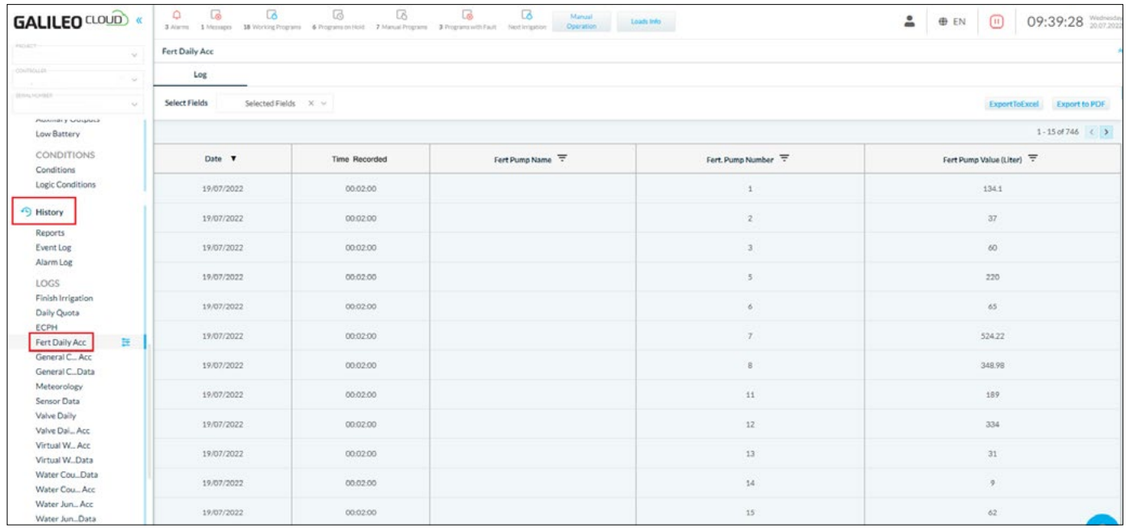
The user can select the data columns to be included in the table from a drop-down list at the upper left side of the screen:

- Fert Center Number - the number of the fertilizing center
- Fert Program Number - the number of the fertilizing program
- Curr Average EC - the current average of the EC readings
- Curr Average pH - the current average of the pH readings
- Curr Required EC - the currently required EC level
- Curr Required pH - the currently required pH level
- Source EC - the reading of the EC level at the water source
- EC Range - the number of the EC range number as defined at the water source: 0 = Not Active, 1 = Range A, 2 = Range B, 3 = Range C, 4 = the reading is below range A, 5 = the reading is above range C, 6 = not defined.
- Average Water flow - the average water flow of this fertilizer center
- Irrigation Program number A - the number of the valve irrigating in program A
- Irrigation Program number B - the number of the valve irrigating in program B
- Irrigation Program number C - the number of the valve irrigating in program C
- Irrigation Program number D - the number of the valve irrigating in program D
- Irrigation Program number E - the number of the valve irrigating in program E

The dates range of the information to be displayed on this log, can be selected by pressing the configuration icon located to the right of this log entry at the system's main menu.

Fertilizer Daily Accumulation Log:

This log presents the Fertilizer Daily Accumulation data according to the dates range and the columns selected by the user:



The user can select the data columns to be included in the table from a drop-down list at the upper left side of the screen:

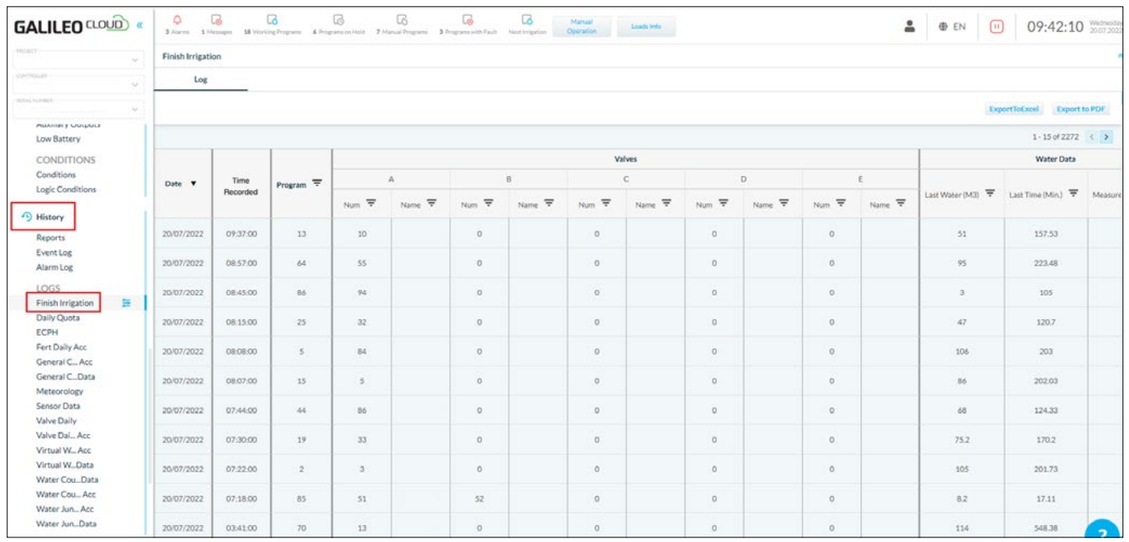
- Fert Pump Name - the name of the local fertilizer pump
- Fert Pump Number - the number of the local fertilizer pump
- Fert Pump Valve - the number of the valve that receives fertilizer from this pump

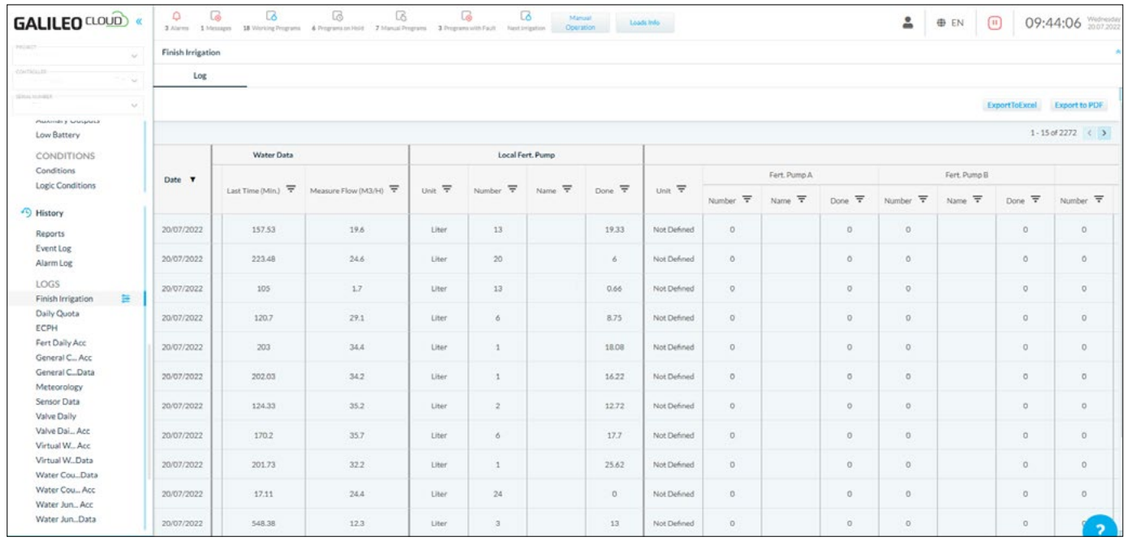
The dates range of the information to be displayed on this log, can be selected by pressing the configuration icon located to the right of this log entry at the system's main menu.

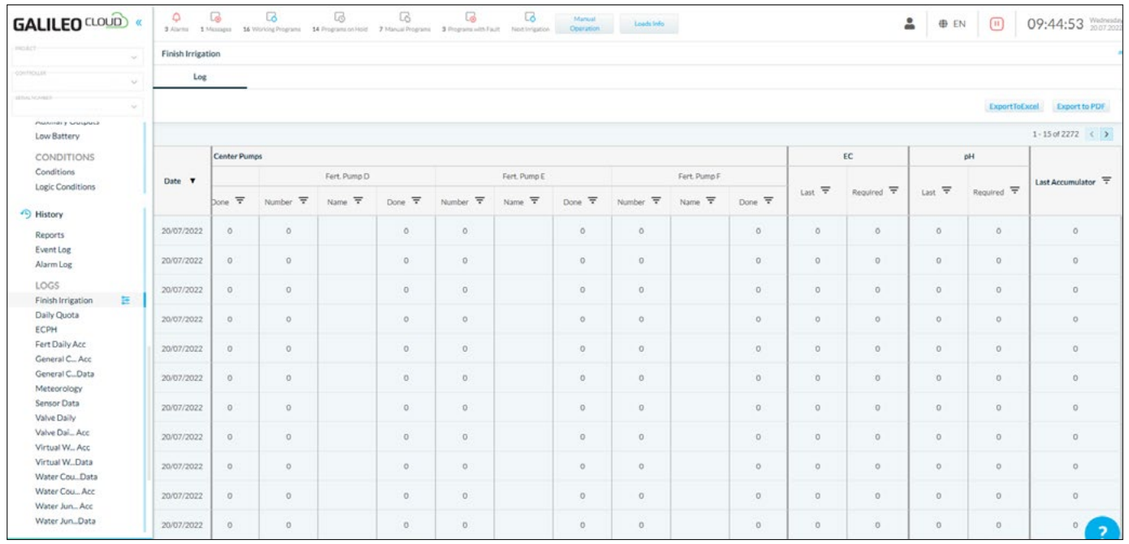
The number of lines displayed can be selected on the upper right corner of the table.

Finished Irrigation Log:

This log presents all the data items of the finished irrigation programs according to the dates range selected by pressing the configuration icon located to the right of this log entry at the system's main menu.





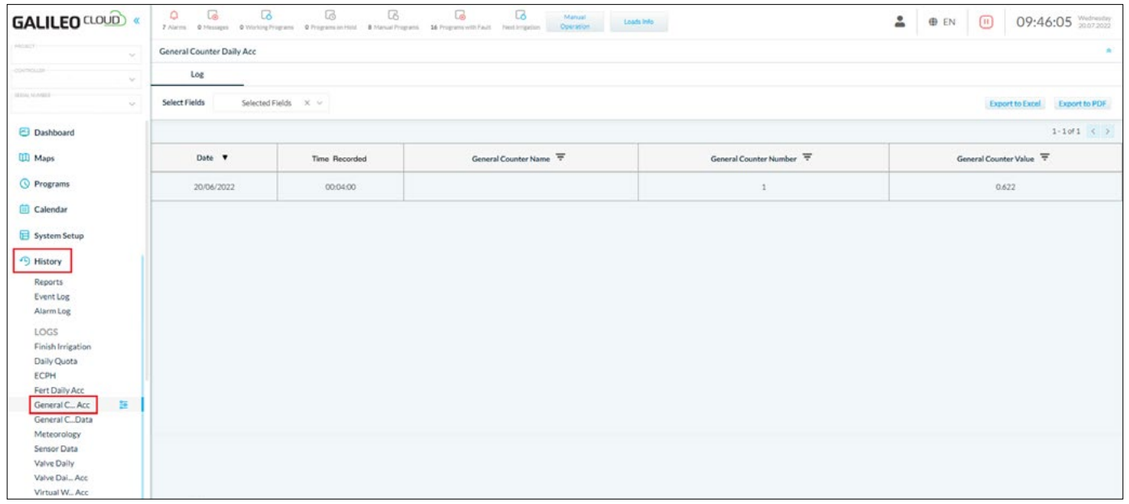


The data presented in this log:

- Time - the record line time.
- Program - the record line program number.
- The Valves - the names of the 5 valves operated by this program.
- Water data - the water volume irrigated by this program, the water unit, the time irrigated by this program, and the flow-rate by the end of the irrigation.
- Local Fertilizer Pump data - the fertilizer unit, the required number of fertilizer units, the name of the pump, and the accumulated fertilizer units.
- The fertilizer center pumps - the fertilizer unit, followed by 6 pumps (A - F), where for each pump the table displays the required number of fertilizer units, the name of the pump, and the accumulated fertilizer units.
- EC- the EC data: last reading and the required EC level.
- pH- the pH data: last reading and the required pH level.
- Last Accumulator - the total accumulated readings of a specific sensor (such as Solar Radiation sensor) since the beginning of the previous irrigation till the beginning of the current irrigation.

General Counter Daily Accumulation Log:

This log presents the daily accumulated data of the general counter devices according to the dates range and the columns selected by the user:



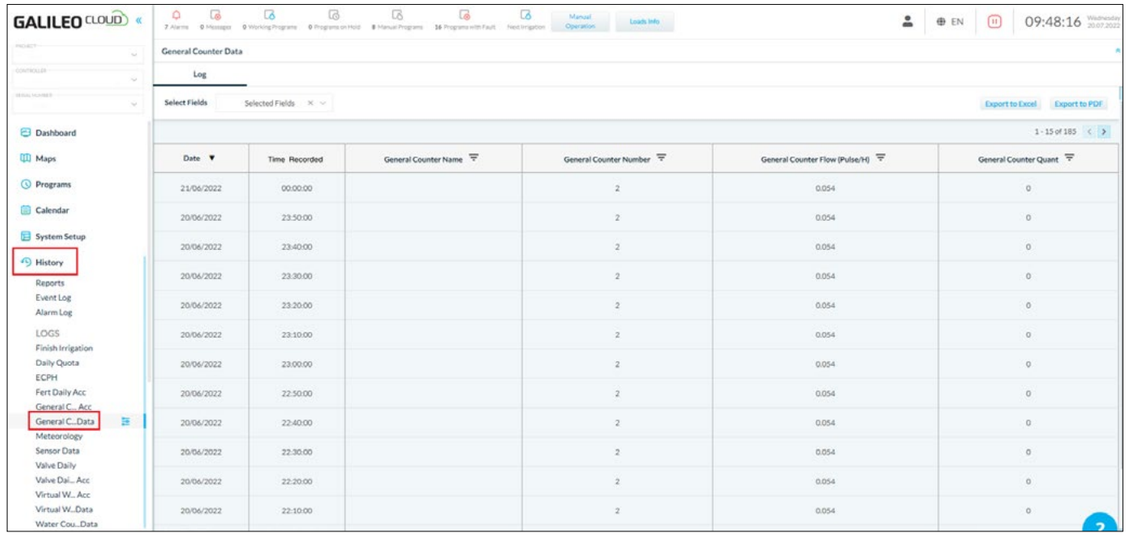
The user can select the data columns to be included in the table from a drop-down list at the upper left side of the screen:

- General Counter Name - the name of the General Counter
- General Counter Number - the Number of the General Counter
- General Counter Value

The dates range of the information to be displayed on this log, can be selected by pressing the configuration icon located to the right of this log entry at the system's main menu.

General Counter Data Log:

This log presents the data of the general counter devices according to the dates range and the columns selected by the user:



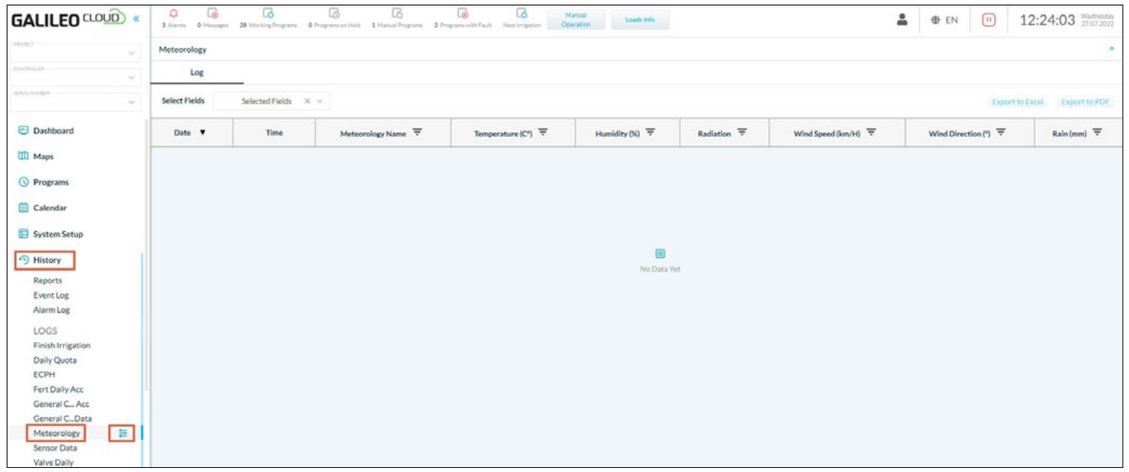
The user can select the data columns to be included in the table from a drop-down list at the upper left side of the screen:

- General Counter Name - the name of the General Counter
- General Counter Number - the Number of the General Counter
- General Counter Flow - the flow rate of the general counter
- General Counter Quant - the accumulated count of the general counter

The dates range of the information to be displayed on this log, can be selected by pressing the configuration icon located to the right of this log entry at the system's main menu.

Meteorology Log:

This log presents the data of the Galileo Cloud Weather station according to the dates range and the columns selected by the user:



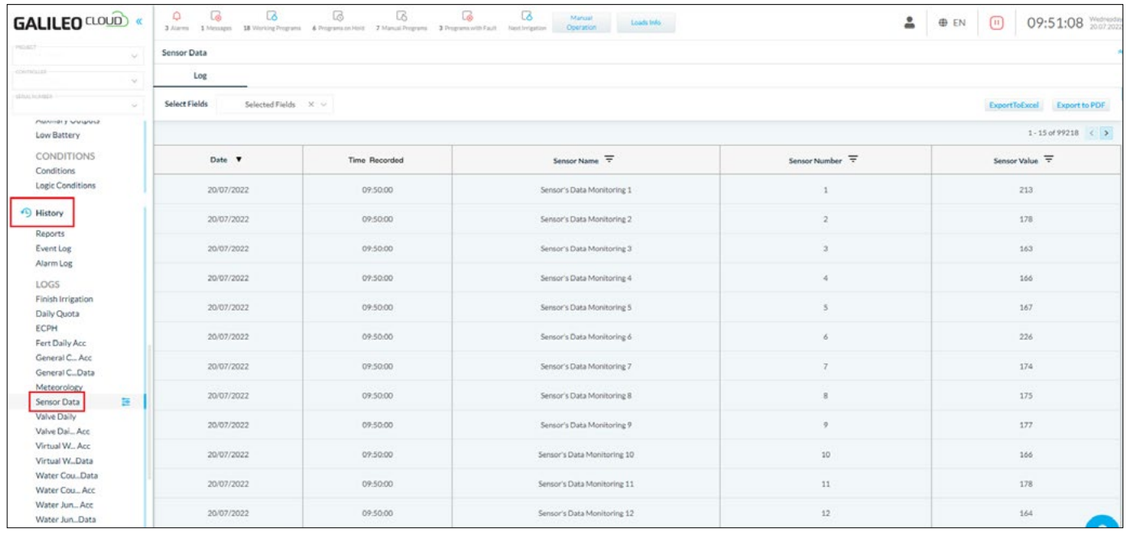
The user can select the data columns to be included in the table from a drop-down list at the upper left side of the screen:

- Meteorology name - the weather station name
- Temperature
- Humidity
- Radiation
- Wind Speed
- Wind Direction
- Rain

The dates range of the information to be displayed on this log, can be selected by pressing the configuration icon located to the right of this log entry at the system's main menu.

Sensor Data Log:

This log presents the reading of the system sensors according to the dates range and the columns selected by the user:



The user can select the data columns to be included in the table from a drop-down list at the upper left side of the screen:

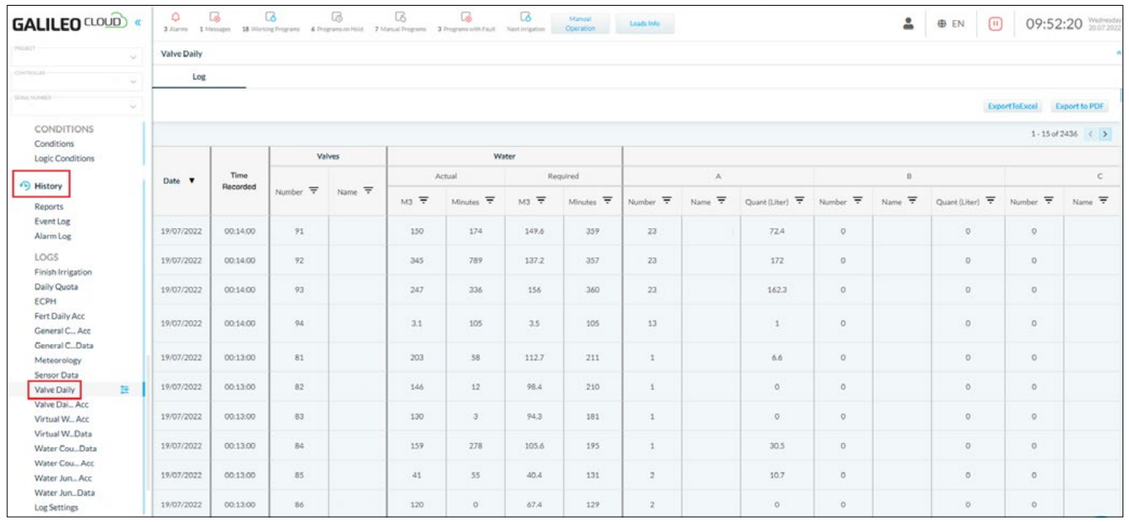
- Sensor Name - the name of the sensor
- Sensor Number - the number of the sensor
- Sensor Value - the Reading of the sensor

The dates range of the information to be displayed on this log, can be selected by pressing the configuration icon located to the right of this log entry at the system's main menu.

The number of lines displayed can be selected on the upper right corner of the table.

Valve Daily Log:

This log presents the daily log of the system's valves according to the dates range selected by the user:



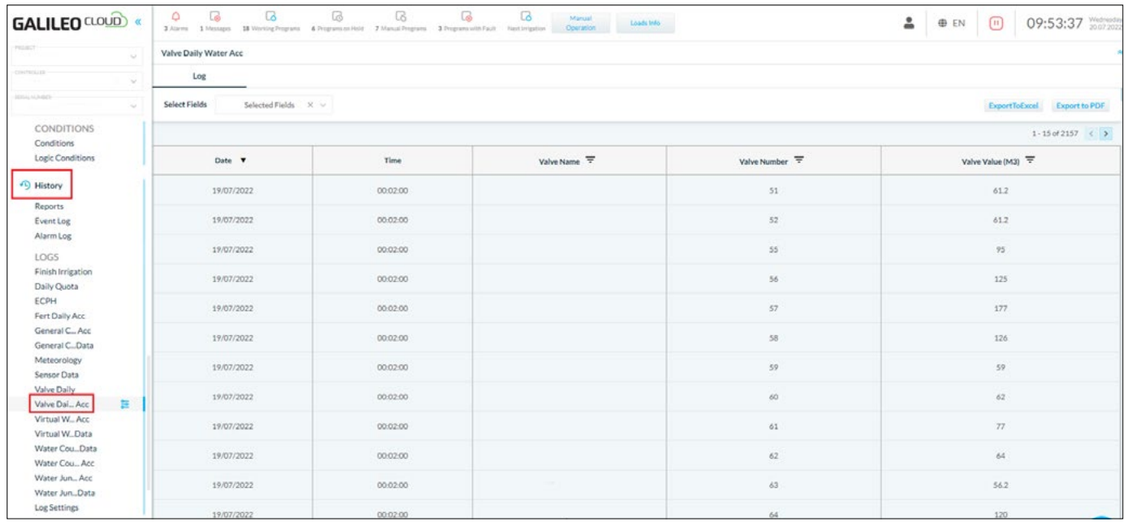
The dates range of the information to be displayed on this log, can be selected by pressing the configuration icon located to the right of this log entry at the system's main menu.

The number of lines displayed can be selected on the upper right corner of the table.

This log presents the Water and Fertilizer usage of the valves together with the names of their Plots, Pipeline and their Area size.

Valve Daily Water Accumulation:

This log presents the daily log of the valves water accumulation according to the dates range selected by the user:



The user can select the data columns to be included in the table from a drop-down list at the upper left side of the screen:

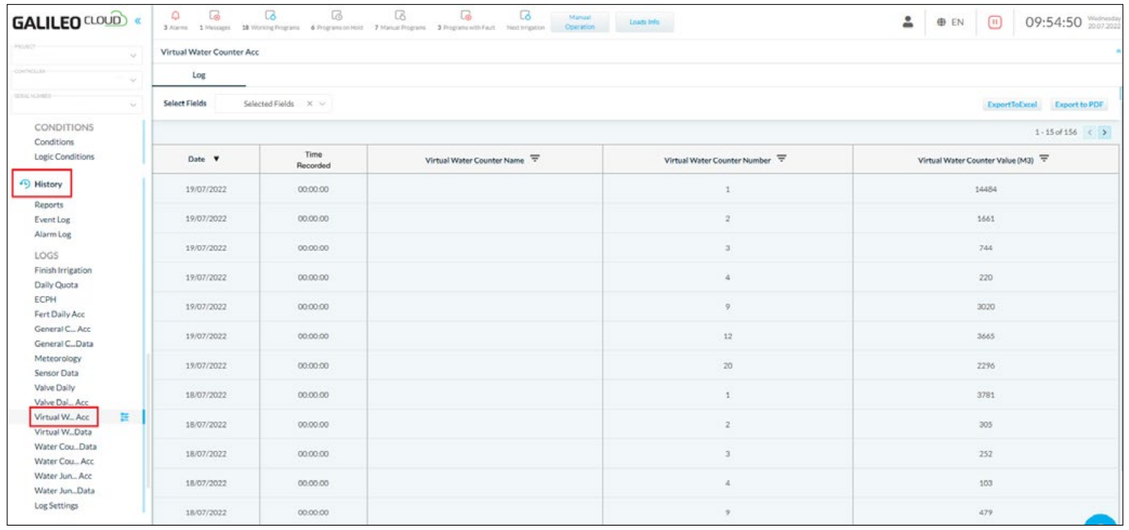
- Valve Name - the name of the Valve
- Valve Number - the number of the Valve
- Valve Value - the Reading of the Valve

The dates range of the information to be displayed on this log, can be selected by pressing the configuration icon located to the right of this log entry at the system's main menu.

The number of lines displayed can be selected on the upper right corner of the table.

Virtual Water Counter Accumulation:

This log presents the log of the virtual water counters accumulation according to the dates range selected by the user:

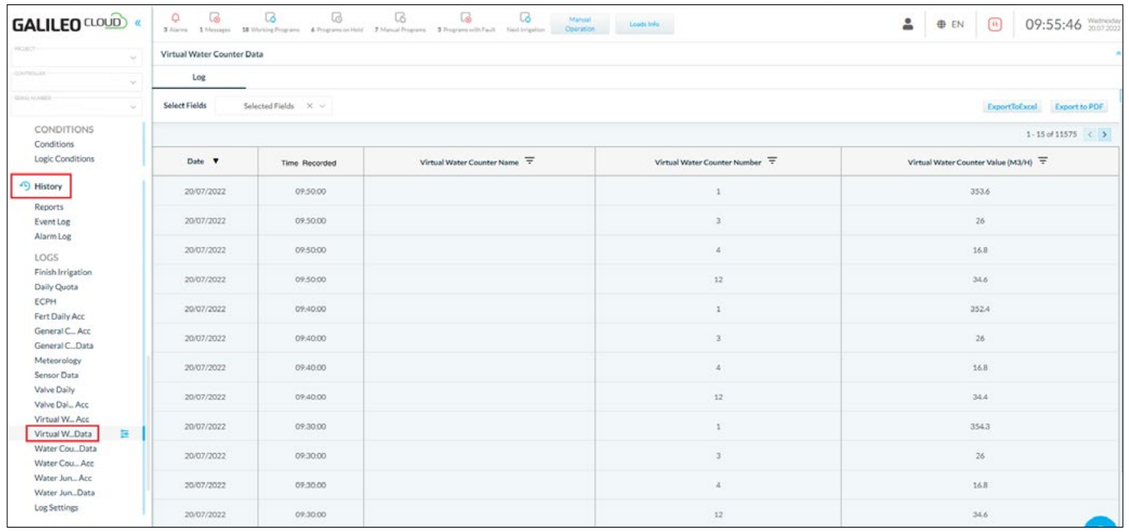


The user can select the data columns to be included in the table from a drop-down list at the upper left side of the screen:

- Virtual Water Counter Name - the name of the Counter
- Virtual Water Counter Number - the number of the Counter
- Virtual Water Counter Value - the Reading of the Counter

Virtual Water Counter Data:

This log presents the log of the virtual water counters data according to the dates range selected by the user:



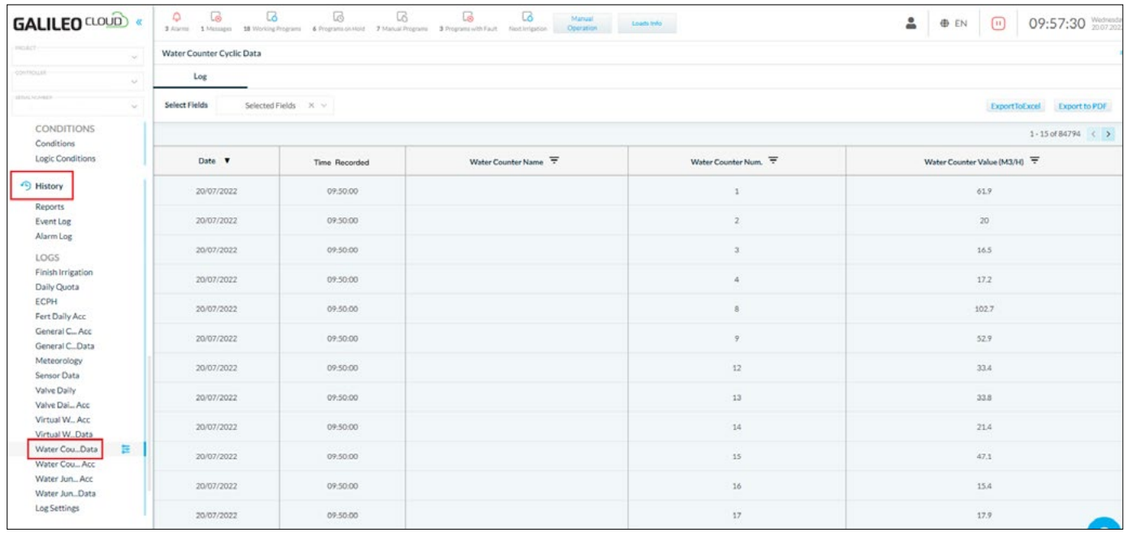
The user can select the data columns to be included in the table from a drop-down list at the upper left side of the screen:

- Virtual Water Counter Name - the name of the Counter
- Virtual Water Counter Number - the number of the Counter
- Virtual Water Counter Value - the Reading of the Counter

The dates range of the information to be displayed on this log, can be selected by pressing the configuration icon located to the right of this log entry at the system's main menu.

The number of lines displayed can be selected on the upper right corner of the table.

This log presents the log of the water counters Cyclic data according to the dates range selected by the user:



The user can select the data columns to be included in the table from a drop-down list at the upper left side of the screen:

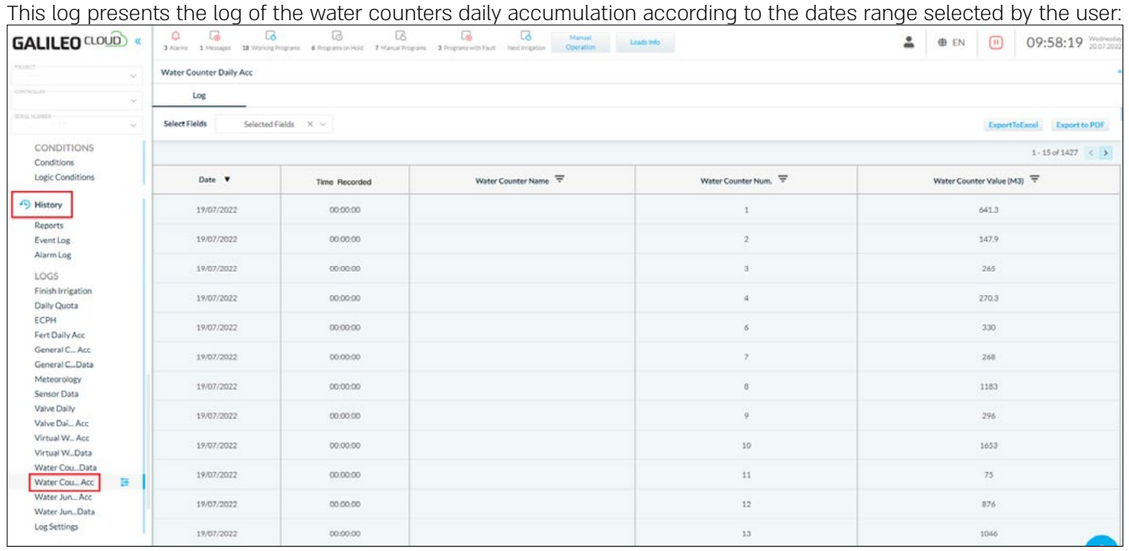
- Water Counter Name - the name of the Counter
- Water Counter Number - the number of the Counter
- Water Counter Value - the Reading of the Counter

The dates range of the information to be displayed on this log, can be selected by pressing the configuration icon located to the right of this log entry at the system's main menu.

The number of lines displayed can be selected on the upper right corner of the table.

Water Counter Daily Accumulation:

This log presents the log of the water counters daily accumulation according to the dates range selected by the user:



The user can select the data columns to be included in the table from a drop-down list at the upper left side of the screen:

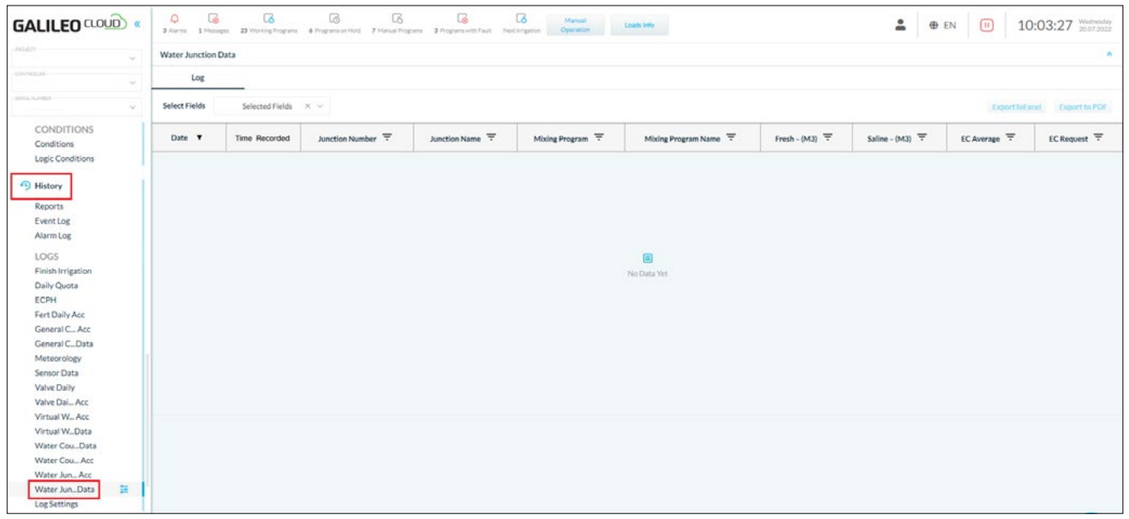
- Water Counter Name – the name of the Counter
- Water Counter Number – the number of the Counter
- Water Counter Value – the Reading of the Counter

The dates range of the information to be displayed on this log, can be selected by pressing the configuration icon located to the right of this log entry at the system's main menu.

The number of lines displayed can be selected on the upper right corner of the table.

Water Junction Data:

This log presents the log of the water Junctions data according to the dates range selected by the user:



The user can select the data columns to be included in the table from a drop-down list at the upper left side of the screen:

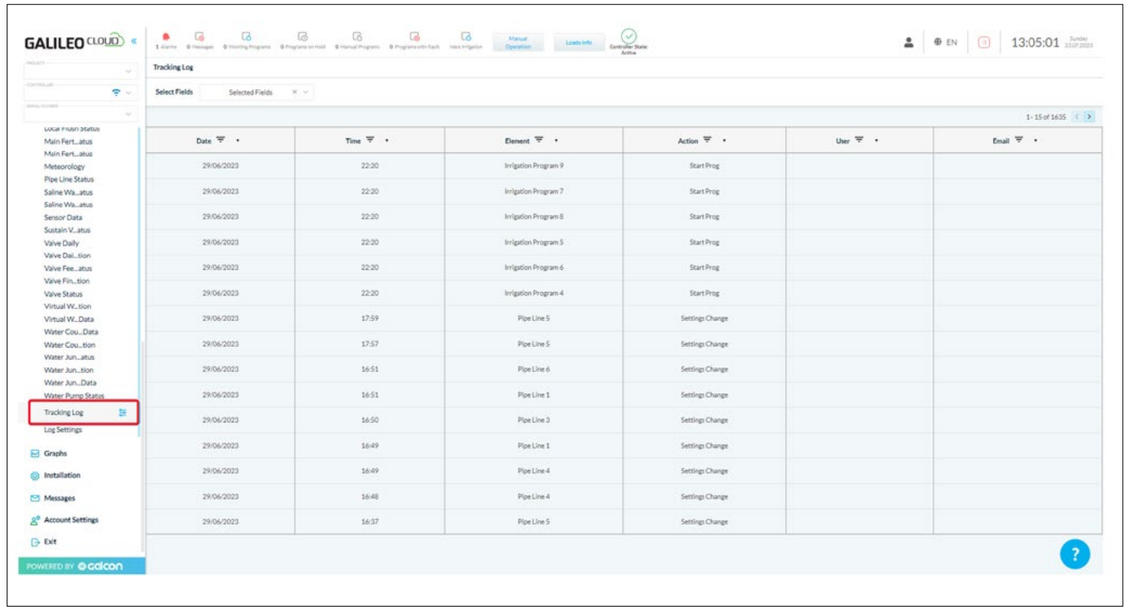
- Junction Number - the number of the Junction
- Junction Name - the name of the Junction
- Mixing Program - the Mixing Program Number
- Mixing Program Name - the Mixing Program Name
- Fresh - the Reading of the Fresh Water
- Saline - the reading of the Saline Water
- EC Average - the average reading of the EC sensor
- EC Request - the requested EC level

The dates range of the information to be displayed on this log, can be selected by pressing the configuration icon located to the right of this log entry at the system's main menu.

The number of lines displayed can be selected on the upper right corner of the table.

Tracking Log:

This log allows the user to track, within a time frame, all the activities done by a system element:



The log presents the Date, Time, The Element, the Action done, The User who performed the Action, and the user's e-mail address.

The filters on the headlines of this screen columns enable the user to select the required element, the action done and the user who done this action.

The possible elements and actions to be tracked by this log are presented in the following table:

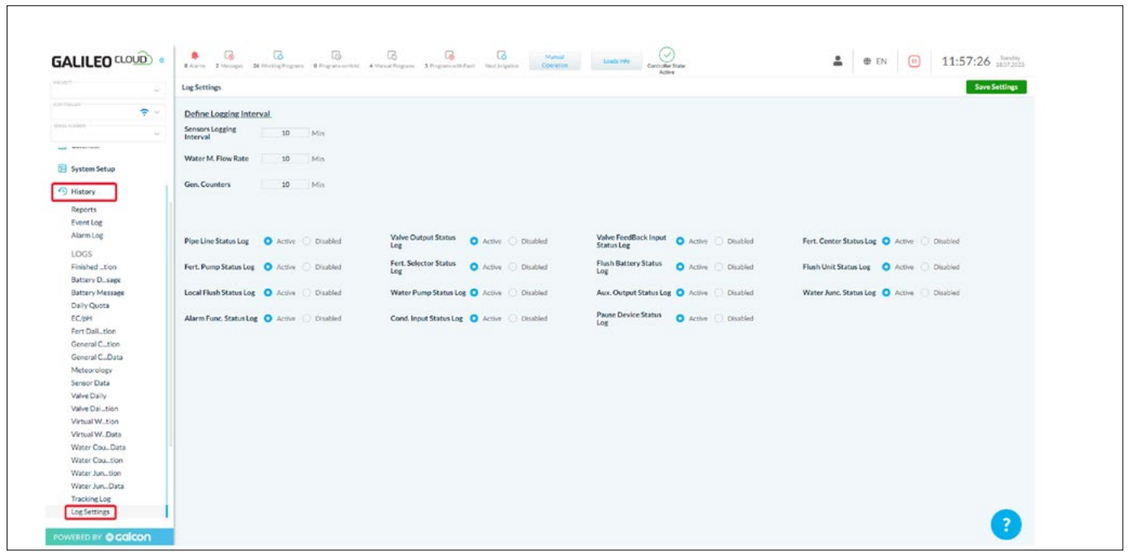
Element	Action
Irrigation program	Active/Inactive
Controler	
Logic condition	
Irrigation Sequence	
Irrigation program	Manual Operation (Open/Close)
Valve	
Fertilizer Pumo	
Filter	
Irrigation Sequence	
Water Meter	Setting Change
Fert Pump	
Filter	
Irrigation Program	
Analof Sensor	
Logic condition	
All comuncation operations provided remotely	
Valve	
Valve group	
Virtual water meter	
Pipeline	
Plots	
Pumpa	
Pump House	
Fert Center	
Sensor Group	
Irrigation Sequence	

The log presents the following elements' types:

- Active\Inactive of the irrigation programs, irrigation sequences, controller, and Logic conditions.
- Manual Operations of the irrigation programs, the irrigation sequence valves, the fertilizer pumps, and the filters.
- Every change in the settings of water meters, fert pumps, filters, irrigation programs, irrigation sequences, analog sensors, logic conditions, remote communication operations such as, valves, valve groups, virtual water meters, pipelines, plots, pumps, pumping stations, fert centers, and sensor groups.

Log Settings:

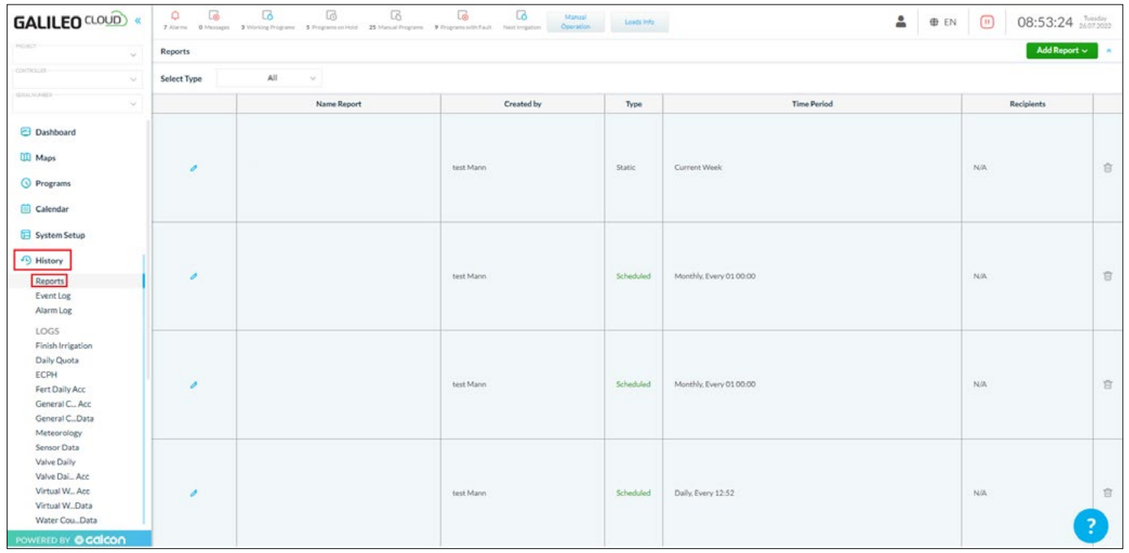
In the Screen the user can define the logging interval time of the controller's elements:



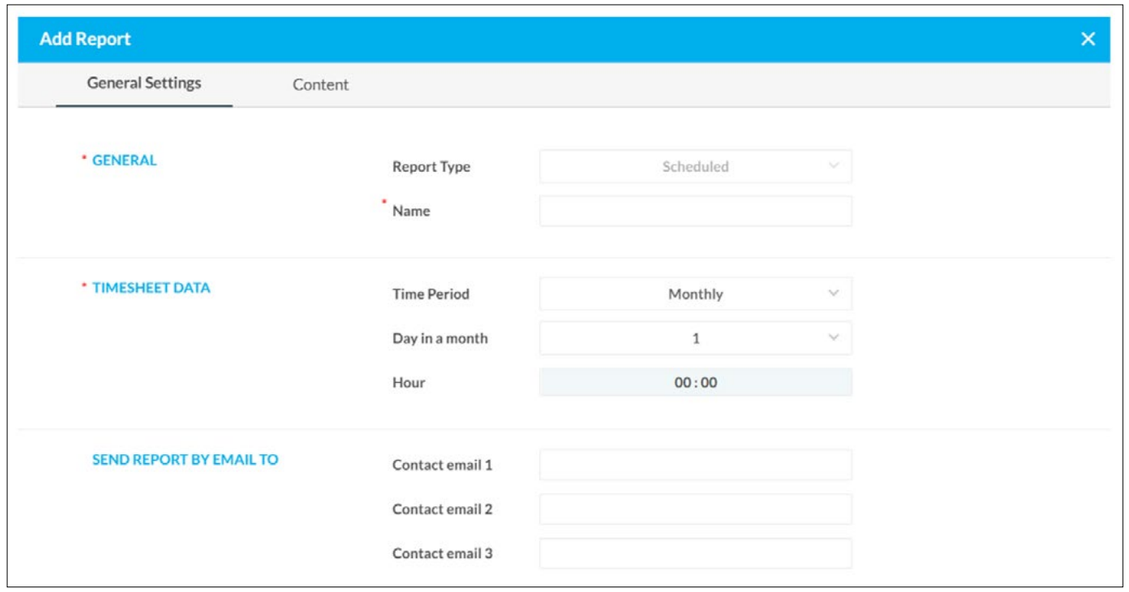
- Sensors Logging Interval – enter the required interval for logging the system's sensors.
- Water Meters Flow Rate – enter the required interval for logging the flow-rates of the system's flow meters.
- General Counters – enter the required interval for logging the readings of the system's General counters.

M.5. Reports

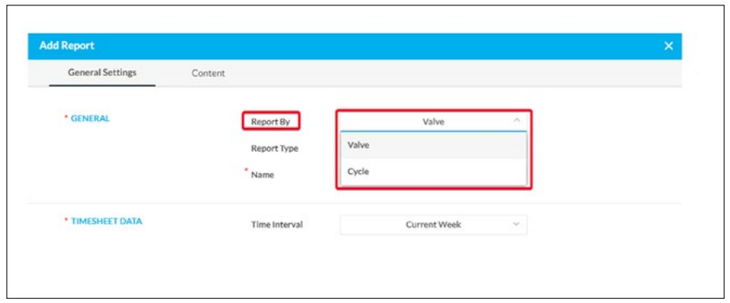
The reports screen enables the user to configure reports based on valves data by days range.



For configuring a new report click on the "Add Report" button.

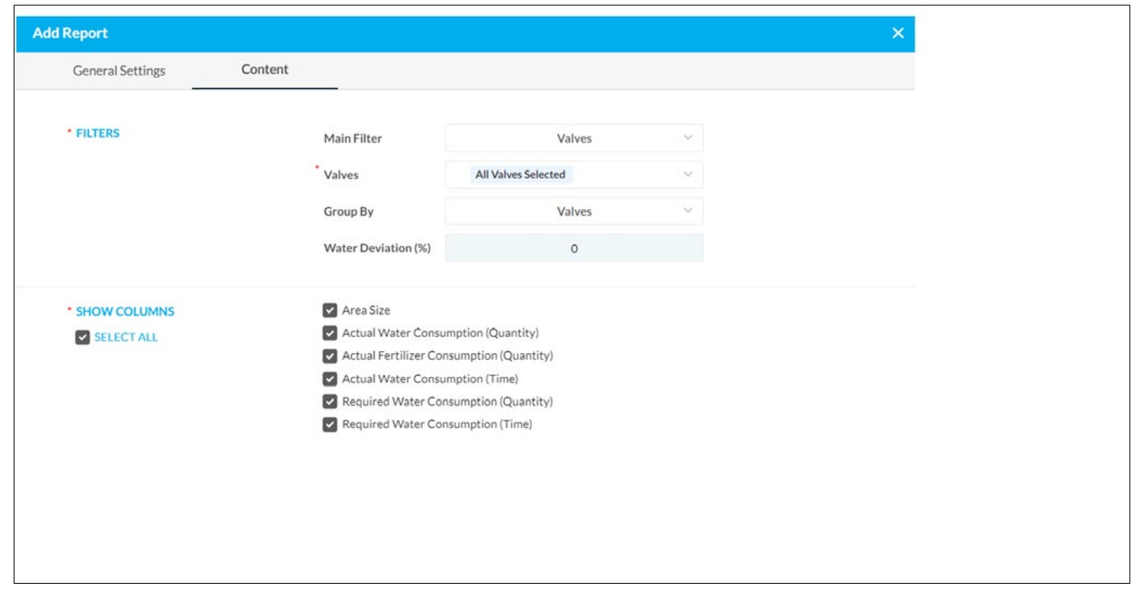


- General – select the report type and set a name for it, the options are: Valve – report by valve's data, and Cycle – report by Valve's Cycles data.

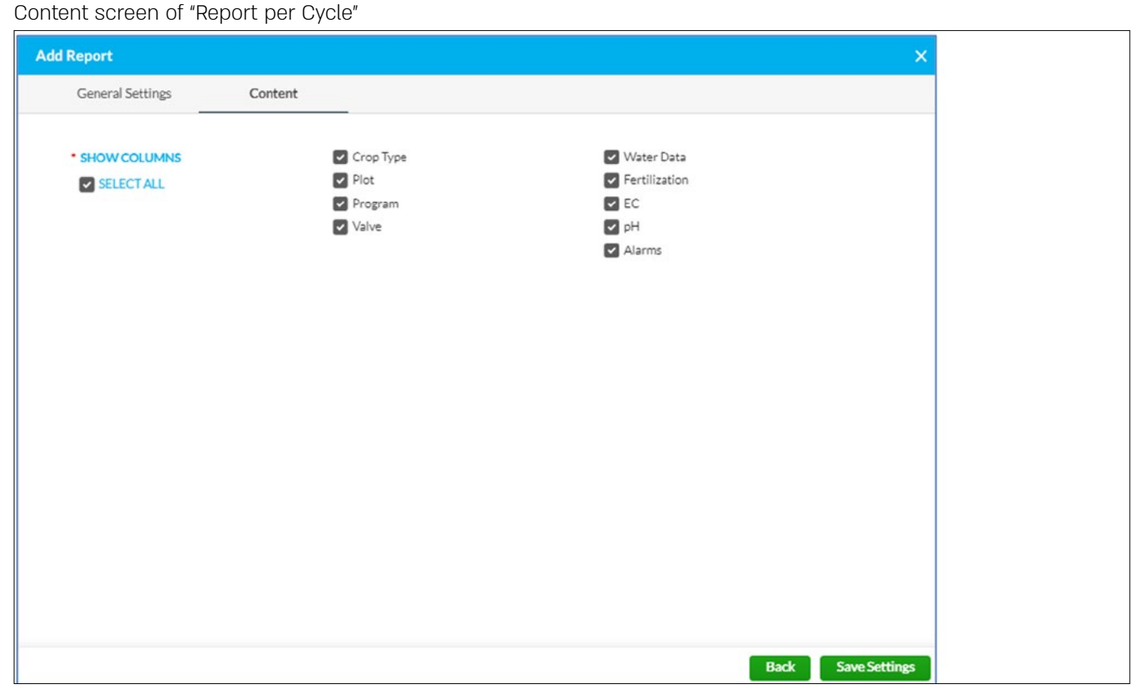


-
- Timesheet Data – this section of the new report generation screen enables the user to set a time interval for the report to be generated, e.g., every week, every Wednesday, at 11:25 hour.
- Send Report by E-mail – the user can enter up to 3 e-mail addresses for the report to be sent to.
- Press Next – the following "Main Filter" screen appears

Content screen of "Report pr Valve".



Content screen of "Report per Cycle"



The "Main Filter" selection list enables the user to select the main subject of the report:

- When selecting "Valves" in the first selection list, then the second selection list displays the valves that can be selected.
- When selecting "Plots" in the first selection list, then the second selection list displays the plots that can be selected. In this case the generated report includes the selected plots together with their designated valves.

- When selecting "Pipe Lines" in the first selection list, then the second selection list displays the pipe lines that can be selected. In this case the generated report includes the selected pipe lines together with their designated valves.
- When selecting "Crops" in the first selection list, then the second selection list displays the crops that can be selected. In this case the generated report includes the selected crops together with their designated valves.

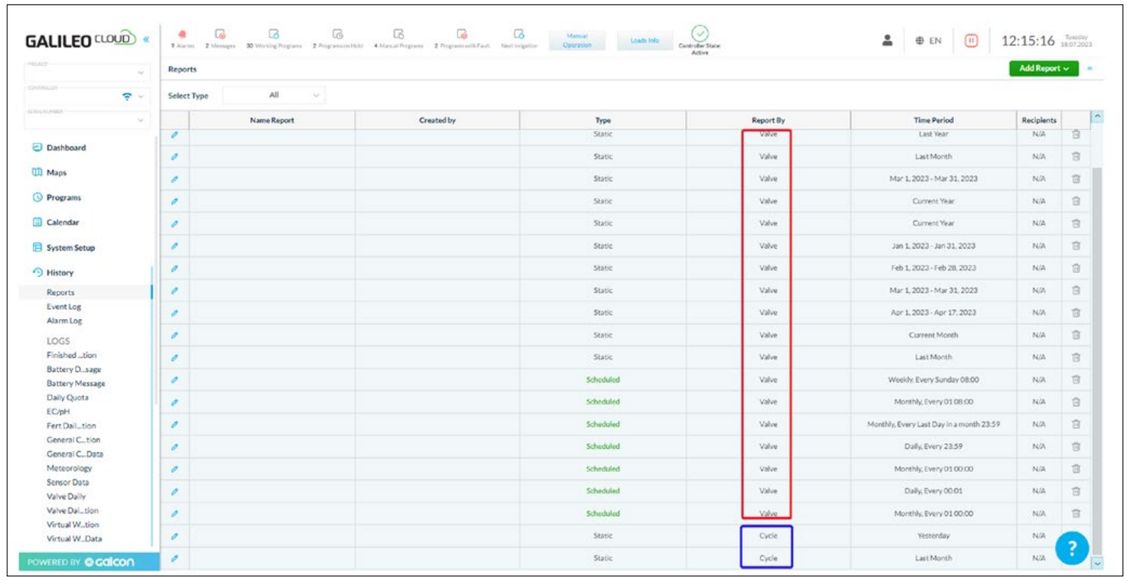
The "Group by" selection list enables the user to group the valves in the report according to the "groped by" selection.

The "Water Difference" parameter enables the user to set a difference between the planed and the actually done water application so when this difference exceeds, its data appears in red in the report and the chart.

The second part of the report configuration screen enables the use to select the columns to be displayed in the report.

Save the settings of the new report, close the filter window and return to the reports list screen.

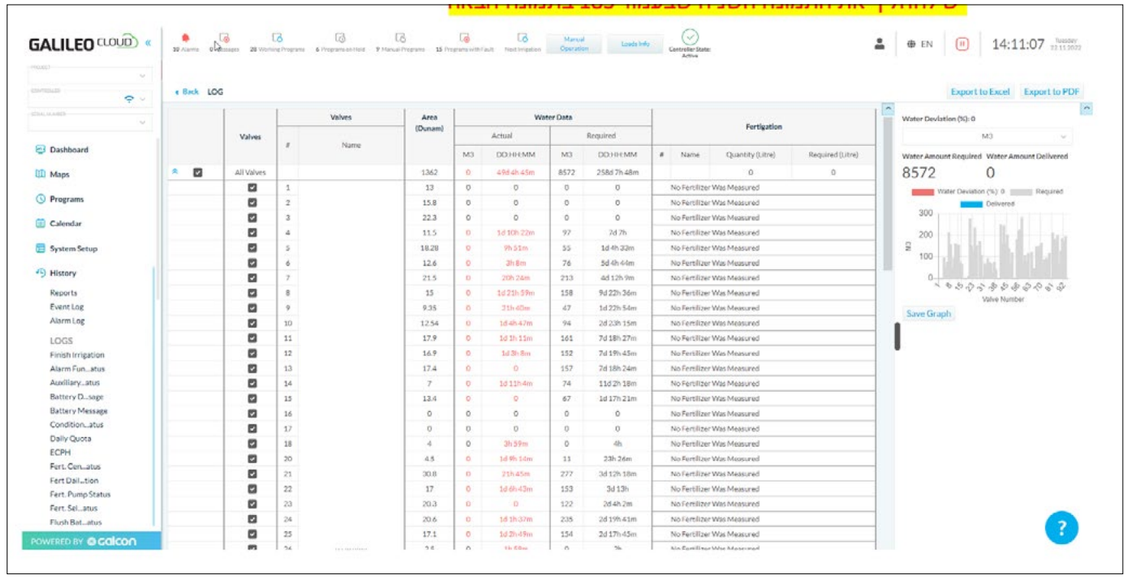
From the reports list select the report to be opened:



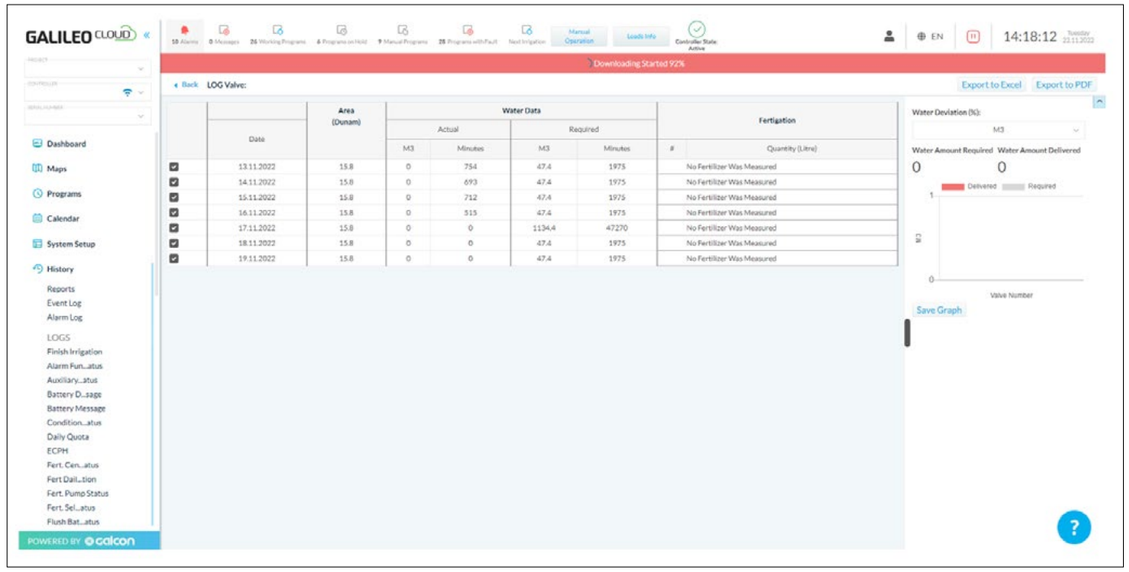
Depend by the report type, the system displays the following screens:

Reports by Valve type:

This screen shows the summary of all the valves of the selected report. For showing all the report's valve click on the arrow at the first column of the report, the following screen appears:



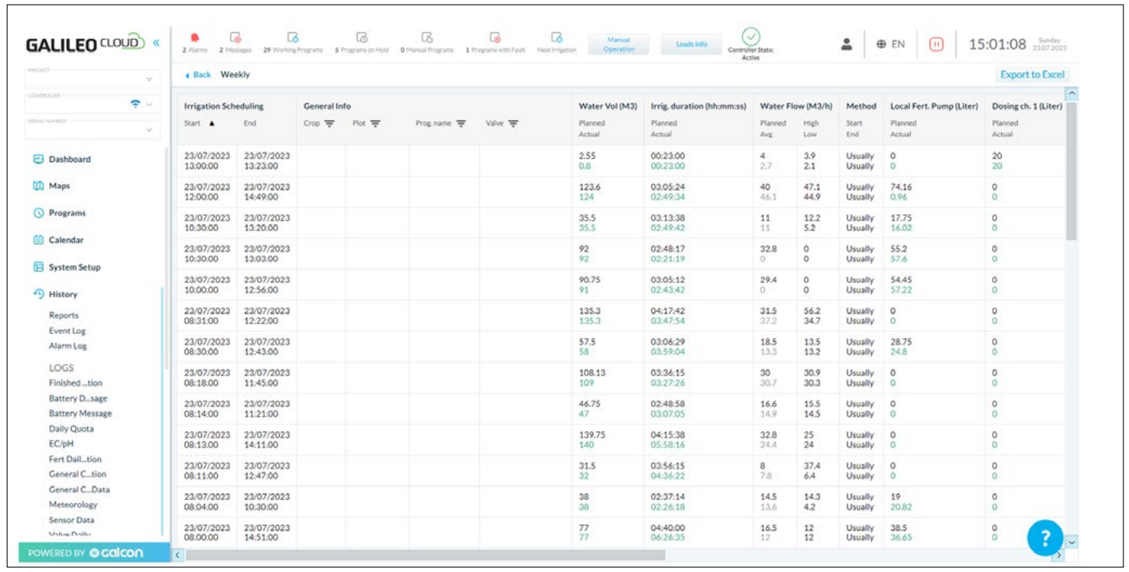
When clicking on a valve's row in the table the system display's a detailed report for the selected valve:



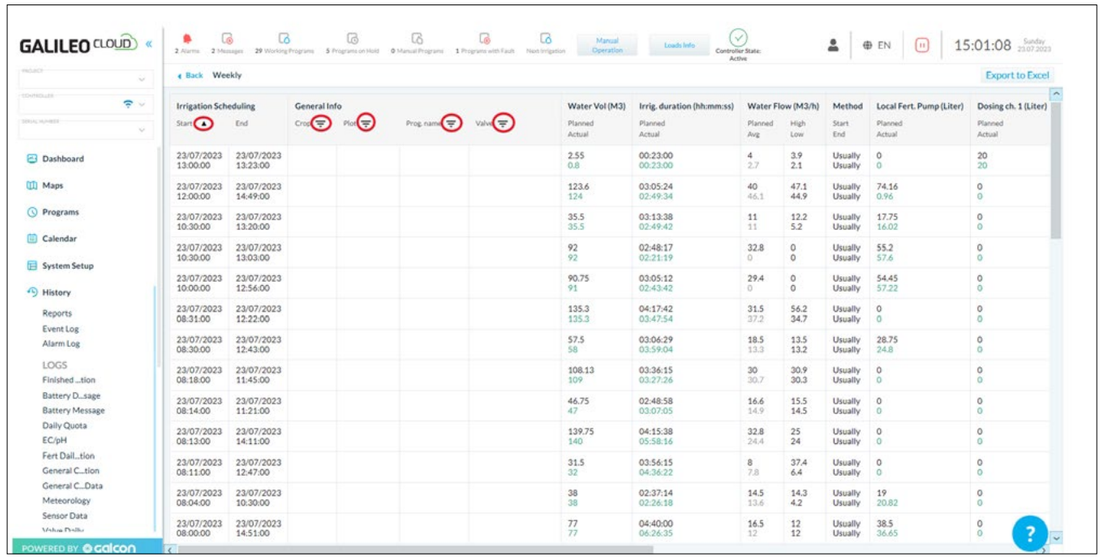
The reports and the charts can be exported to files in standard file format.

Reports by Cycle:

This screen shows the valve's data according to its irrigation cycles:



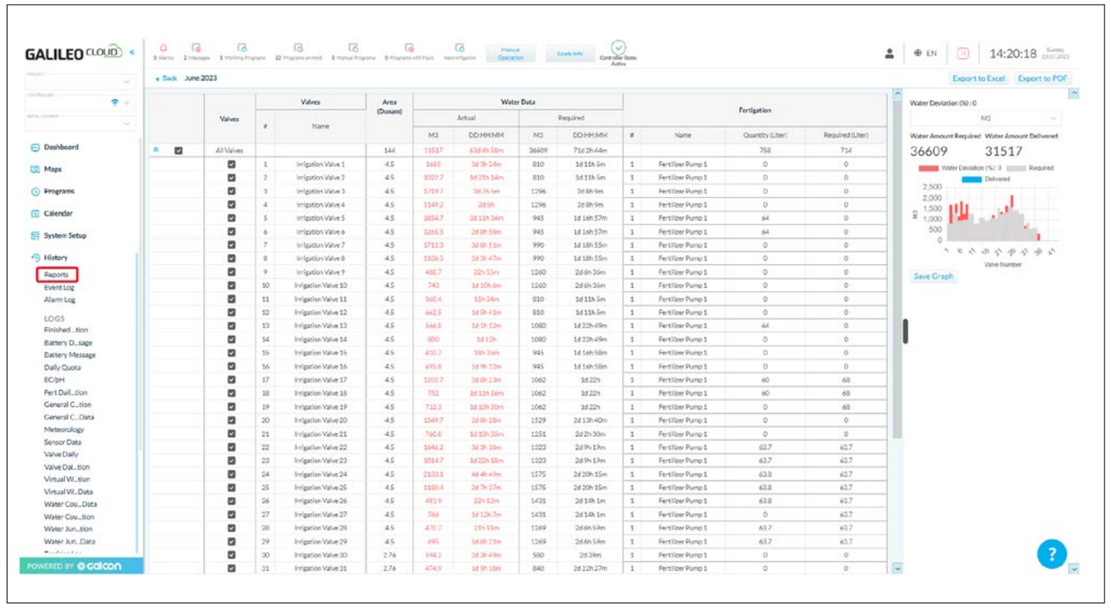
The user can sort the data according to the filters shown on the headline of each column as depicted in the following example



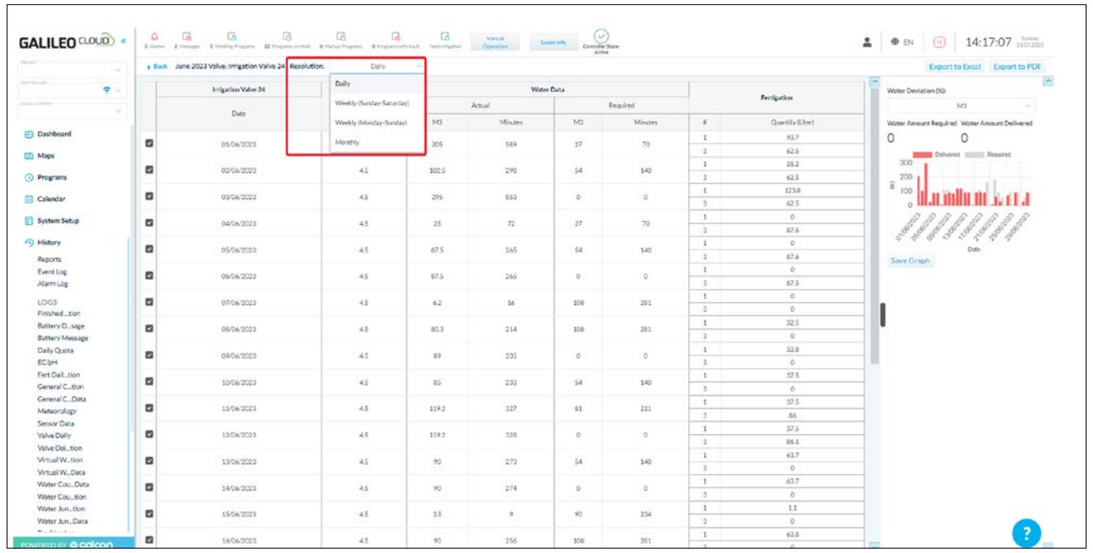
Setting the report's display and export resolution:

Note that this feature is available for Valves reports only (not valid for cycle type reports)

When a valve report is displayed, the user may click on a valve to open its detailed screen.



At the detailed screen at the upper line the user may set the required Resolution. The options are: Daily, Weekly (Sunday – Saturday), Weekly (Monday – Sunday), and Monthly.



The export feature of this report exports the report as set by the selected resolution.

M.6. Event Log

Important Note regarding Modem operation messages: The usage of the communication device between the controller and the Galileo server is prioritized, the first option is a cable connection to the Internet, the second option is WIFI connection and the last option is Cellular Modem. The system switches automatically between these options according to their availability, in case a cellular modem exists in the controller and no other communication can be established the cellular modem enters into action and corresponding messages are sent to the events log. At the very beginning of the modem initialization process the modem reads the cellular signal level and send the reading to the events log (from -1 to 100 where 100 is the strongest signal and -1 is reading error). From time to time during the modem operation the signal strength level is also sent to the events log.

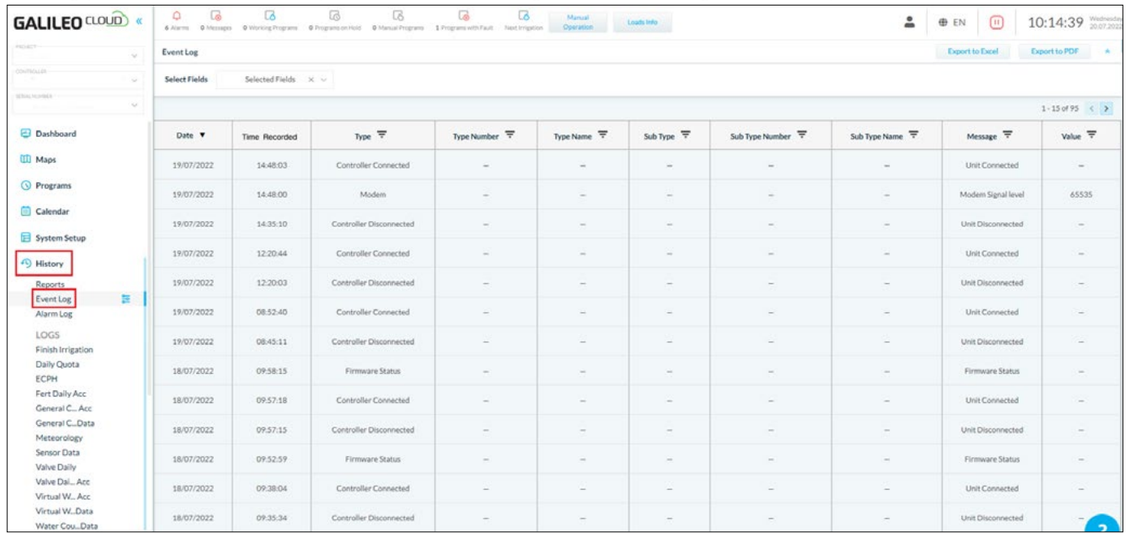
The following table lists all the possible system messages that can appear in the Events log:

Please note that the following table lists only the Type, Sub Type, and the Message columns of the Event Log screen, for the other columns (such as Date, Time, Value, etc.) please refer to the full description of the event log screen.

Type	Sub-type	Message	Remarks
Irrigation Program		Fertilizing Started	The irrigation program started fertigating
Irrigation Program		Fertilizing Stopped	The irrigation program stopped fertigating
Irrigation Program		Irrigation Started	The irrigation program started irrigating
Irrigation Program	Valve	Finished	The valve finished irrigating in this program
Irrigation Program		Priority Delay	The irrigation program entered to Priority Delay mode
Irrigation Program		Stopped Manually	The irrigation program was stopped manually
Irrigation Program		Irrigation Cycle Canceled	The irrigation cycle was canceled
Irrigation Program		Stop Condition	The irrigation program was stopped by a Stop condition
Irrigation Program		End Operation Condition	The operation of the irrigation program was stopped due to an End Operation Condition.
Irrigation Program		Irrigation End Time	The irrigation program ended due to End Time parameter
Irrigation Program		Programming while irrigating	The irrigation program stopped because the user started programming it while it was irrigating
Flush Battery		Cycle Started	The filtration battery started a flushing cycle
Flush Battery		Cycle Ended	The flushing cycle of the filtration battery ended
Local Filter		Cycle Started	The local filter started a flushing cycle
Local Filter		Cycle Ended	The flushing cycle of the local filter ended
Logic Condition		Off to On	The logic condition was switched from Off to ON
Logic Condition		On to Off	The logic condition was switched from On to Off
Auto Cancel Alarm		Auto Cancel Alarm	The automatic cancel alarm was activated
Test Mode Started			
Modem		Modem Signal Level	The current reading of the modem's signal level
Test Mode Started			The user started the hardware outputs test mode
Test Mode Ended			The hardware outputs test mode was ended
Output Opened in Test mode			The output was opened in test mode
Output Closed in Test mode			The output was closed in test mode
Irrigation Program		Paused-Flow limit	The irrigation program is paused by flow-rate limit

Type	Sub-type	Message	Remarks
Irrigation Program		Paused by Time	The irrigation program is paused by pause time schedule
Irrigation Program		Limited Pause	The irrigation program is paused by predefined pause length
Irrigation Program		Paused Manually	The irrigation program is paused manually
Irrigation Program		Paused by Plot	The irrigation program is paused by the plot
Irrigation Program		Paused by Pipe	The irrigation program is paused by the pipeline
Irrigation Program		Paus.by Prog. Cond.	The irrigation program is paused by its internal pause program
Irrigation Program		Paus.by Logic Cond.	The irrigation program is paused by a logic condition
Irrigation Program		Fault by Logic Cond.	The irrigation program entered to fault by a logic condition
Irrigation Program		Pause by Pipe Flow	The irrigation program is paused by the pipeline flow-rate limit
Irrigation Program		Pause by Priority	The irrigation program is paused by a higher priority program
Irrigation Program		Pause by Sequence	The irrigation program is paused by another irrigation sequence
Irrigation Program		Pause by Counter	The irrigation program is paused by a water meter
Irrigation Program		Pause by Frt. Pump	The irrigation program is paused by a fertilizer pump
Irrigation Program		Pause by Frt. Counter	The irrigation program is paused by a fertilizer counter
Irrigation Program		Pause by Valve	The irrigation program is paused by a valve
Irrigation Program		Pause by Fert. Prog	The irrigation program is paused by a fertilizing program
Irrigation Program		Pause by Time Range	The irrigation program is paused by a time range schedule
Irrigation Program		Paus.by Flw. Limit	The irrigation program is paused by a flow-rate limit
Irrigation Program		Paus.by Mix. Prog	The irrigation program is paused by a mixing junction program
Controller Connected			The controller was connected to the communication network
Controller Disconnected			The controller was disconnected from the communication network
Firmware Status			The status of the controller's firmware updating process
Connection Type		LAN \ Wi Fi \ Modem	This event will appear whenever the controller reconnefts

This log presents the list of the system events according to the dates range selected by the user:



The user can select the data columns to be included in the table from a drop-down list at the upper left side of the screen:

- Type - the type of the event
- Type Number - the type number of the event
- Type Name - the type name
- Sub Type - the sub type of the event
- Sub Type Number - the sub type number of the event
- Sub Type Name - the sub type name
- Message - the message text
- Value - the value of the event

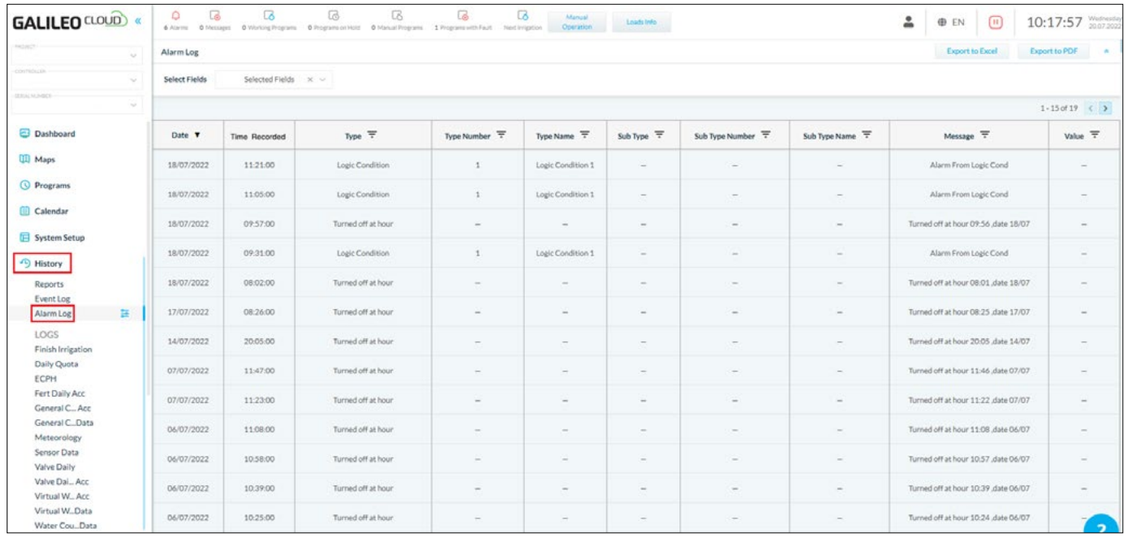
The dates range of the information to be displayed on this log, can be selected by pressing the configuration icon located to the right of this log entry at the system's main menu.

The number of lines displayed can be selected on the upper right corner of the table.

Please note that the columns can be filtered according to the selection icons next to each column headline.

M.7. Alarm Log

This log presents the list of the system Alarms according to the dates range selected by the user:



The user can select the data columns to be included in the table from a drop-down list at the upper left side of the screen:

- Type Name - the type name of the alarm
- Sub Type - the sub type of the alarm
- Sub Type Number - the sub type number of the alarm
- Message - the message text
- Value - the value of the alarm

The dates range of the information to be displayed on this log, can be selected by pressing the configuration icon located to the right of this log entry at the system's main menu.

The number of lines displayed can be selected on the upper right corner of the table.

Please note that the columns can be filtered according to the selection icons next to each column headline.

Please note that the following table lists only the Type, Sub Type, and the Message columns of the Alarm Log screen, for the other columns (such as Date, Time, Value, etc.) please refer to the full description of the alarm log screen.

Type	Sub-type	Message	Remarks
Fertilizer		Uncontrolled	The fertilizer pump is in uncontrolled fertilizer Alarm
Fertilizer		No Pulse	The fertilizer pump is not receiving pulses from its meter
Fertilizer		Flow Failure	The fertilizer pump is in fertilizer flow-rate alarm
Fertilizer Center	Fert. Program	EC Alarm	The fertilizing program of the Fertilizer Center is in EC Alarm mode
Fertilizer Center	Fert. Program	pH Alarm	The fertilizing program of the Fertilizer Center is in pH alarm
Fertilizer Center	Fert. Program	EC / pH Extreme	The fertilizing program of the Fertilizer Center is in extreme EC or pH fault
Irrigation Program		No Water Pulse	The irrigation program is in No Water Pulse alarm
Irrigation Program		Flow	The irrigation program is in Flow-rate alarm

Type	Sub-type	Message	Remarks
Irrigation Program		Fertilizer Fault	The irrigation program is in Fertilizer fault
Irrigation Program		Fert. Not Finished	The irrigation program did not finish fertilizing alarm (the value column displays the amount of delivered fertilizer)
Irrigation Program	Valve	Fault	The valve finished irrigating in fault in this irrigation program
Flush Battery		Continuous Flush	The filtration battery is in Continuous flushing alarm
Burst Protection		Fault	The system's burst protection is activated (fault mode)
Water Meter		Uncontrolled	The water meter is in uncontrolled water fault
Water Meter		No Water Pulse	The water meter is not receiving pulses
Local Filter		Continuous Flush	The local filter is in Continuous flushing alarm
Pause Element		Activated by its condition input	The pause element was activated by its hardware condition input
Pause Element		Activated by Low Sensor Value	The pause element was activated by a low reading of its sensor
Pause Element		Activated by High Sensor Value	The pause element was activated by a high reading of its sensor
Pipe Line		Uncontrolled Water	The pipeline entered to fault due to uncontrolled water
Mixing Junction	Water mixing program	EC Fault	The program of the mixing junction is in fault due to EC fault
Mixing Junction	Water Source	No water pulse	The mixing junction is in fault due to no pulses received from its water source
Mixing Junction	Water Source	Uncontrolled water	The mixing junction is in fault due to uncontrolled water in its water source
Mixing Junction	Water Source	Restart for Calibration	The operation of the mixing junction is recalibrated
Sensor		Sensor Value Alarm	The sensor value is out of range alarm
Low Battery Fault		Low Battery Fault	The level of the controller's battery is too low
Low Battery to Pause		Low Battery to Pause	The controller's operation was paused due to low battery level
Battery OK		Battery OK	The level of the controller's battery is OK
RTU		RTU Disconnected	The RTU was disconnected
RTU		Connected / Fixed	The RTU was reconnected or Fixed
I/O Card		Failure	The I/O card is faulty
RTU		Low Battery	The level of the RTU battery is low
RTU		Battery OK	The level of the RTU battery is OK
Double output Definition Error		Double output Definition Error	The same hardware output number is assigned to two different elements
Memory Fault		Memory Fault	The controller's memory is faulty
Turned off at hour		Time / Date	The controller was switched off
Water Pump		Failure	The water pump is faulty

Type	Sub-type	Message	Remarks
Logic Condition		Alarm From Logic Condition	The logic condition alarm was activated
Irrigation Program		Time/Quant Limit	The irrigation program reached its water quota limit
Valve		Season Quant Limit	The valve reached its seasonal daily water quota limit
Irrigation Program		Passed Over Cycle	The program did not finish its cycles
Double input Definition Error		Double input Definition Error	The same hardware input number is assigned to two different elements
Comm. Variable		Alarm From Comm. Variable index	Alarm is received from another controller via the communication network
Over Quota		Over Quota	Controller alarm that the daily water quota was exceeded
Valve		Off-Feedback On	The valve's opened signal not received alarm
Valve		Off-Feedback Off	The valve's opened signal disconnected alarm
Communication to the server Fault			The controller is disconnected from the communication system for more than 30 minutes

M.8. Graphs

This screen presents charts based on the accumulated sensors data according to the dates range selected by the user:

The user can select the data to be included in the chart table from three drop-down lists at the upper left side of the screen:

- Time period - 3, 5, 7, or custom number of days
- Time range - the range of the chart
- Choose Sensors - select the sensors to be displayed on the chart

Important note: - when selecting a graph of a "Last Day" type, or selecting a single date at the custom range, the system does not show elements that appear only once a day. Only elements that has more than a single data point in that day can be selected to be displayed on the graph.

New graphs cannot be generated in this screen; Generate and edit graphs at the Sensors -> Sensors Graphs entry of the system's main menu.

It is possible to add a remark to be always displayed on the graph in this date.

Zooming into a required area is done by selecting it, exiting the zooming is done by clicking on the "Reset Zoom" button.

Adding engineering units of sensors to the graph can be done by assigning engineering units to the Sensors tab at the Sensors main menu entry.

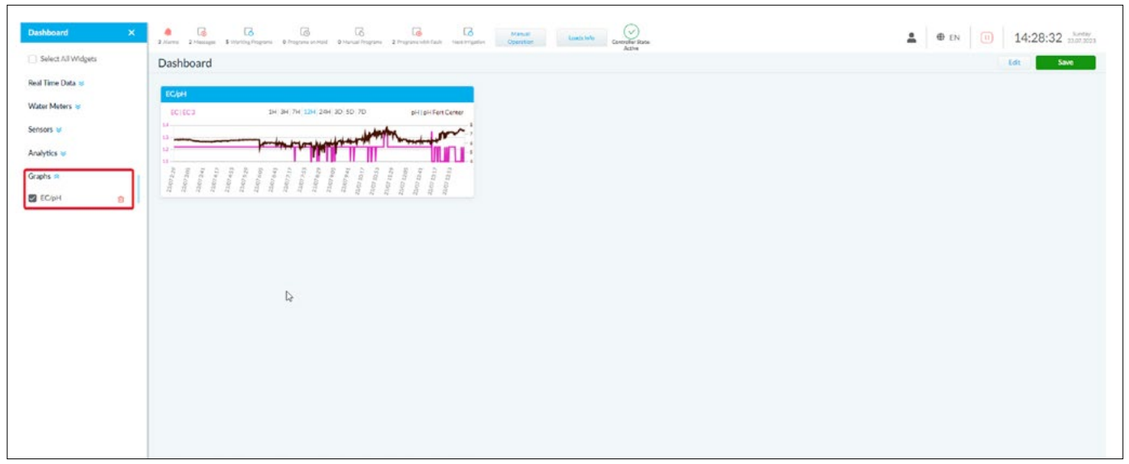
Advanced Option after creating a Graph:

Adding a Graph as a widget to the dashboard screen:

While creating a graph, the user can save it also as a Dashboard's Widget.

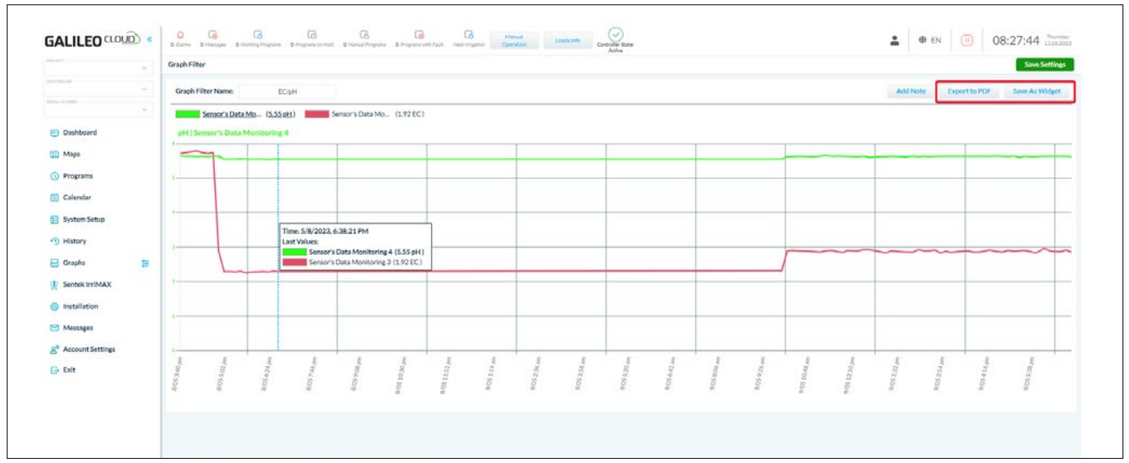
At the Real Time Data entry of the Galileo main menu select the option Graphs and select the required graph.

The graph will be added to the dashboard as a widget



Very Important:

- In order to save a graph as a widget, the graph should have no more than two parameters (two data lines).



- As seen in picture above, the time span of the widget can be selected in the widget itself, the options are: 1 hour, 3 hours, 7 hours, 12 hours, 1 day, 3 days, 5 days, and 7 days.
- The graph can be also exported as a PDF file.

N. Maintenance

O.1. Upgrading the Galileo Controller - FOTA

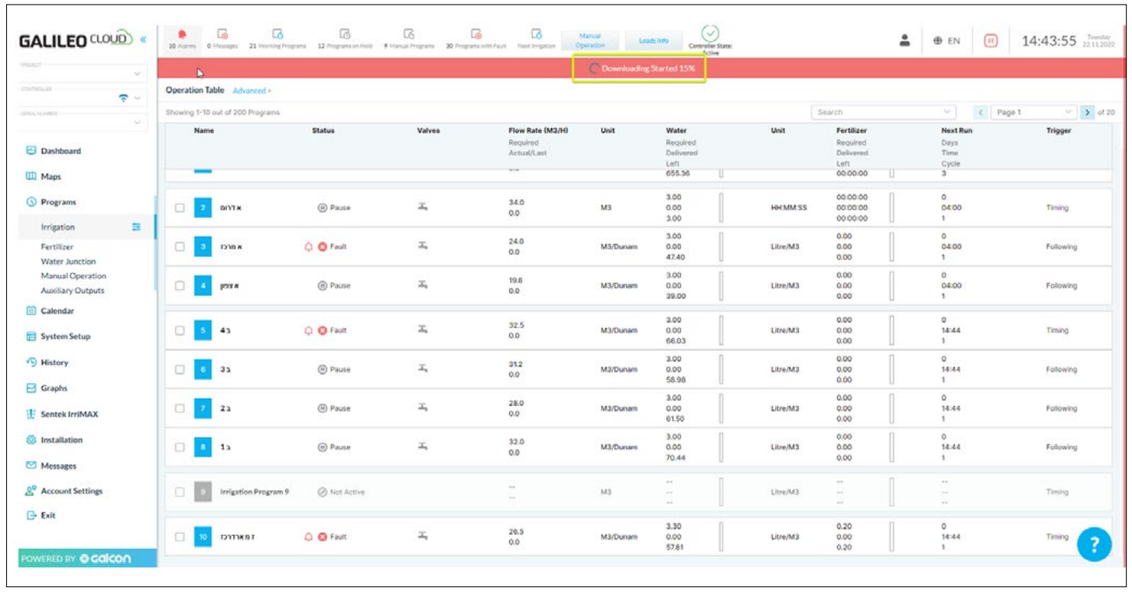
The Galileo system has a built-in upgrading mechanism for upgrading the software of the Galileo Controllers; this FOTA (Firmware Over The Air) feature is automatically controlled by the system. Upon accessing the system, if a new software version is available the user gets the following message:

The user may reject the upgrading process to a later time, or activate the upgrading process. In case the user prefers not to upgrade the controller at this time, the system will notify him again at any new day entry to the Galileo system. At the beginning of the upgrade process the user has to accept the "Upgrading Terms" document that is displayed on the screen, by reading it and clicking on the appropriate button at its end.

During the upgrading process the screen display the following message:

Please make sure to act according to the following important points:

- The upgrading process takes about 30 minutes to complete.
- The upgrading process should be done per each controller separately. In a system that contains several controllers, the user should enter each one of the controllers in order to upgrade it.
- During the upgrading process of a controller the system set it to pause mode. The irrigation programs cannot operate during the upgrading process; therefore, the user has to make sure to activate the upgrading process when no irrigation program is running.



- The Upgrading process takes about 30 minutes to complete; the system displays the progress of the downloading by showing the downloaded percentage.
- Make sure not to activate any manual operation during the upgrading process of the controller.

Annex A. - Connecting the Galileo Controller to the communication Network

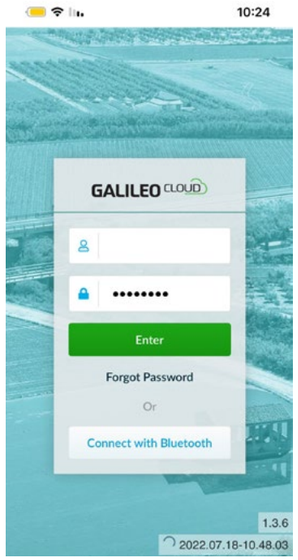
In order for the Galileo controller to connect to the Galileo communication system, and to allow the users to communicate with it through the Galileo Cloud web site, the user (or the installation technician) should configure the correct communication parameters in the controller upon the first initialization process of the controller (brand new controller, or controller after a total reset process).

The hardware of the Galileo Controller has built-in 5 communication devices: Bluetooth, Cable TCP connection, Serial connection, WIFI, and Cellular modem.

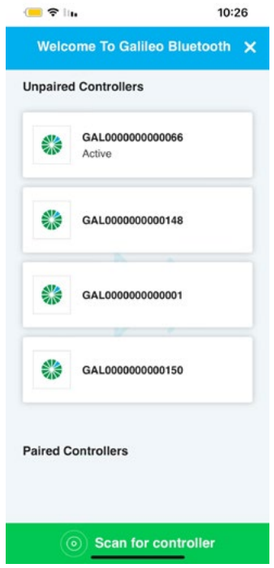
Important Note: Once configured, the usage of a communication device between the controller and the Galileo server is according to the following priority: the first option is a cable connection to the Internet, the second option is WIFI connection, the third option is the Serial connection port, and the last option is the Cellular Modem. The system switches automatically between these options according to their availability, in case a cellular modem exists in the controller and no other communication can be established, the cellular modem enters into action and corresponding messages are sent to the events log.

The Bluetooth communication option is used for configuring the Galileo controller before it can be connected to the web site. Note that once the controller appears in the web site it is possible to change or amend the communication parameters through the Basic Communication Setting screen. For connecting the Galileo controller to the Galileo Application via Bluetooth, please perform the following steps after the installation of the Application in your smartphone (or another compatible device):

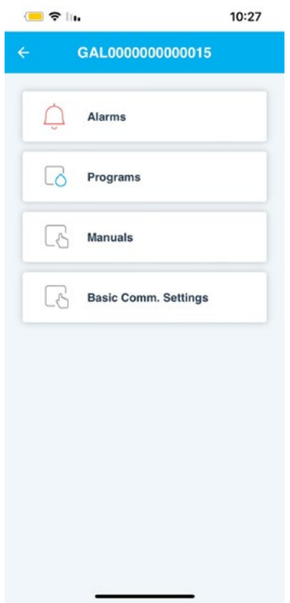
1. Make sure that the Bluetooth communication of your device is active.
2. The Galileo Application has a Location Sharing and Bluetooth connection permits.
3. Start the application and click on the "Connect with Bluetooth" option at the login screen.



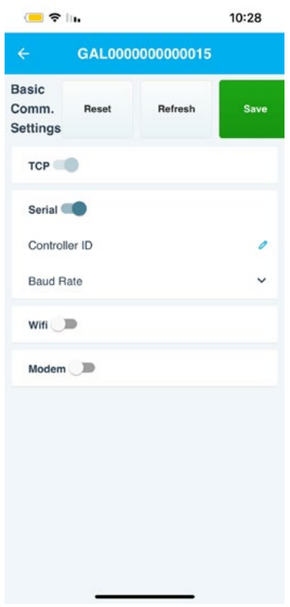
4. Wait for the "Unpaired Controller" screen and look for the required controller, if the required controller doesn't appear click on the Scan for Controller" button.



5. Once the required controller appears, click on its mane for pairing with it, and opening its main menu screen.

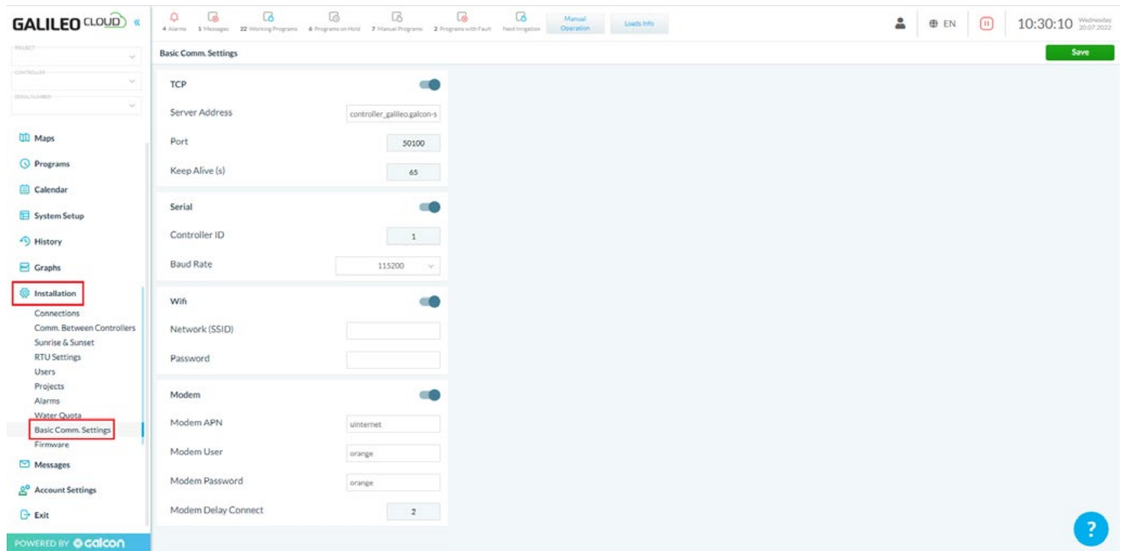


6. Enter to the Basic Communication Settings screen.



7. Click on the pencil icon next to each configuration parameter and enter its details as received from your dealer.

Note that the same screen appears under the "Basic Communication Settings" menu-entry of the Galileo Cloud web screen, however it is not possible to enter that screen before configuring the communication to this controller via the Bluetooth application.



The upper option box is used for configuring the TCP Cable connection to the Internet: Enable the option, and set the server's name and port number as received from your Galcon's dealer. The Keep Alive (s) parameter should be set to 65 seconds.

The second option is the Serial Connection: this option is used for connecting the Galileo controller via a serial cable to a serial port of a local PC computer that provides Internet access. In such case enable the Serial option, enter the Controller ID number (found also in the upper parameter of the General Settings screen of the Galileo Setup -> Connections entry, and set the PC computer's serial port Baud Rate.

The third option is the WIFI connection, use the hot-spot SSID Name and Password to connect the Galileo Controller to the Internet. In this case make sure to also set the TCP parameters on the upper option box.

The last option is the Cellular modem connection: in such case an appropriate SIM card should be purchased from a local Cellular Communication provider (for Data communication). The parameters for this option should be obtained from the cellular communication provider. Remember that the system automatically uses the modem communication only when all the other options are not available or disconnected.

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