

OPERATING MANUAL

System for water and irrigation installations

hydroOne

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Legal notice

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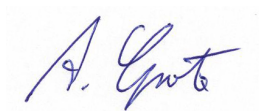
hydroOne

to which this declaration refers complies with the following directives and standards:

- Directive 2014/30/EU Electromagnetic Compatibility
- Directive 2014/35/EU Low Voltage Directive
 - EN61439 - Low-voltage switchgear and controlgear assemblies
- Directive 2011/65/EU and 2015/863/EU RoHS Directive

This declaration applies to all identical copies of the product. The declaration becomes invalid if any modification is made to the device or if it is improperly connected.

ANDO Technik GmbH - 01.06.2024



Andre Grote (Managing Director)

This declaration certifies compliance with the mentioned directives but does not guarantee specific properties. The safety instructions in the accompanying product documentation must be observed.

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1 Safety instructions

The following safety instructions apply generally to the installation, commissioning, operation, maintenance and modification of the *hydroOne* system. They do not replace the installation manual, the project-specific wiring diagram or the manufacturer's documentation for connected components.

1.1 Intended use

hydroOne is a control system for water, pumping, irrigation and dosing installations. The system may only be used in accordance with its intended function, the project-specific design, the wiring diagram and the information in this documentation.

Intended use includes, in particular:

- correct installation, wiring and commissioning,
- operation within the permissible electrical, hydraulic and mechanical limits,
- correct assignment and configuration of inputs and outputs,
- the use of suitable sensors and actuators,
- implementation of the protective measures required for the complete installation.

Any other use, or use beyond these limits, is considered improper. This applies in particular to the connection of unapproved voltages, overloading of outputs, operation in potentially explosive atmospheres or use as a safety-related control system.

1.2 Qualified personnel

Installation, electrical connection, commissioning, maintenance and modifications to the installation may only be carried out by suitably qualified personnel.

Work on electrical installations may only be carried out by qualified electricians or under their direction and supervision. Work on hydraulic or chemical parts of the installation may only be carried out by persons able to assess the associated hazards reliably.

Operation and configuration may only be carried out by persons familiar with the function of the installation concerned and the effects of the settings they make.

1.3 Not a safety device



hydroOne is not a safety-related control system and must not be used as an emergency stop device, a personnel protection device or the sole safety device.

Operating functions such as dry-running monitoring, MIN/MAX alarms, flow monitoring or automatic shutdown do not replace independent protective measures where a fault could endanger people, the environment or valuable property.

1.4 Electrical hazards

Depending on the version, a *hydroOne* control unit or a control cabinet based on *hydroOne* may contain 230 V AC, 400 V AC, 24 V AC, 24 V DC and hazardous DC-link voltages from frequency converters.



Touching live parts can cause serious or fatal injuries. Before starting work, disconnect the installation completely from all power supplies, secure it against reconnection and verify that no voltage is present.

Switching off via the display, software, enable contact or an internal circuit breaker does not replace safe isolation from the mains.

Even after the main supply has been switched off, external power supplies, active signals, other control systems or connected devices may introduce voltage into the control unit.



Before starting work, identify all internal and external voltage sources, switch them off and secure them against reconnection.

Frequency converters can retain hazardous voltages even after disconnection from the mains supply. Observe the discharge time specified on the device or in the manufacturer's documentation. Before starting work, use a measuring instrument to verify that no voltage is present.

The motor connection of a frequency converter must not be switched, disconnected or connected during operation.

1.5 Automatic restart



hydroOne can automatically start pumps, valves, agitators, dosing equipment and other peripherals. A start may occur, in particular, when power or an enable signal returns, when a fault clears, when an alarm is acknowledged, in response to a time or signal condition, or through remote access.

The system builder and operator must take suitable measures to ensure that an automatic or remotely initiated start does not cause a hazard.

Before working on connected components, reliably prevent automatic starts.

1.6 Hydraulic and mechanical hazards

Pumps and valves can build up pressure or cause water to escape in an uncontrolled manner. Pumps, valves, agitators, dosing pumps and other actuators may also start automatically or change position.



Before working on pipework, pumps, valves, measuring points or moving parts of the installation, switch off the installation, secure it against restarting and, where necessary, depressurise it completely.

The system builder is responsible for the design of pipework, fittings, pressure vessels and the necessary safety devices.

1.7 Configuration and operation

Settings may only be changed by persons familiar with the function of the installation and the effects of the parameters concerned.



Incorrect parameter settings can cause malfunctions, unintended starting, dry running, excessive pressure, insufficient supply or incorrect dosing.

Setpoints, limits, runtimes, enable signals, alarm functions and automatic programs must be matched to the specific installation. After making changes, check that the affected function operates correctly.

1.8 Dosing and chemicals

When dosing functions are used, fertilisers, acids, alkalis or other substances may be conveyed.



Incorrect wiring, configuration or flow measurement can cause uncontrolled dosing. Suitable measures must be taken to limit dosing. When there is no water flow, impermissible dosing must be prevented by the installation design and protective measures provided for this purpose.

Observe safety data sheets, personal protective equipment requirements, material compatibility, backflow prevention requirements and the regulations applicable to the substances used.

1.9 Remote access and cloud operation

When a cloud connection or VNC connection is enabled, the installation can be monitored and operated remotely.



Remote operation is only permitted if the state of the installation is known and it is ensured that starting or switching components on site will not cause a hazard.

Actions carried out remotely can have the same effects as operating the installation locally. The operator must therefore ensure that remote access is restricted to authorised persons.

Information on registration, the dashboard, remote access and alarm notifications via *UniCloud* can be found in Chapter 9.

1.10 Alarms and faults

Alarm and monitoring functions provide operational monitoring of the installation and are not safety-related functions unless expressly stated otherwise.



Do not acknowledge alarms without checking and eliminating their cause.

Depending on the configuration, the installation may restart automatically after a fault is acknowledged or clears. Before acknowledging a fault, therefore, ensure that operation can safely resume.

1.11 Maintenance, cleaning and servicing

Automatic functions must not become active unintentionally during maintenance, cleaning, adjustment or servicing.



Place the installation in a safe state before starting work.

Depending on the installation, this includes, in particular:

- switching off and securing all relevant power supplies,
- preventing automatic and remotely initiated starts,
- depressurising water-carrying pipes,
- securing moving parts,
- preventing unintended dosing,
- observing the discharge times of frequency converters.

1.12 Modifications and repairs

Unauthorised changes to hardware, wiring, protective devices or software can impair the safety, function and conformity of the control unit or the complete installation.

The following are not permitted, in particular:

- bypassing fuses, interlocks or enable signals,
- fitting fuses with a different rating,
- using undocumented connections,
- changing internal wiring without professional inspection and documentation,
- operating with a damaged or open enclosure outside permitted servicing activities.

Modifications must be documented and the affected functions must then be tested again.

1.13 Responsibility for the complete installation



Within their respective areas of responsibility, the system builder, installer and operator must carry out the required risk assessment, define suitable protective measures and establish or maintain the conditions for correct and safe operation of the complete installation.

The control, alarm and monitoring functions provided by *hydroOne* support operation of the installation but do not replace the safety design required for the complete installation.

1.14 Disposal

This product is subject to the Waste Electrical and Electronic Equipment Directive.



Do not dispose of the device with household waste.

Take it to a suitable collection point for electrical and electronic equipment.

2 Function overview

2.1 What is *hydroOne*?

hydroOne is an intelligent system for modern water and irrigation installations. It combines pump control, irrigation, dosing, water management, measurement acquisition, flow monitoring and alarm management on a common platform. This makes even complex installations straightforward to operate, efficient to run and flexible enough to adapt to changing requirements.

Whether for pressure boosting, level control, water blending, automatic irrigation or flow-proportional dosing, *hydroOne* combines the individual functions into an intelligent overall system. Pumps, valves, water meters, sensors and dosing units are coordinated centrally as a whole instead of working independently. This allows the system to identify current demand, control processes efficiently and reliably monitor important operating states.

Operation follows a consistent concept with a clear structure and a straightforward display of all relevant information. Individual names make the installation intuitive to operate. With the optional cloud connection, *hydroOne* becomes a connected control platform: process data is recorded automatically, important messages are reliably forwarded and the entire installation can be monitored and operated remotely at any time.

hydroOne is the smart and flexible solution for anyone wishing to control their water systems as well as centrally monitor, analyse and optimise them – locally and, when required, worldwide.

2.2 Pump modules

The pump modules in *hydroOne* control up to five water pumps with frequency converters efficiently and according to demand. The aim is constant pressure, a constant water level or a constant flow rate – automatically adjusted to the current demand of the installation. The pumps can operate together in one module or be divided between two independent pump modules, for example for two separate pressure boosting systems.

In addition to cascade speed control, *hydroOne* provides important protective and additional functions. These include dry-running protection, zero-flow shutdown, flow monitoring, pipe filling, setpoint switching, base load change in multi-pump operation and setpoints specified by irrigation programs. Pumps are therefore controlled and reliably monitored, protected against typical causes of damage and intelligently integrated into the overall system. The consistent *hydroOne* interface makes operation and monitoring straightforward.

2.3 Water meters

Water meters measure water volumes and provide current flow rates and consumption values centrally within the overall system. Up to eight water meters can be integrated – using pulse signals or analog 4–20 mA signals, depending on the version.

The measured values can be flexibly linked to pump, analog, irrigation and dosing modules. This allows pump module flow rates to be monitored, water blending to be controlled, irrigation volumes to be recorded for each valve and dosing to be controlled in proportion to the current water flow.

With the optional cloud connection, total water volumes can also be recorded and analysed retrospectively.

2.4 Analog modules

Analog modules acquire and monitor analog sensor signals within the installation. Up to four independent analog modules can evaluate measurements such as pressure, level, flow, moisture or other process variables from 0–20 mA or 4–20 mA sensors and provide these for display and water management throughout the system.

The measured values can be used to generate alarms and status signals and to control outputs. This enables tank refilling, level monitoring and switching functions to be derived directly from the measurements.

The status signals generated by the analog modules can be flexibly linked to pump and irrigation modules. For example, irrigation programs can start depending on levels or soil moisture, and pumps can switch off automatically when the water level in a storage tank is too low.

The analog modules also support blending control (MIX control) to refill storage tanks from two water sources.

2.5 Irrigation modules

The irrigation modules in *hydroOne* control up to two independent irrigation systems. Each module can contain up to eight irrigation programs, each with up to 35 valves. Irrigation can be triggered by scheduled start times, as pulse irrigation or in response to external signals, the light sum and installation states. Calendar scheduling offers conventional weekday selection and a repeating cycle of 1 to 14 days.

A nominal flow rate is entered for each valve. *hydroOne* uses these values together with the configured maximum system capacity to coordinate several valves according to the delivery capacity of the installation. The actual measured flow rate is used for display, volume counting and – if enabled – flow monitoring; it does not influence the decision on whether another valve may be switched on.

The irrigation duration of a program can be quickly adapted to seasonal or weather-related requirements using a common percentage adjustment. A temperature-dependent runtime adjustment can also be applied. In addition, *hydroOne* records the water volumes of each valve as daily, weekly, monthly and total values – for greater transparency, control and optimisation.

Valves and irrigation programs can be started directly using external push-buttons. Currently active valves can be skipped when necessary to move quickly to the next irrigation step. This allows convenient local operation – for example on sports grounds, in greenhouses or in the field.

Status signals from the analog modules can also be integrated into irrigation control. For example, irrigation starts can be triggered depending on tank levels or soil moisture values.

Irrigation modules can be linked to pump and dosing modules. Pump setpoints and dosing recipes can therefore be stored directly in the respective irrigation program. In conjunction with the pump modules, *hydroOne* also supports intelligent pipe filling when a program starts.

2.6 Dosing modules

The dosing modules enable precise, flow-proportional dosing based on the current water flow rate. Up to two independent dosing modules can be controlled, each with up to nine dosing channels and recipes. Flexible recipe management makes it easy to adapt dosing to different requirements and operating conditions.

EC and pH measurements can optionally be integrated and used to control dosing. This allows the EC and pH setpoints in the recipes to be maintained automatically and the dosing output to be adjusted accordingly. Dosing can be coupled to irrigation so that a suitable recipe can be selected for each irrigation program and used automatically.

Minimum flow enabling, dosing channel limits, recipe management and manual and automatic agitator control integrate dosing into the overall system in a controlled, flexible and practical way. These operational monitoring and limiting functions do not replace any required independent protective measures.

External signals allow, for example, dosing tank empty signals or leak detection signals to be integrated into the dosing modules.

2.7 Filter modules

Up to two filter modules control backwashing of up to five filter chambers each. Flush and pause times are set individually for each chamber. Flushing can be requested depending on the pressure difference or by an operator action.

Coupling to the associated irrigation module postpones new valve starts while a flush request is present. Normal flushing waits until the valves already running have finished; urgent flushing can begin immediately. Further information can be found in Section 6.7.

2.8 Weather functions

The weather functions provide locally measured radiation, indoor and outdoor temperature and wind speed, together with rain and frost signals. Eight independently configurable light sum controls can trigger irrigation starts. Four temperature adjustments modify the runtimes of the assigned irrigation programs.

The weather functions to be taken into account are selected for each irrigation program. Rain and storms can prevent automatic irrigation; the frost function enables repeated irrigation while a frost signal is active. Priorities and enabling conditions are described in the sections on program and weather configuration.

2.9 External signals

External signals allow *hydroOne* to integrate additional contacts and status signals from the installation into the overall system. Examples include float switches, pressure switches, empty signals, enable signals and external fault signals. The signals can be used to enable or inhibit specific modules or trigger alarm messages.

Important installation states can therefore be easily integrated into the control system and linked to pump, irrigation, analog, dosing or filter modules. Each external signal has an adjustable trigger delay. Rain, frost and storms are integrated into the irrigation programs through the weather functions.

2.10 Event and alarm records, counters

hydroOne records events and alarms. This makes fault diagnosis easier and supports analysis of installation operation. The system also records the following statistics:

- Operating hours of pumps and pump modules

- Energy consumption of pumps and pump modules
- Operating hours of the status signals/outputs of analog modules
- Total volumes of water meters
- Daily, weekly, monthly and total volumes of irrigation module valves

2.11 Cloud connection

With the optional cloud connection, *hydroOne* becomes a connected control platform. Important process data such as setpoints, actual values and analog values, together with water volumes and energy consumption, is saved at regular intervals and can be analysed retrospectively.

When a cloud connection has been set up, alarm messages can be sent in plain text by email and, with the *UniCloud* app installed, also as push notifications.

Remote access also provides direct access to the system using the same interface as the local touch panel. The installation can therefore be monitored and operated from any location, subject to the safety instructions for remote access. Registration, the dashboard, data history, the app and alarm notifications are described in Chapter 9.

3 General information

3.1 Scope

This manual describes the operating concept and functions of the *hydroOne* system. The system is used in different hardware versions and can serve a variety of applications:

- Control of complex water systems (*hydroOne* system with a central control unit and decentralised peripherals),
- Turnkey pumping systems (*FluMaster* and *Nivelo* series),
- Acquisition of measurements using analog values and water meters, together with alarm functions,
- Dosing technology (*hydroOne dos*, control of dosing pumps and fertiliser mixers).

Depending on the hardware version, not all system functions are available. The screenshots show example installations with freely assigned names and example values; the settings and actual state of your installation are decisive.

3.2 Relationship to the installation manual

This manual describes operation and operational configuration of the system after installation has been completed. Electrical connections, channel assignments, basic hardware configuration and work at the installation level are not part of normal operation and are described in the *installation manual*.

3.3 Enable signals / Switch-on via clearance

An enable signal (*clearance*) is assigned to each module in the *hydroOne* system during installation. This may be provided by a key switch, float switch or another external contact, for example; depending on the installation, the enable signal may also be permanently present. If a module's enable signal is absent, its on/off button is shown as unavailable.

The *enable signal* and the *Switch-on via clearance* function must be distinguished: the enable signal permits the module to operate. *Switch-on via clearance* additionally determines whether the module switches on automatically when the enable signal is applied or returns. This function is available for the system's modules. Enabling it has the following effects:

- If the enable signal is present after a system restart, for example after a power failure, the module switches on automatically. This may cause connected pumps to start operating immediately after the system restarts.
- If a module's enable signal is initially absent and is then applied, the module switches on when the enable signal is applied.



Only enable *Switch-on via clearance* when safe operation of the installation is assured. Pumps and other moving parts may start immediately after switching on again. The operator must assess the resulting hazards to people and machinery and prevent them by suitable measures. Within their area of responsibility, the operator is responsible for implementing the organisational and technical protective measures required for operation.

3.4 Recommended configuration sequence

The easiest way to configure *hydroOne* is to set up the installation according to its functional dependencies rather than working through the menus one by one. The general principle is: **first measurements and basic functions, then the modules that depend on them, and finally automatic sequences and links**. Modules or functions that are not present can simply be skipped in the following sequence.

This procedure assumes that the control unit, sensors and actuators have been correctly installed and electrically connected, and that the required channels have already been assigned to the correct functions. In factory-configured *hydroOne* versions, these assignments are generally already prepared for the application, so operational setup can be completed entirely at the configuration level described here. If the interface does not display plausible measurements or connected components do not respond to a request, do not attempt to "compensate" by using unusual parameter settings. In this case, suitably qualified personnel must first check the installation and channel assignments.

1. **Check the system and names.** First check the date, time and language. Then assign clear names to pumps, water meters, analog modules, irrigation programs, valves and dosing functions. Clear names make all subsequent assignments easier.
2. **Set up measurements first.** Configure the water meters and analog modules in use before selecting them in other modules. Set the scaling, measuring range and unit to suit the connected sensor and compare the displayed values with the actual state of the installation. An incorrectly scaled measurement inevitably produces incorrect results in all subsequent functions as well.

3. **Set up analog functions and MIX where applicable.** If analog modules are used to switch outputs as well as display values, define switching levels, hysteresis and delays only after a plausible measurement is displayed. MIX control should first be checked using plausible tank and reference values before automatic MIX control is permanently enabled. Then configure the weather sensors in use and check their measurements before enabling weather functions in irrigation programs.
4. **Configure the pump modules.** Only enable pumps that are actually installed and set the sensor range, setpoints and switch-on/switch-off behaviour to suit the hydraulic installation. Then configure operational monitoring functions such as MIN/MAX alarms, lack of water and flow monitoring, together with base load change, a booster pump or a jockey pump where applicable. Electrical motor and frequency converter parameters may only be changed by suitably qualified personnel.
5. **Set up dosing modules before automatic irrigation.** Configure flow enabling, EC/pH measurement, dosing channels, capacities and limits. Then create the required recipes and initially check dosing under controlled conditions. If a dosing module will later be requested by an irrigation program, its independent operation should already have been fully tested.
6. **Set up the irrigation modules.** First configure basic settings such as the water meter, coupled pump and dosing modules and system capacity. If filters are installed, set up their pressure measurements, flush times and coupling to irrigation beforehand. Then configure the individual valves with runtime, pause time and expected flow rate. Only then create programs, start times, external starts and program-specific pump setpoints or dosing recipes.
7. **Add external signals and automatic restarts deliberately.** Link external signals only to modules that the signal is intended to affect. Functions such as *Switch-on via clearance* or *Automatic restart* should only be enabled after checking the behaviour when the relevant signal is lost and returns.
8. **Test functions individually first.** Initially test pumps, valves, outputs, measurements and dosing functions individually and using manageable runtimes. Only after these individual tests have been successful should several modules be operated together and automatic programs enabled.
9. **Finally check automatic operation and remote access.** Lastly, check timed sequences, behaviour when power returns and the cloud connection, if applicable. When using remote access and automatic starts, always bear in mind that connected components can start without any direct local operator action.

In brief: A reliable measurement is the basis for control; correctly configured control is the basis for linking modules; only then should programs and automatic starts be enabled.

4 Display and navigation

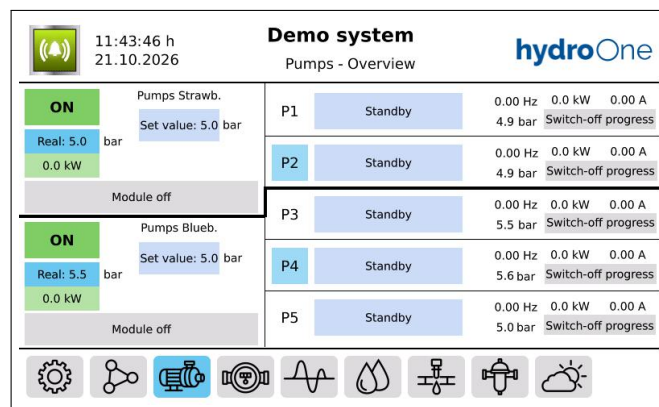


Figure 4.1: Pump module overview with navigation bar

4.1 General

Use the *navigation bar* at the bottom of the display to switch between views (see Figure 4.1).

The system has three operating levels:

- *Operating level* for monitoring the system during normal operation
- *Configuration level* for configuring the system
- *Installation level* for basic hardware setup, described in the installation manual

Tap the  button to switch between the operating and configuration levels. The installation level is accessible through *System*  at the configuration level.

The cogwheel button identifies the operating levels by colour as follows:

-  Operating level
-  Configuration level

Buttons with a grey background are used to change the view. A button with a blue background identifies the view currently open. In the irrigation and dosing modules, the navigation bar button switches between irrigation/dosing module 1 and 2. The filter view is accessed using the filter symbol and the weather view using the weather symbol.

4.2 Navigation within configuration

Use the navigation bar within configuration to switch between the different elements to be configured. For example, in the pump parameter view, the navigation bar allows you to switch between the pumps to be configured.

4.3 Configuration level

As supplied, the configuration level is protected by the password **12345**. Figure 4.2 shows the password view. Tap the  button to leave the password view. Within the configuration level, use the navigation bar to switch between the different main views for module configuration.

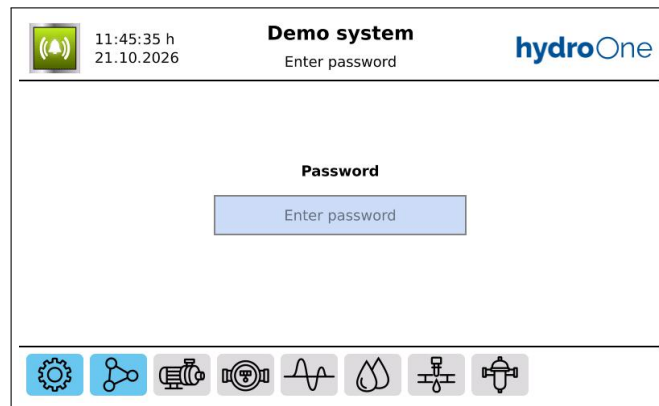


Figure 4.2: Password view

4.4 Operating level

Use the navigation bar at the operating level to switch between the following views:

	Configuration level
	System overview
	Pumps
	Water meters
	Analog modules
	Irrigation modules
	Dosing modules
Filter	Filter modules
Weather	Weather functions

4.5 Colour coding

Display fields and controls use consistent colour coding:

- A grey background indicates an inactive state. This includes disabled functions, controls that have not been operated, outputs that are not energised and inactive status signals or alarms. Important on/off buttons for modules are shown in red when inactive so that they stand out from the other controls.
- A green background indicates an active state, in particular active functions or energised outputs.
- A yellow background with red text indicates an active alarm state.

4.6 Plain-text names

In configuration, plain-text names can be assigned to various elements such as pump modules, water meters and status signals. Names can contain a maximum of 15 characters. Editable names are identified in the system by *italic text*. They appear in the configuration views of the modules and functions. Tap the text to change an element's name.

5 Alarms

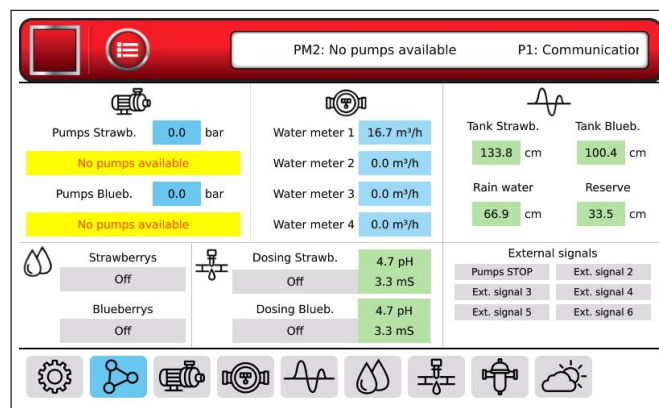


Figure 5.1: Alarm display

Tap the  button to open the alarm overview. If no alarm is active, the button has a green background.

If a fault occurs, the system shows the alarm display (Figure 5.1). Tap the  button to minimise the alarm display. The button remains red as long as an alarm is active. When the alarm display is active, tap  to open the alarm overview.

The alarm overview shows only current alarms. The event and alarm log is accessible through the configuration level and is described in Section 6.1.3.

Plain-text names can be assigned to the various modules in *hydroOne*. However, the system does not use these names in the alarm display, alarm overview or alarm history. Instead, the following abbreviations are used for clarity:

- PM1 – PM2: Pump modules
- P1 – P5: Pumps
- AM1 – AM4: Analog modules
- BM1 – BM2: Irrigation modules
- DM1 – DM2: Dosing modules
- WM1 – WM8: Water meters
- F1 – F2: Filter modules

Further alarm and troubleshooting guidance A detailed description of the alarm messages, including guidance on checking causes and possible remedies, can be found in Chapter 10. When troubleshooting, also use the event and alarm log, as it records operational events that may have preceded the actual alarm.

6 Configuration level

This manual deliberately describes the configuration level before the operating level. Many displays and status messages during operation can only be understood clearly once the associated settings and dependencies are known. You do not need to read every configuration menu in full simply to operate the system; use the cross-references in the operating level to return directly to the relevant setting when required.

When configuring a complete system for the first time, it is advisable to follow a defined sequence. Section 3.4 describes a systematic approach and the main dependencies between the modules.

6.1 System

6.1.1 Main view

The main view of the system configuration is shown in Figure 6.1.

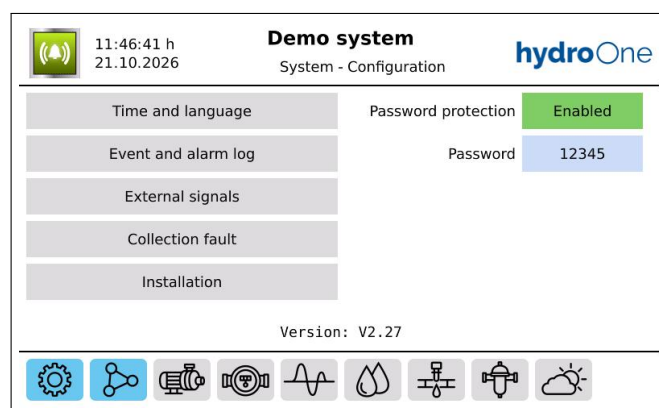


Figure 6.1: System configuration – Main view

Password protection Enable or disable password protection for the configuration level here. Enable password protection if changes to operating parameters are to be restricted to trained personnel. Password protection restricts access to the user interface; it does not replace a technical safety device.

Password 0 – 99999

Enter the password for accessing the configuration level in the *Password* field. Use a password known to authorized operators, but do not make it generally available. The operator responsible for the system should keep a clear record of any changes to access credentials.

Version The system software version is displayed here. This information is particularly important for support requests and after software updates, as individual functions or screen views may depend on the version.

Installation This button opens the separate installation level. It is intended for basic hardware and channel assignment, installation and servicing, and is not part of normal system operation. Changes may only be made by suitably qualified personnel. The installation level has its own password protection and is exited automatically after 30 minutes. Within the installation level, the assignments of digital inputs, digital outputs, analog inputs and analog outputs can each be reset separately. Only use these functions during initial setup or servicing; resetting removes the assignments for the selected group.

Disabling modules Disabling a function in the configuration differs from switching it off during operation using *ON/OFF*. If the pump function is disabled globally, the basic configuration is reset to one pump module with pump 1; the other pumps are disabled and their operating requests are canceled. The enabled setting for pump 1 is only a configuration setting and does not switch the pump on.

Disabling a dosing module also disables its EC and pH measurements, controllers and associated dosing channels. Disabling dosing globally applies this to both dosing modules. Disabling a pump, filter or dosing module also removes its coupling to the associated irrigation module. After enabling the module again, check and re-enable the required subfunctions and couplings. Normal switching off using *ON/OFF* does not delete these settings.

6.1.2 Time and language

The view for configuring the time, date and language is shown in Figure 6.2.

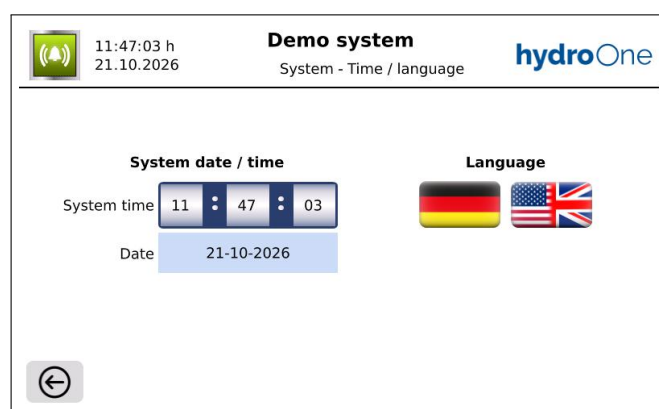
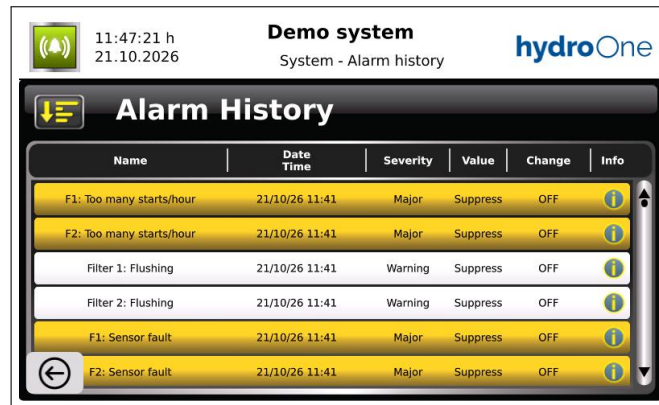


Figure 6.2: System configuration – Date, time and language

Tap the fields under *System date / time* to set the time and date. Use the flags under *Language* to select German or English. Check the system time particularly before setting up start times, irrigation cycles and scheduled base load changes.

6.1.3 Event and alarm log

Tap *Event and alarm log* to open the alarm history. The event and alarm log is shown in Figure 6.3. Messages (events such as pump modules starting) have a white background; alarms have a yellow background.



Name	Date Time	Severity	Value	Change	Info
F1: Too many starts/hour	21/10/26 11:41	Major	Suppress	OFF	
F2: Too many starts/hour	21/10/26 11:41	Major	Suppress	OFF	
Filter 1: Flushing	21/10/26 11:41	Warning	Suppress	OFF	
Filter 2: Flushing	21/10/26 11:41	Warning	Suppress	OFF	
F1: Sensor fault	21/10/26 11:41	Major	Suppress	OFF	
F2: Sensor fault	21/10/26 11:41	Major	Suppress	OFF	

Figure 6.3: System – Event and alarm log

6.1.4 External signals

The view for configuring external signals is shown in Figure 6.4.

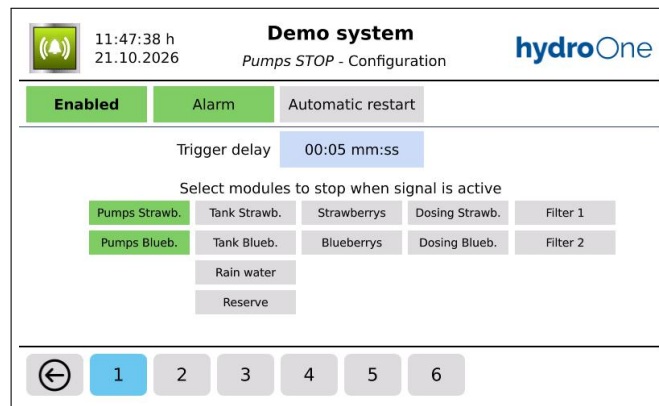


Figure 6.4: System configuration – External signals

Enable Tap the *Enabled / Disabled* button to enable or disable an external signal. The status of enabled signals appears in the main view. Only enable signals that are actually used in the installation and have clear names; this keeps the status display and subsequent troubleshooting easy to follow.

Trigger delay Set how long the input signal must remain continuously active before the external signal takes effect. Enter the time in *mm:ss* format. Shorter signals trigger neither the assigned shutdown nor the alarm. When the input signal clears, the external signal is removed without an additional switch-off delay.

Alarm Tap *Alarm* to enable or disable an alarm for the external signal. If enabled, an alarm is issued when the external signal remains active longer than the configured trigger delay; the external signal then also contributes to the collection fault. In particular, enable the alarm function for conditions requiring an operator response or notification via the cloud. Purely operational information can also be used as a status indication or event without enabling the alarm function.

Select modules to stop when signal is active Tap the displayed module buttons to assign modules to the external signal. Once the trigger delay has elapsed, the assigned pump, analog, irrigation, dosing or filter modules are stopped (switched off). The modules are switched off regardless of whether the *Alarm* button is enabled. Only assign modules whose operation should actually be interrupted by the relevant system condition. For example, an empty dosing tank can stop the dosing module without unnecessarily switching off an independent pump function. Example: a float switch is assigned to an external signal. If the float switch signal is active and pump module 1 is assigned to this external signal, pump module 1 switches off after the trigger delay with the message *External fault*. Float or fault contacts for pumps are connected through these external signals. The separate lack of water monitoring function of the pump module uses the selected outputs/status signals of the analog modules; see Section 6.2.6.

Direct manual operation of the filter outputs remains possible even while an external signal is active. An external signal therefore does not provide isolation for work on a filter or its valves; refer to the manual operation instructions in Section 6.7.

Automatic restart An active external signal removes the software enable of the assigned modules. If *Automatic restart* is enabled, the software enable that was previously present can be

restored automatically after the inhibition ends. A module that was already switched off is not switched on by this function.

If several external signals affect the same module, all of them must clear. If even one assigned signal without *Automatic restart* becomes active during this inhibition, the module remains switched off after the signals clear. This also applies if that signal clears before the others. For a pump module, a simultaneous lack of water signal is taken into account together with its own automatic restart setting.

If the module is disabled or its external enable is removed during the inhibition, the stored restart permission is discarded. Internal faults that cause a shutdown can also prevent restarting. Once the cause has been rectified and the enable signal is present, the module must then be switched on again using *ON/OFF*.

No additional fault acknowledgment is required for an external signal to clear. However, acknowledging an indication neither removes an input signal that is still active nor restores the software enable on its own.



Only enable *Automatic restart* if safe system operation is assured. Pumps and other moving parts can start immediately after the module switches back on. The operator responsible for the system must assess the resulting hazards to people and machinery and prevent them through suitable measures. Within their area of responsibility, the operator must implement the organizational and technical protective measures required for operation.

6.1.5 Collection fault

The view for configuring the collection fault is shown in Figure 6.5. Use the module buttons to select which modules contribute to the central collection fault.

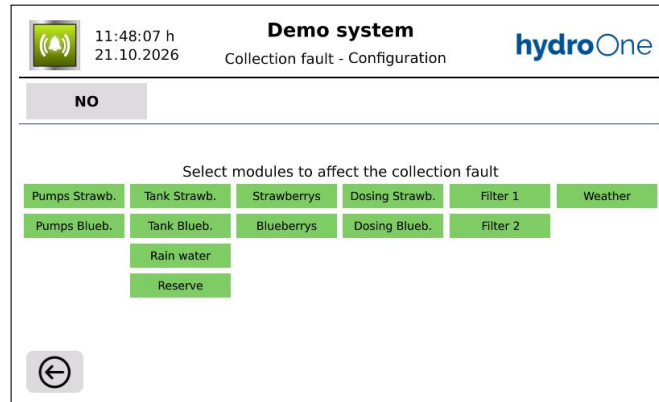


Figure 6.5: System configuration – Collection fault

Pump, analog, irrigation, dosing and filter modules, as well as weather sensor monitoring, can be included. External signals configured as alarms also contribute to the collection fault. Electrical monitoring signals, particularly short-circuit monitoring, can take effect independently of the module selection; see Chapter 8.

Use *NO* / *NC* to select the signal polarity of the collection fault output. With *NO*, the signal is active when a collection fault is present; with *NC*, it is active when no fault is present. The physical output is assigned in the installation level.

This selection affects the collection fault, not the shutdown function or individual indication of a module alarm. After configuring it, test the indication on the connected horn, lamp or higher-level controller.

6.2 Pump modules

6.2.1 Main view

The main view of the pump module configuration is shown in Figure 6.6.

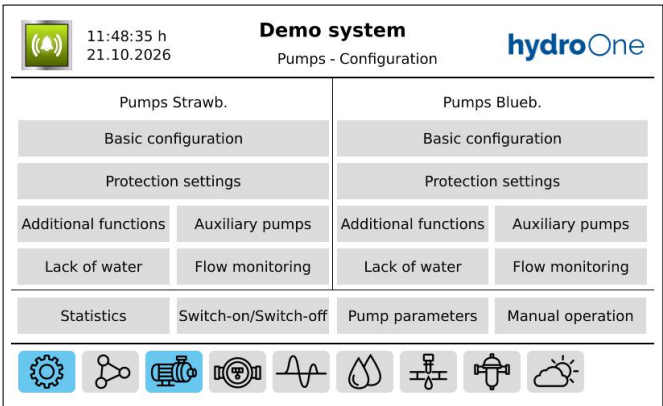


Figure 6.6: Pump module configuration – Main view

Pump assignment to the pump modules is defined in the installation level and follows a fixed arrangement: if only one pump module is used, pumps P1 to P5 belong to pump module 1. If two pump modules are used, P1 and P2 belong to pump module 1 and P3 to P5 belong to pump module 2. This arrangement affects setpoints, the base load and pump sequence, flow monitoring, and all module-specific fault and enable functions. The project-specific setting is made in the installation level and should not be changed during normal operation.

6.2.2 Basic configuration

The basic configuration view for the pump modules is shown in Figure 6.7.

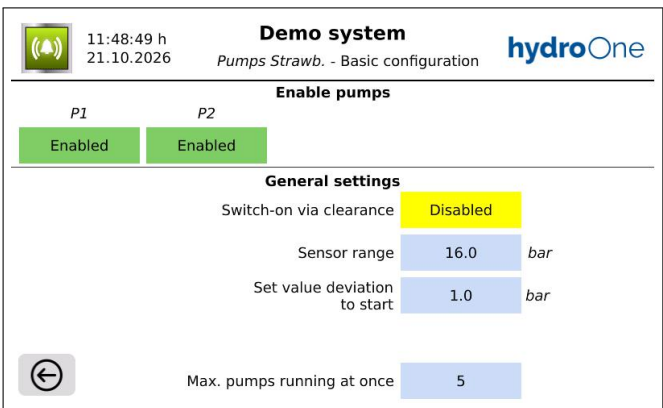


Figure 6.7: Pump modules – Basic configuration

Enable pumps Specify which pumps are connected here. Enable or disable the pumps using the buttons under *Enable pumps*. Only enable pumps that are physically present and ready for operation. This selection affects the pump sequence, multi-pump operation, flow monitoring and statistics, among other functions.

Sensor range 0.0 – 99999.0

Set the measuring range of the sensors for the pump module here. The entered range must match the actual measuring range of the connected sensor. Incorrect scaling distorts the actual value, the comparison with the setpoint, and all dependent alarm and control functions.

Unit Tap the unit after the input fields to change it (e.g. *bar*, *cm*, *m³/h*). Select the unit to suit the physical variable being controlled and then use it consistently for setpoints and alarm limits. The unit does not alter the actual sensor wiring; it affects the display and scaling within the system.

Set value deviation to start 0.1 – *Sensor range*

Enter the difference between the setpoint and actual value at which the pump module starts operating. A small value makes the module respond to a deviation sooner, but may result in more frequent starts. A larger value allows a greater fluctuation, but reduces the number of starts in many installations. Choose the value to suit the pressure vessel, pipe network and required control performance.

Max. pumps running at once This parameter limits how many of the enabled pumps in the module may run simultaneously. Once the configured number is reached, no further pump is started, even if the pumps already running have not yet reached the setpoint. This limit does not change which pumps are enabled; it only sets the maximum number permitted to run in parallel in automatic operation. Set the value to suit the hydraulic design, the available electrical supply capacity and the actual permitted number of pumps operating in parallel. It must not exceed the number of enabled pumps.

P1 always base load This function is only available when pump module 1 is used on its own. Enable it to always use pump 1 as the base load pump. Pump 1 will then always start first after the pump module is switched on. If base load change is enabled, it only takes place between the other enabled pumps. Use this setting when pump 1 should be given priority for hydraulic or operational reasons. If operating time should be distributed as evenly as possible across all pumps, do not specify a fixed base load pump.

Switch-on via clearance The *Switch-on via clearance* function can be enabled for a pump module here. This is particularly useful when a higher-level enable contact, such as a key switch or external system enable, is also intended to act as a deliberate request for operation. If the enable should only be an additional operating condition without switching the module on itself, leave this function disabled.



Observe the safety instructions in Section 3.3.

6.2.3 Protection settings

The view for configuring the protection and monitoring parameters of the pump modules is shown in Figure 6.8.



Choose the values in this menu with great care. These parameters protect the installation against damage in the event of a fault.

Demo system		hydroOne
11:49:06 h 21.10.2026 Pumps Strawb. - Protection settings		
MIN Alarm	1.0	bar
MIN Alarm delay	10 s	
MAX Alarm	7.0	bar
MAX Alarm delay	10 s	
Maximum runtime	Disabled	05:00 hh:mm
Maximum starts per hour	20 x	
Stop if set value is exceeded in multi-pump operation (deviation)		1.0 bar

Figure 6.8: Pump modules – Protection settings

MIN Alarm 0.1 – MAX Alarm

In the *MIN Alarm* field, enter the threshold below which the pump module switches off once the configured *MIN Alarm delay* has elapsed. Choose a limit outside the normal control range, but one that still detects an unusually low measured value in good time. Typical causes include a lack of delivery, a large open consumer or an incorrect measurement.

MAX Alarm MIN Alarm – Sensor range

In the *MAX Alarm* field, enter the threshold above which the pump module switches off once the associated *MAX Alarm delay* has elapsed. The limit should be above the normal setpoint range but below unacceptable system conditions. Take the permitted pressures and measuring ranges of the connected components into account. When operating as a pressure boosting system, set this value so that it does not exceed the maximum permitted operating pressure of the installation.

MIN Alarm delay 0 – 99 [sec]

Enter the delay for the MIN Alarm here. This prevents brief dips during starting, valve switching or rapid load changes from immediately triggering an alarm. However, do not set it so long that an unacceptable condition can persist for an extended period.

MAX Alarm delay 0 – 99 [sec]

Enter the delay for the MAX Alarm here. This allows brief pressure or measurement peaks to be ignored. Set the delay no longer than necessary for the dynamics of the installation.

Maximum runtime hh:mm

Limit the maximum runtime of the pump module here. The system counts the actual operating time during pipe filling and automatic pump operation; standby time since switching on is not included. If the pumps run continuously for longer than the configured time, the system shuts down with an alarm. Enable or disable the function using the associated button. This function is useful if unusually long continuous operation would indicate a leak, failure to reach the setpoint or another system fault. For applications with planned continuous operation, set a suitably long

time or disable the function. If the pumps are used for irrigation, for example, the value should be slightly longer than the longest expected irrigation cycle.

Maximum starts per hour 1 – 99

Enter the maximum number of starts per hour for the pump module. If the pumps start more often than this within one hour, the module shuts down with an alarm. Do not set the limit above the switching frequency permitted for the motor and pump, and keep it no higher than necessary for normal system operation.

This alarm is often caused by insufficient pre-charge pressure in the diaphragm pressure vessel. Check the diaphragm pre-charge pressure with the system depressurized. This alarm can also indicate a leak in the installation.

Stop if set value is exceeded in multi-pump operation (deviation)

0.2 – Sensor range

This function is only available when more than one pump is enabled. It rapidly switches off additional follower pumps without the normal switch-off delay when the setpoint is exceeded quickly. With the *Raise* control action (the standard setting, e.g. for pressure boosting systems), the condition is met when the actual value exceeds the setpoint by the configured difference. With *Lower* (e.g. for level reduction systems), it is met when the actual value falls below the setpoint by this difference.

During multi-pump operation, this condition is evaluated cyclically for the running follower pumps. As the PLC executes several program cycles before reading a new actual value from the frequency converters, in practice a significant setpoint overshoot will typically cause several follower pumps to be switched off in immediate succession. The system can therefore reduce operation to the base load pump very quickly. The base load pump remains active to continue controlling the process. Set the threshold outside normal control fluctuations so that ordinary load changes do not cause an unnecessarily large reduction in the pump cascade.

6.2.4 Additional functions

The view for configuring the additional functions of the pump modules is shown in Figure 6.9.

The screenshot shows the 'Additional functions' configuration screen for a pump module. At the top, it displays the system name 'Demo system', the user 'Pumps Strawb.', and the time '11:49:26 h' on '21.10.2026'. The 'hydroOne' logo is in the top right corner. The screen is divided into three main sections: 'Base load change', 'Set value switching', and 'Pipe filling'. 'Base load change' has 'Enabled' selected, with options for 'by time' (Disabled, 05:00 hh:mm) and 'by cycle' (Enabled, 5 x). 'Set value switching' has 'Disabled' selected. 'Pipe filling' has 'Enabled' selected, with settings for 'Switch-off value' (1.5 bar), 'Pipe filling time' (02:00 mm:ss), and 'filling frequency' (40.00 Hz). A 'Scheduled switching' button is also visible.

Figure 6.9: Pump modules – Additional functions

Pipe filling Pipe filling is only available in systems configured for pressure boosting (FluMaster). This function fills supply lines and pipework in a controlled manner at reduced pump output before automatic control begins. It is particularly useful for larger pipe networks or installations that may be partly empty after a standstill. It is generally unnecessary for systems that remain permanently filled and pressurized.

Pipe filling always uses the current base load pump. Only one pump runs during filling, even if several pumps are available in the module.

Switch-off value 0.1 – Setpoint

Enter the actual value at which the system ends pipe filling and changes to automatic control. Choose the value so that the pipe network is largely filled, while leaving sufficient margin below the normal setpoint for the control process. This supports a smooth transition to controlled operation. The pumps must be able to reach this value at the configured *Filling frequency*. If in doubt, test this several times.

Pipe filling time mm:ss

Enter the maximum duration of pipe filling. Once this time has elapsed, the system ends filling and starts automatic control, even if the switch-off value has not yet been reached. Choose a time slightly longer than the filling time required under normal conditions. An excessively long time unnecessarily prolongs operation at the reduced filling frequency if the switch-off value cannot be reached for another reason.

Filling frequency 15 – 60 [Hz]

Enter the frequency at which the pumps fill the pipes. A lower frequency generally reduces pressure surges during filling, but must still be sufficient to move water reliably through the installation. The appropriate value therefore depends on the pump, pipe network and static head. It must be within the minimum and maximum frequency limits of all pumps. In practice, values between 37 and 47 Hz are common.

Set value switching This function switches the setpoint using a potential-free contact (configured to suit the installation). When enabled, the pump module overview also displays the second setpoint. This is suitable, for example, for different pressure levels during the day and at night or for two clearly separate operating conditions. Both setpoints must be permissible for the connected installation.

Setpoint selection follows this priority: if a coupled irrigation program specifies its own pump setpoint, it takes precedence over normal setpoint switching. If there is no irrigation setpoint, the pump module uses *Setpoint 2* when the switching contact is active; otherwise, *Setpoint 1* applies. As soon as the irrigation request ends, the pump module automatically returns to normal selection between setpoints 1 and 2. A setpoint currently specified by irrigation is shown in the pump overview as the active external or program-specific setpoint.

Base load change Base load change determines which pump starts first when the system starts in multi-pump operation. Base load change can be enabled or disabled. When disabled, no regular change of the base load pump takes place. An existing valid base load assignment is retained; if the designated base load pump is unavailable while stopped, the system selects an available pump as the base load pump. Pump 1 is only given deliberate priority if *P1 always base load* is also enabled.

When base load change is enabled, it can be triggered by cycle count, elapsed time or a calendar schedule. Several trigger methods can be used simultaneously. The aim is generally to distribute operating hours and starts more evenly across several pumps.

Base load change by cycle 1 – 9999

A cycle is the period from the start to the end of an active operating period of the pump module. When base load change *by cycle* is enabled, the base load pump changes after the configured number of cycles. This mode primarily distributes the number of starts more evenly and is therefore suitable for systems with frequent operating cycles of similar duration.

Base load change by time **hh:mm**

When base load change *by time* is enabled, the base load pump changes after the configured time has elapsed. If the time expires during operation, the system does not carry out the change until the pump module enters standby or is switched off. This option is particularly suitable when pump cycle lengths vary considerably, so that operating time rather than the number of starts should be balanced.

Scheduled switching A base load change can also be triggered on selected weekdays at a specified time. Tap *Scheduled switching* to configure this. This option is useful when a change should take place at predictable times regardless of previous runtime, for example as part of regular operating cycles. Further information is provided in the next section.

6.2.5 Base load change schedule

The view for configuring scheduled base load changes is shown in Figure 6.10.

13:21:28 h
21.10.2026

Demo system
Pumps Strawb. - Base load change

hydroOne

Base load change schedule

Enabled

Monday Tuesday Wednesday Thursday Friday Saturday Sunday

Changeover time 23 00 HH:MM

Figure 6.10: Pump modules – Base load change schedule

Unlike base load changes by cycle or elapsed time, a scheduled base load change is forced. If the pumps are running at the changeover time, they are briefly switched off, after which the system restarts with the new base load pump.

Enabled / Disabled Enable or disable the schedule here.

Weekdays Select the weekdays on which the forced base load change is to take place. Only choose days on which a change is operationally useful; excessively frequent switching may be unnecessary for installations that are rarely used.

Changeover time Select the time at which the forced base load change is to take place. Unlike changes by cycle or elapsed time, the change is forced at this time. If the pump module is running, the pumps are briefly switched off; the system then restarts with the new base load pump if the request is still present.

6.2.6 Lack of water

The view for configuring lack of water monitoring for the pump modules is shown in Figure 6.11.

The lack of water function switches off the pump module if insufficient water is available for the intended pump operation. It uses the selected outputs/status signals of the analog modules. Configure the function so that an actual lack of supply is detected reliably without brief fluctuations in the water source causing unnecessary shutdowns.

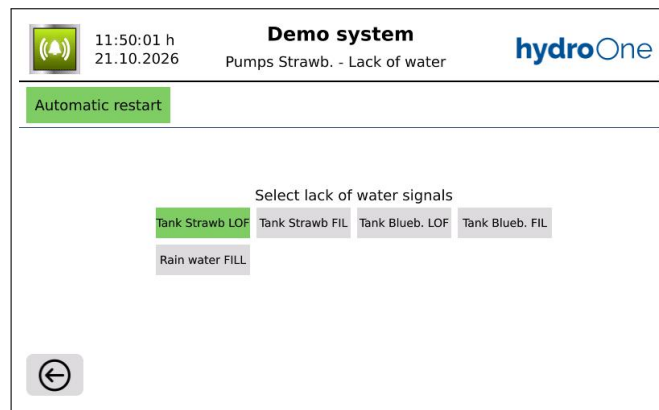


Figure 6.11: Pump modules – Lack of water

If an external contact, such as a float switch, is to inhibit the pump module, configure it as a general external signal and assign it to the pump module. The delay and *Automatic restart* setting of the external signal apply to that contact; the settings on this page apply to the lack of water signal from the analog modules.

Automatic restart An active lack of water signal always switches off the pump module. Enable *Automatic restart* if the pump module should switch back on automatically after the lack of water signal clears. If this function is disabled, the pump module remains switched off after the signal clears and must be deliberately switched on again. Automatic restarting is particularly useful when the water supply returns by itself; for faults whose cause should be checked before restarting, leave the function disabled. Automatic enable is only restored for a module that was previously switched on, and only once all assigned lack of water and external signals have cleared. If a signal without automatic restart was active during the inhibition, the module remains switched off. Removing the external enable also discards the stored restart permission.

Select lack of water signals Select which outputs/status signals of the analog modules are to be used for the lack of water signal. Use the *Raise / fill / lack of water* operating mode for these outputs/status signals. Their switching thresholds allow hysteresis to be set for the lack of water signal. The lower switching point should detect a condition in which the water reserve is no longer sufficient for pump operation; the upper switching point should provide enough separation to prevent the installation from switching off again immediately after refilling.

6.2.7 Flow monitoring

The view for configuring flow monitoring for the pump modules is shown in Figure 6.12.

Enabled / Disabled Enable or disable flow monitoring here. Only use this function if the selected water meter reliably measures the total flow relevant to the pump module. Incorrect or incorrectly scaled flow measurements could otherwise cause false alarms. *Flow monitoring* is a separate water meter monitoring function and must not be confused with the pump module functionality *Flow* selected in the installation level.

MIN flow / MAX flow Enter the minimum and maximum permitted flow for each individual pump. During operation, the limits of all pumps currently running are added together. The measured total flow must therefore be at least the sum of the configured MIN values and no more than the sum of the configured MAX values of the active pumps. For example, if pump 1 is set to 2–10 m³/h and pump 2 to 3–12 m³/h, the permitted range when both run is 5–22 m³/h. Base the settings

Figure 6.12: Pump modules – Flow monitoring

on plausible flow ranges under actual operating conditions, not solely on theoretical pump data. Limits that are too narrow quickly lead to false alarms during normal load changes.

These limits monitor for leaks, burst pipes and operation outside the permitted delivery range. The alarm delay is evaluated during automatic pump operation. A persistently unacceptable flow switches off the pump module and also contributes to the collection fault.

Alarm delay 5 – 59 [s]

Enter the delay for the flow alarm. The time should allow for brief deviations when pumps start, when additional pumps are switched on or off, and when consumers change rapidly, while still detecting a persistently implausible flow promptly.

Select water meter Select the water meter for flow monitoring. The selected meter must measure the combined flow of the pumps whose MIN/MAX values are combined in this monitoring function. Check that the displayed flow is plausible before enabling the alarm function.

6.2.8 Auxiliary pumps

The view for configuring auxiliary pumps for the pump modules is shown in Figure 6.13. Auxiliary pumps are only available when the relevant pump module operates in pressure boosting mode (FluMaster).

Figure 6.13: Pump modules – Auxiliary pumps

Pre-feeding pump A pre-feeding pump supplies the main pressure boosting system with water or inlet pressure. It must therefore start before the main pumps. This function is intended for

installations where the main pumps are not supplied directly from an adequate source with sufficient inlet pressure. After the lead time, the pre-feeding pump remains continuously requested throughout pipe filling and subsequent automatic operation of the main pumps. It is only switched off again when the pump request ends and the pump module returns to standby or the switched-off state.

The pre-feeding pump is generally controlled by an external, usually simple, pump controller. If this controller provides a pump fault contact, such as an auxiliary contact on a motor protection circuit breaker, this contact should always be integrated into the *hydroOne* system as an external signal. This allows a failed pre-feeding pump to be detected and prevents the main pumps from starting. Without the pre-feeding pump, the main pumps may suffer damage from cavitation or dry running.

Pre-feeding pump lead time 0 – 99 [sec]

Enter the lead time for the pre-feeding pump and adapt it to the installation. Entering 0 seconds disables this function. The time should be long enough to establish a stable supply or sufficient pressure at the main pump inlets before they start. The configured time only defines the period before the main pumps start; it does not limit the subsequent runtime of the pre-feeding pump.



Do not set the lead time too short. Otherwise, the pressure boosting pumps may be damaged.

Jockey pump Jockey pumps are generally smaller than the main pumps and supply small water demands. This can avoid unnecessary starts of the larger main pumps. As soon as the pump module leaves automatic standby and begins the main pump start sequence, the jockey pump is switched off. It therefore does not continue running alongside the pre-feeding, pipe filling or regular main pump sequence. Its request is also canceled when the jockey function is disabled or the pump module is switched off.

Switch-on pressure 0.0 – Jockey pump switch-off pressure [bar]

Enter the pressure at which the system switches on the jockey pump. This pressure can be below the pump module setpoint, but should be above the pump module start threshold; otherwise, the jockey pump will never start. The aim is to compensate for small pressure drops with the jockey pump before a main pump is required.

Switch-off pressure Jockey pump switch-on pressure – Sensor range [bar]

Enter the pressure at which the system switches the jockey pump off again. It switches off only after the follow-up time has elapsed. The difference between the switch-on and switch-off pressures forms the jockey pump hysteresis and should be large enough to avoid frequent cycling during small pressure fluctuations.



Set the jockey pump switch-off pressure at least 0.5 bar below the pump's maximum pressure. Depending on the installation, a smaller margin may also be sufficient. If the switch-off pressure is set too high, the pump may fail to switch off and may be damaged.

Follow-up time 0 – 59 [sec]

Enter the jockey pump follow-up time. A short follow-up time can help the switch-off pressure stabilize and avoid frequent switching at the threshold. An unnecessarily long follow-up time merely increases pump runtime and can cause excessive pump heating.

6.2.9 Statistics

The statistics view for the pump modules is shown in Figure 6.14.

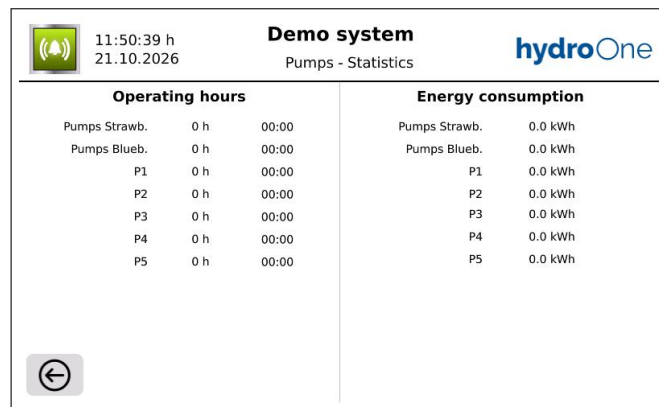


Figure 6.14: Pump modules – Statistics

6.2.10 Start / stop behavior

The view for configuring pump start and stop behavior is shown in Figure 6.15.

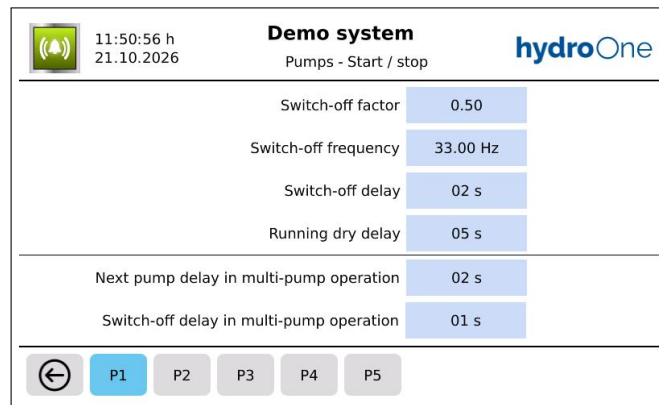


Figure 6.15: Pumps – Start / stop behavior

Select pump Select the pump to be configured using the navigation bar.

Switch-off factor 0.0 – 1.0

The switch-off factor determines the frequency-dependent power consumption at which the system detects very low or no water demand. A larger switch-off factor makes detection more sensitive and produces a switch-off request sooner; a smaller factor makes detection less sensitive. Set the switch-off factor individually for each pump.

Simple adjustment without calculation

No calculation is required for commissioning. The switch-off factor can be determined empirically on the installation. A simple rule is: **If the pump switches off too early during normal water demand, reduce the factor. If it fails to switch off when there is definitely no water demand, increase the factor.** Make changes in small steps only.



Only carry out a test with the consumers closed if the pump and hydraulic installation permit brief operation with no water demand on the discharge side. Never close the suction side or deliberately run the pump dry. If you cannot determine whether a zero-flow test is permitted for the installed pump, have the adjustment carried out by qualified personnel.

Proceed as follows for each pump:

1. First select a suitable starting value from Table 6.1. Before doing so, check that the name-plate data stored in the pump parameters match the pump (see Section 6.2.11).
2. Run the installation in automatic operation and allow it to reach the setpoint. Then close the normal consumers on the discharge side so that no water is actually being drawn. **Never close the pump's suction side for this test and never deliberately cause dry running.**
3. Observe the *Switch-off progress* indicator in the pump module overview (see Section 7.2). When there is no water demand, the green bar should decrease to the switch-off threshold (the bar is then completely gray), and the pump should switch off once the configured switch-off delay has elapsed.
4. If the pump fails to switch off despite there definitely being no water demand, increase the switch-off factor in small steps, e.g. by 0.05, and repeat the test. If the pump switches off unintentionally during normal water demand, reduce the switch-off factor accordingly.
5. After successfully testing zero-flow shutdown, also check the smallest consumer encountered during normal operation. The pump must not switch off unintentionally at this water demand. Repeat both checks several times before accepting the setting.

If no value can be found that reliably switches the pump off with no water demand while keeping it running at the smallest normal demand, do not simply continue increasing or reducing the factor. In this case, check the pump data, hydraulics, non-return valves, inlet pressure, measured values and configured switch-off frequency.

Table 6.1 lists reference values that have proved useful as starting points in practice. These are not fixed requirements or limits; the appropriate factor depends on the pump, hydraulic installation and inlet pressure, among other factors, and may differ from the table in your installation.

Table 6.1: Reference values for the switch-off factor

Scenario	Example setting range
Dry-installed pump, no inlet pressure	0.35 – 0.45
Dry-installed pump, inlet pressure present	0.45 – 0.65
Borehole pump	0.55 – 0.65

Technical background and calculation of the switch-off factor

The switch-off factor can be estimated from the power curve of the installed pump. This method provides a useful initial setting even before commissioning. The final setting should then be checked under actual operating conditions.

Determination from the pump curve

In addition to the head curve, pump data sheets often contain a power curve showing the power absorbed by the pump as a function of flow rate. The relevant curve is the pump power curve, usually designated P_2 .

For a centrifugal pump, the required power generally decreases as the flow rate decreases. A characteristic power value therefore occurs at very low or near-zero flow. This value can be used to calculate the switch-off factor.

The switch-off factor is the ratio of this switch-off power to the stored rated power of the pump:

$$k_A = \frac{P_A}{P_N}$$

where:

- k_A : switch-off factor to be set,
- P_A : power read from the power curve in the zero-flow or switch-off range,
- P_N : rated pump power stored in the pump parameters.

Example:

For a pump with a rated power of 11 kW, the power curve indicates approximately 6 kW at very low or near-zero flow (illustrated in Figure 6.16).

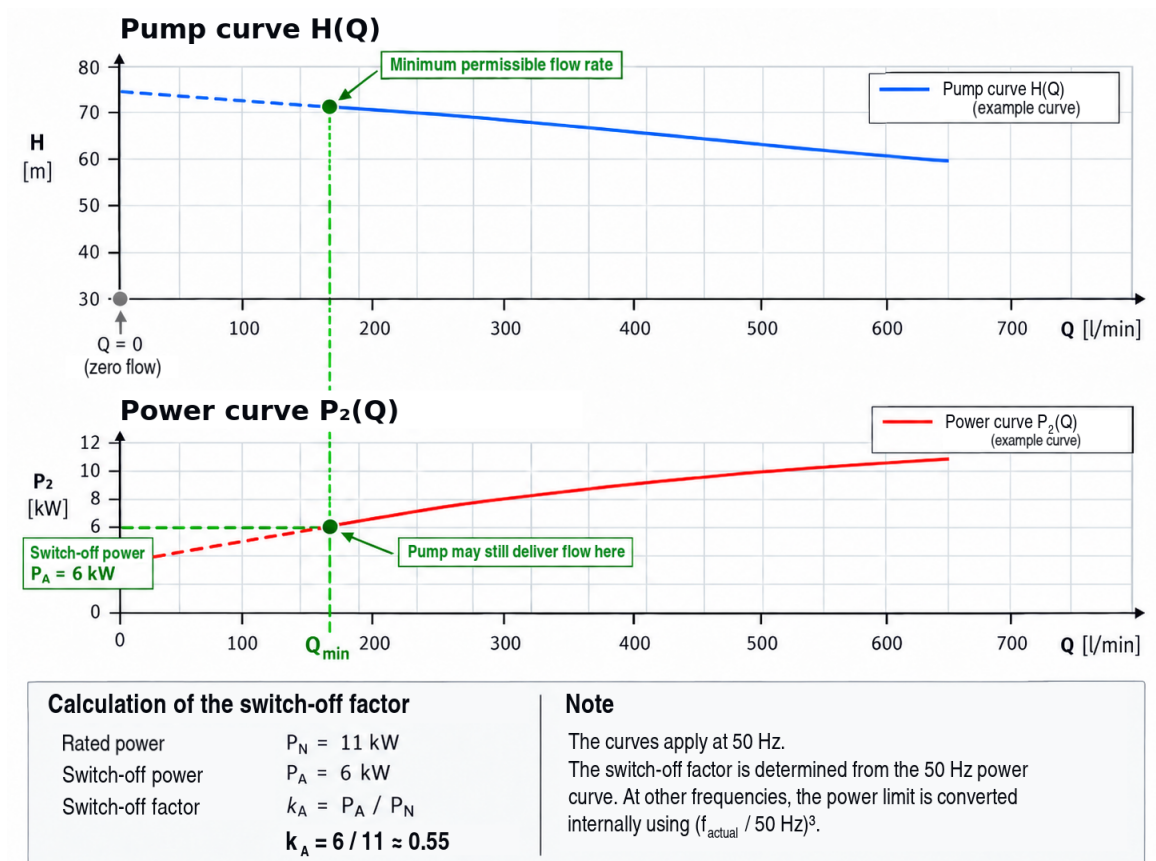


Figure 6.16: Example of determining the switch-off power from a pump power curve.

This gives:

$$k_A = \frac{6 \text{ kW}}{11 \text{ kW}} \approx 0.55$$

A switch-off factor of approximately 0.55 can therefore be used as an initial setting.

Allowing for different pump frequencies

The power curve in the pump data sheet usually refers to a pump frequency of 50 Hz. During controlled operation, however, the pump often runs at a lower frequency.

When the speed changes, the power consumption of a centrifugal pump changes approximately with the cube of the speed. As pump speed is approximately proportional to frequency, the power limit is automatically adjusted to the current pump frequency:

$$P_{\text{limit}} = P_N \cdot k_A \cdot \left(\frac{f_{\text{actual}}}{50 \text{ Hz}} \right)^3$$

where:

- P_{limit} : current power limit for zero-flow detection,
- P_N : stored rated pump power,
- k_A : configured switch-off factor,
- f_{actual} : current pump frequency.

The switch-off factor determined from the 50 Hz curve remains unchanged. Only the resulting power limit is adjusted according to the current frequency.

For the previous example with $P_N = 11 \text{ kW}$ and $k_A = 0.55$, the limit at 50 Hz is:

$$P_{\text{limit},50\text{Hz}} = 11 \text{ kW} \cdot 0.55 \approx 6.05 \text{ kW}$$

At a current pump frequency of 35 Hz, the limit is:

$$P_{\text{limit},35\text{Hz}} = 11 \text{ kW} \cdot 0.55 \cdot \left(\frac{35}{50} \right)^3 \approx 2.08 \text{ kW}$$

The switch-off point determined from the pump curve at 50 Hz is thus approximately transferred to the current speed.

Adjustment notes

Use the pump's power curve when determining the factor from a pump data sheet. Head and efficiency are not the relevant values for calculating the switch-off factor directly.

After any calculated initial setting, verify that zero flow is detected reliably and the pump switches off. Inlet pressure or a long suction pipe can cause the actual switch-off factor to differ from the calculated value; in this case, determine it empirically.

For multistage pumps, such as borehole pumps, the power curve often shows only a single stage. In this case, first multiply the switch-off power read from the curve by the number of pump stages before calculating the factor.

Switch-off frequency Minimum frequency – Maximum frequency [Hz]

Enter the frequency used by the system for switching off the pump. If the pump frequency remains below the *Switch-off frequency* for the configured *Switch-off delay*, the system switches the pump off. This value mainly detects very small water demands at which continued pump operation is no longer useful. It should therefore be slightly above the minimum frequency without cutting off normal low-load operation.

Switch-off delay 0 – Running dry delay [sec]

Enter the delay before the system switches the pump off. This delay applies both to automatic shutdown using the switch-off factor and to shutdown using the switch-off frequency. A value that is too small can cause unnecessary stops during brief load fluctuations; a value that is too large prolongs operation when there is genuinely no demand.

The switch-off delay only applies while the pump is the current base load pump. If it is running as an additional pump in multi-pump operation, the *Switch-off delay in multi-pump operation* applies.

Running dry delay **Switch-off delay – 59 [sec]**

Enter the delay before the system issues the dry-running alarm. Dry-running detection is adjusted automatically through the switch-off factor; no additional settings are required. The delay should allow for normal starting and control processes without allowing actual dry running to continue unnecessarily.

Dry-running detection is identical to zero-flow detection. The only distinction between normal shutdown and dry-running detection is whether the pump module has currently reached its setpoint (shutdown) or not (dry running).

Next pump delay in multi-pump operation **0 – 59 [sec]**

Enter the delay before this pump is switched on during multi-pump operation. Additional pumps are requested when the pump currently controlling the process is running at maximum frequency and does not reach the setpoint. The delay prevents an additional pump from starting immediately during brief load peaks. A longer delay may be used for slow systems; a shorter delay is appropriate when demand rises quickly.

Switch-off delay in multi-pump operation **0 – 59 [sec]**

Enter the delay before this pump is switched off during multi-pump operation while more than one pump is still active (if only one pump is active, the normal *Switch-off delay* applies). The system switches pumps off when the switch-off condition of the pump currently controlling the process is met and the setpoint has been reached. A sufficient delay avoids unnecessary switching between one and several pumps when demand fluctuates.

6.2.11 Pump parameters

The view for configuring the pump parameters is shown in Figure 6.17.

Demo system		hydroOne	
Pumps - Parameters			
Rated voltage	400 V	Minimum frequency	30.00 Hz
Rated frequency	50.00 Hz	Maximum frequency	50.00 Hz
Rated current	9.0 A	Ramp-up time	2.0 s
Rated power	4.0 kW	Braking time	2.0 s
Rated speed	2850 rpm	Proportional term (P)	1.00
PWM frequency	2500 Hz	Integral term (I)	0.2 s

Navigation bar: P1, P2, P3, P4, P5

Figure 6.17: Pumps – Pump parameters



Pump parameters directly affect the motor and frequency converter. Changes to nameplate data, minimum and maximum frequency, ramp-up and braking times, PWM frequency or controller parameters may only be made by a qualified electrician competent to perform this work. The installation must have been completed correctly, and the motor, frequency converter and pump must be unambiguously assigned to one another.

Select pump Select the pump to be configured using the navigation bar.

Table 6.2: Nameplate data

Parameter	Limits
Rated voltage	100 – 1000 V
Rated frequency	50 – 60 Hz
Rated current	0.1 – 500 A
Rated power	0.1 – 250 kW
Rated speed	725 – 3600 rpm

PWM frequency 1000 – 8000 [Hz]

Where possible, leave the carrier frequency (PWM frequency) at its factory setting. A higher frequency can be selected if the pump produces excessive noise. Discuss this with your dealer, taking into account the length of the motor cable to the pump.



If the system is equipped with a du/dt filter or sine-wave filter because of a long motor cable, this value is already set appropriately. Do not change it in this case. If in doubt, contact your dealer.

Minimum frequency 5 – Maximum frequency [Hz]

Enter the minimum frequency at which the pump may operate. This value is not taken from the nameplate; adapt it to the application. A frequency that is too low can lead to unfavorable pump operation, insufficient motor cooling or unstable control. An unnecessarily high minimum frequency limits the usable control range at small water demands.

In practice, values below 30 Hz are unusual because centrifugal pumps can deliver little useful flow below this frequency. As a rule, 30 Hz is the standard setting and does not need to be changed.



Do not set a minimum frequency below 30 Hz for submersible pumps. Lower values can damage the pump.

Maximum frequency Minimum frequency – 60 [Hz]

Enter the maximum frequency at which the pump may run during controlled operation. This value is not taken directly from the nameplate, but must be below the maximum frequency permitted for the pump. The maximum frequency also limits the maximum achievable pump output. Increasing it above the values approved for the pump, motor and hydraulics (rated frequency) is not permitted.

Ramp-up time 1 – 10 [sec]

Enter the time the pump takes to accelerate from standstill to the minimum frequency. A longer ramp reduces sudden electrical and hydraulic load changes, but delays the build-up of pressure or flow. Choose the value to suit the pump type and installation.



For submersible pumps, limit the ramp-up and braking times to a maximum of 2 s. Longer times can damage the pump.

Braking time 1 – 10 [sec]

Enter the time the pump takes to come to a standstill from operation. Do not set the braking time too short; excessively small values can trigger an *Overcurrent* alarm. An excessively long braking

time can cause the pump to continue delivering unnecessarily after a stop request. Match the ramp to the inertia and hydraulic behavior of the installation.

For pumps up to 7.5 kW, braking times of 2–3 s have proved effective. From 11 kW upwards, the braking time should be at least 4 s to avoid fault messages.

Proportional term (P) 0.5 – 10

The proportional term determines how strongly the controller responds immediately to the current difference between the setpoint and actual value. The higher the setting, the more the pump frequency changes even for a small pressure deviation.

A high proportional term gives a fast response, but an excessively high setting can cause pressure fluctuations or oscillating control. A lower proportional term makes control steadier, but slows the response to load changes.

Integral term (I) / integral time 0.1 – 100 [s]

The integral term corrects a control deviation that persists over time. The configured value is the integral time T_i . The following applies:

- a **short integral time** produces strong, fast control action,
- a **long integral time** produces slower, steadier control action.

An excessively short integral time can cause the controller to overshoot the setpoint or continually adjust the pump frequency. A longer integral time makes control steadier, but persistent pressure deviations are corrected more slowly.

Interaction between proportional term and integral time The PI controller combines two effects. The proportional term responds immediately to the current pressure deviation. The integral term also takes into account how long a deviation has existed and continues adjusting the output until the remaining control deviation is eliminated.

The proportional term therefore mainly determines the immediate response of the system, while the integral time affects how quickly the controller corrects a persistent deviation.

As a guide:

- Control responds too slowly: carefully increase the proportional term and/or reduce the integral time.
- Control overshoots or oscillates: reduce the proportional term and/or increase the integral time.
- Pressure initially responds well but then remains away from the setpoint for too long: carefully reduce the integral time.
- Pump frequency responds too erratically to small pressure changes: reduce the proportional term.

Recommended initial settings The following values are proven starting points. Actual control behavior depends on pump size, system volume, diaphragm pressure vessel, pipe network and demand dynamics, among other factors. Adapt the values to the individual installation during commissioning.

Application	P	T_i [s]	Control behavior
Standard application	1.00	0.20	Fast and stable control. Recommended initial setting for typical pump installations up to approximately 11 kW with a diaphragm pressure vessel of about 24 l.
Steady standard control	0.80	0.50	Slightly reduced response to rapid pressure changes. Suitable if the standard setting is slightly unstable or the pipe network causes more pronounced pressure fluctuations.
Large, slow system	0.50	2.00	Steady, slow correction for large pump and irrigation installations with large pipe volumes, such as golf course irrigation. Rapid load changes are deliberately corrected less aggressively.
Highly dynamic system	1.50	0.15	Fast response to short-term pressure changes. Only use for installations with low hydraulic inertia and check for overshoot or oscillation during commissioning.

Table 6.3: Guideline values for PI controller adjustment

Always begin adjustment from a stable initial setting. Make changes gradually and observe the installation after each change. If the proportional term and integral time are both changed substantially at the same time, it becomes difficult to determine the cause of any change in control behavior.



Change the control parameters with great care. Incorrectly adjusted controllers can damage pumps and the installation. These values may only be changed by a suitably instructed qualified electrician. Under normal circumstances, these parameters do not need to be changed.

6.2.12 Manual operation

The pump manual operation view is shown in Figure 6.18.

Manual operation frequency Minimum frequency – Maximum frequency [Hz]

Specify the frequency at which the pump should run in manual operation. When the associated *Manual-o-Automatic selector switch* is set to *Manual*, the pump runs at this frequency. For testing and servicing, choose a frequency at which the installation can be operated in a controlled manner, and never exceed the permitted frequency limits of the pump and motor.



During manual operation, the protection, interlock and monitoring functions of automatic operation may be limited or ineffective. Continuously monitor the installation during manual operation and only use this mode for commissioning, maintenance or troubleshooting by suitably qualified personnel.

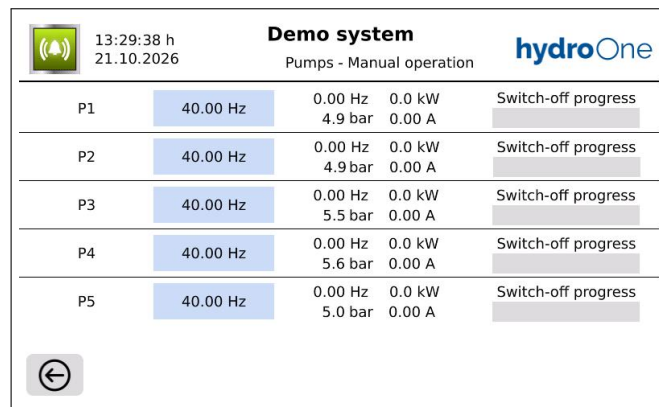


Figure 6.18: Pumps – Manual operation

6.3 Analog modules

6.3.1 Main view

The main view of the analog module configuration is shown in Figure 6.19.

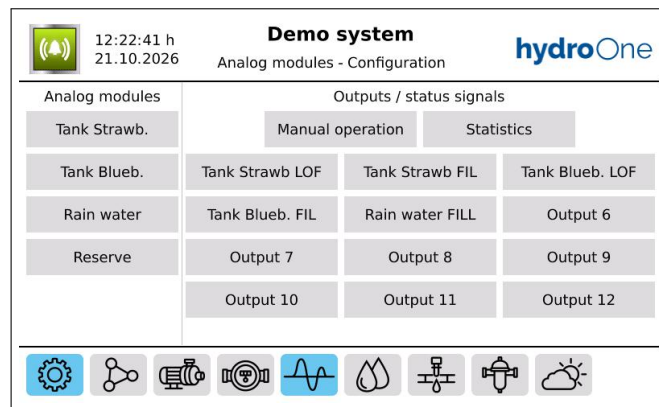


Figure 6.19: Analog module configuration – Main view

6.3.2 Analog modules – Basic configuration

The basic configuration view for the analog modules is shown in Figure 6.20.

12:23:05 h 21.10.2026		Demo system Tank Strawb. - Basic configuration		hydroOne
Enabled	MIX control	Switch on via clearance		
Sensor type		4-20mA		
Sensor range		400.0 cm		
MAX Alarm / delay		190.0	05.000 s	
MIN Alarm / delay		30.0	05.000 s	

← General MIX Water sources

Figure 6.20: Analog modules – Basic configuration

Enabled / Disabled Enable or disable the analog module here. Disable unused analog modules so that measurements, alarms and outputs that are not present remain hidden during operation. Only enable a module once its sensor has been correctly connected and its scaling is known.

Switch on via clearance The *Switch on via clearance* function can be enabled for the analog module here. This is useful when the analog module should start automatically together with a higher-level system enable signal. If the enable signal should only act as an interlock without switching on the module itself, leave this function disabled.

Sensor type Select whether the connected sensor provides a 0–20 mA or 4–20 mA signal. The setting must exactly match the sensor's output signal. An incorrect selection causes incorrect scaling throughout the measuring range; with 4–20 mA, it can also impair detection of a missing or excessively low signal. With 4–20 mA, a signal below the configured sensor error threshold is evaluated as a sensor error. With 0–20 mA, a low signal down to 0 mA is part of the valid measuring range and therefore does not trigger this sensor error.

Sensor range MAX Alarm – 32000

Set the measuring range of the connected sensor here. Use the full-scale value corresponding to 20 mA, as specified on the sensor or in its data sheet. After entering the value, check the reading against at least one plausible system condition before using it for switching or alarm functions.

Unit Tap the unit after the *Sensor range* input field to change it (e.g. *bar*, *cm*, *m³/h*). Select the unit to match the actual measured quantity; it is then also used for switching thresholds, alarm limits and the display.

MAX Alarm MIN Alarm – Sensor range

Enter the MAX Alarm threshold and the associated delay. The limit should identify a condition that does not occur during normal operation and should be checked by the operator. The delay prevents brief measurement peaks from immediately triggering an alarm.

MIN Alarm 0 – MAX Alarm

Enter the MIN Alarm threshold and the associated delay. Select a limit below the normal operating range, allowing for natural process fluctuations. The analog module's MIN/MAX alarms switch off its assigned outputs/status signals unless they are explicitly set to *Always active*.

MIX control Enable *MIX control* if the analog module is to be used for controlled filling of a tank from two water sources. The measured value of this analog module then serves as the level of the tank to be filled. Once enabled, the navigation bar also displays the *MIX* and *Water sources* views. The two sources can be given project-specific names. The required source proportions are not simply estimated from time, but adjusted using the water volumes recorded by the assigned source water meters. Both sources must therefore be suitably connected to the hydraulic system, and the associated water meters must be configured correctly. Parameter settings and the basic operating principle are described in Section 6.3.3.

6.3.3 MIX control

When an analog module's *MIX control* is enabled, *hydroOne* uses the measured value of this analog module as the level of the tank to be filled and controls two water sources for tank filling. The view is shown in Figure 6.21.

The screenshot shows the 'MIX configuration' screen for a 'Demo system' (Tank Strawb.). The interface includes a top status bar with a signal icon, time (12:23:19 h), date (21.10.2026), and the hydroOne logo. Below this is a table of configuration parameters:

Demo system			
Tank Strawb. - MIX configuration			
Switch-off level / delay	250.0	05.000 s	Cycle time 10:00 mm:ss
Switch-on level / delay	150.0	05.000 s	
Reference system	Tank Strawb.	Tank Blueb.	
	Rain water	Reserve	
High level / Q1 dosing	200.0	50.0 %	
Low level / Q1 dosing	100.0	50.0 %	

At the bottom, there is a navigation bar with a back arrow and three tabs: 'General', 'MIX' (which is highlighted in blue), and 'Water sources'.

Figure 6.21: Analog modules – MIX configuration

Basic operating principle MIX control combines level control with volume-based blending of the two sources. Filling starts when the level of the tank to be filled falls below the configured switch-on level. At the same time, *hydroOne* calculates the required percentage of source 1 from the measured value of a selectable reference system; the target percentage of source 2 is automatically calculated as the remainder up to 100 %.

During filling, the control system records the water volumes from both sources using the assigned source water meters and calculates the actual proportion of source 1. For a setpoint between 0 % and 100 %, both sources are initially requested. Once the configured cycle time has elapsed, *hydroOne* compares the measured actual proportion with the calculated target proportion. If the proportion of source 1 is too low, only source 1 is temporarily requested; if it is too high, source 2 is given preference instead. As soon as the target proportion is reached again or crossed in the required direction, both sources are requested again, and the next evaluation takes place after the cycle time has elapsed. At 0 % or 100 %, only the required source is used.

Until a water volume has been recorded, no correction is derived from an assumed mixing ratio. Monitoring of the actual source flow should therefore be configured appropriately.

The cycle time is thus **not a time ratio between the two sources**; it determines the interval at which volume-based mixing control is evaluated and corrected. Blending accuracy depends directly on correct operation and configuration of the source water meters. Incorrect pulse values, missing pulses or substantial hydraulic fluctuations in the sources lead to a correspondingly incorrect volume balance.

Switch-on level / delay 0 – Switch-off level

If the tank level remains below the configured switch-on level for longer than the associated delay, MIX control starts filling the tank. This value therefore defines the required minimum reserve in the tank. The delay should filter out brief fluctuations in the level signal without unnecessarily postponing the required refilling.

Switch-off level / delay Switch-on level – Sensor range

If the tank level reaches or exceeds the configured switch-off level for longer than the associated delay, MIX control ends filling. Leave a sufficient gap between the switch-on and switch-off levels to prevent small level fluctuations from continually switching the sources on and off. The switch-off value must also leave sufficient reserve below the tank's maximum permitted level.

Reference system Select the analog module whose measured value is to influence the required blend of the two sources. For example, the level of a rainwater storage tank can be used as the reference system. This allows a smaller proportion of rainwater to be used at a low rainwater level and a larger proportion at a high level. The reference system should represent a quantity from which the preferred source can sensibly be determined; its measuring range and display must therefore be configured correctly beforehand.

Low level / Q1 dosing 0 – High level / 0 – High-level dosing [%]

Set the low reference value and the required percentage of source 1 at this value. This point describes the required source proportions at a low reference system value. If, for example, a limited rainwater reserve is to be conserved, set a suitably low proportion of the rainwater source here.

For a fixed mixing ratio, simply set dosing at the low and high levels to the same percentage. The system then operates independently of the reference system.

High level / Q1 dosing Low level – 32000 / Low-level dosing – 100 [%]

Set the high reference value and the required percentage of source 1 at this value. The proportion of source 1 is linearly interpolated between the low and high reference levels. For example, if the proportion is 20 % at the low level and 80 % at the high level, the proportion of source 1 increases uniformly from 20 to 80 % between the two reference values.

The proportion of source 2 is automatically calculated as 100 % – Q1 proportion and therefore cannot be set separately. At 100 % source 1, only source 1 is active; at 0 % source 1, only source 2 is active.

Cycle time mm:ss

The configured cycle time determines how long the control system lets both sources supply water together before evaluating the actual volume ratio. Once the cycle time has elapsed, the system compares the actual proportion of source 1, determined from the source water meters, with the calculated target proportion. If necessary, it temporarily requests only source 1 or only source 2 until the ratio has been corrected in the required direction. Another phase with both sources then begins. At 0 % or 100 %, this correction sequence is omitted and only the required source is controlled. Do not select an unnecessarily short cycle time, as this would cause valves and pumps to switch too frequently; a very long cycle time, on the other hand, results in larger temporary deviations from the required mixing ratio.

Assignment of source outputs The two MIX sources are assigned to fixed outputs/status signals for each analog module:

Analog module	Source 1	Source 2
1	Output/status signal 1	Output/status signal 2
2	Output/status signal 3	Output/status signal 4
3	Output/status signal 5	Output/status signal 6
4	Output/status signal 7	Output/status signal 8

For a source output to actually switch, the relevant output/status signal must be enabled in the configuration and assigned to a physical output during installation. The same outputs/status signals can also be used for normal analog control or time schedules. The requests are combined using logical OR: as soon as at least one active operating mode – analog control, time schedule or MIX control – requests the output, it switches on. For example, a weekly forced flushing cycle can also be implemented using the time schedule.

6.3.4 MIX sources and flow monitoring

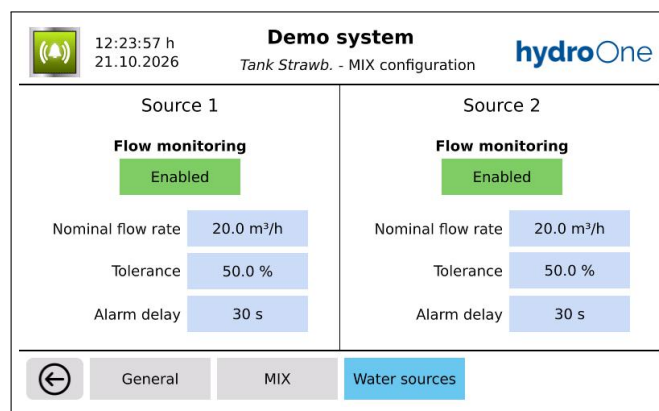


Figure 6.22: Analog modules – MIX sources and flow monitoring

The *Water sources* view is shown in Figure 6.22. Separate flow monitoring can be configured for each source. The source water meters used for the volume balance are assigned to the analog modules in fixed pairs:

Analog module	Source 1	Source 2
1	Water meter 1	Water meter 2
2	Water meter 3	Water meter 4
3	Water meter 5	Water meter 6
4	Water meter 7	Water meter 8

For volume-based mixing control, the assigned source water meters must be enabled and set to *Pulse* mode. The debounced pulses and the configured pulse value of each meter are evaluated; a pulse that remains active for an extended period is only counted once. A water meter connected solely by an analog signal does not provide pulses for this volume balance. Before commissioning MIX control, therefore, check both meters individually for correct pulse counting and the correct *Litres per pulse* setting. A missing pulse is not, on its own, detected as a sensor error; enabled flow monitoring is used to detect a lack of source flow.

Flow monitoring Enable flow monitoring separately for source 1 and source 2 if the flow recorded while the source is requested is to be monitored. This function is particularly useful for detecting a valve that fails to open, a failed water source or a significantly different hydraulic condition.

Nominal flow rate 1 – 32000 [m³/h]

Enter the expected flow rate of the relevant source. Wherever possible, use a typical value measured during actual operation rather than relying solely on a theoretical nominal value, as pressure conditions and pipe losses affect the actual flow rate.

Tolerance 0 – 100 [%]

Enter the permitted percentage deviation from the configured nominal flow rate. An alarm is only generated if the recorded flow is outside the resulting tolerance range and the deviation persists for longer than the configured alarm delay. Select the tolerance so that normal pressure and flow fluctuations are accepted, but a failure or significantly reduced source flow is detected.

Alarm delay 1 – 59 [s]

Specify how long an impermissible flow deviation must persist before source flow monitoring triggers an alarm. The delay should allow for flow to build up after the source opens and bridge brief switching events. If a MIX flow alarm is triggered, the MIX requests for both sources are ended. A sensor error in the tank level measurement prevents a new MIX start and ends current MIX requests. Other requests for the same outputs, for example from a time schedule, must be considered separately.

During operation, the analog module overview shows which source is requested and the flow recorded for that source when MIX control is enabled. Project-specific source names can be assigned, allowing the display to show, for example, *Rain water* and *Well water* instead of *Source 1* and *Source 2*.

6.3.5 Outputs/status signals – Configuration

The view for configuring analog control of the analog modules' outputs/status signals is shown in Figure 6.23.

12:25:47 h 21.10.2026		Demo system Tank Strawb LOF - Configuration		hydroOne
Enabled	Analog control	Enabled	Always active	Enabled
Select analog module		Tank Strawb.	Tank Blueb.	
		Rain water	Reserve	
Control action		Raise / fill / lack of water	Lower / empty	
High switching threshold / delay		60.0	05.000 s	
Low switching threshold / delay		50.0	05.000 s	

Figure 6.23: Outputs/status signals – Basic configuration

Outputs/status signals can be requested according to an analog value (*Analog control*), according to time (*Time schedule*) and, when used as source outputs, also by MIX control. Multiple active operating modes work in parallel and are combined using logical OR: as soon as at least one mode requests the output, the output/status signal becomes active.

Enabled / Disabled Enable or disable the output/status signal here. A disabled output is not switched on by a MIX request either. Disable unused functions to prevent them from being activated unintentionally, whether manually or through analog, time or MIX requests.

Always active If *Always active* is disabled, outputs/status signals are switched off when the assigned analog module has an alarm or is switched off. Only enable *Always active* if the relevant output should continue to operate according to its active requests despite an alarm or a switched-off analog module. Assess this setting particularly carefully for functions whose continued operation during a sensor or limit alarm may be undesirable. Enable this option, for example, if the output/status signal is to be used as a lack-of-water signal. *Always active* only works when analog control is also enabled. It does not override disabling of the output or an electrical interlock imposed by short-circuit or 24 V AC monitoring.

Analog control Use this button to enable or disable analog control. Enable it if the output is to switch according to the measured value of an analog module. If only a time schedule or MIX request is intended, analog control can remain disabled.

Select analog module Assign the output/status signal to an analog module here. This module's measured value then forms the basis for the configured low and high switching thresholds. Before enabling the function, therefore, check that the measuring range and unit of the selected analog module are correct.

Control action Select the operating principle of the output/status signal:

- *Raise / fill / lack of water*: switches on at the *Low switching threshold* and off at the *High switching threshold*. Use this action, for example, to refill a tank or switch on a function when the measured value is too low.
- *Lower / empty*: switches off at the *Low switching threshold* and on at the *High switching threshold*. This action is suitable, for example, for pumping out, emptying or switching on a function when the measured value is too high.

The deciding factor is not the name of the connected component but the intended effect on the measured value: if the active function should increase the measured value, select *Raise / fill*; if it should decrease it, select *Lower / empty*.

Low switching threshold / delay 0 – High switching threshold / 1 – 59 [s]

Set the *Low switching threshold* and the switching delay here. Together with the high switching threshold, this creates a hysteresis that prevents frequent switching when the measured value fluctuates. The delay can additionally filter out brief fluctuations.

High switching threshold / delay Low switching threshold – 32000 / 1 – 59 [s]

Set the *High switching threshold* and the switching delay here. Select a sufficient gap from the low switching threshold to allow the connected function to have an adequate effect on the process between switching on and off.

6.3.6 Outputs/status signals – Time schedule configuration

The view for configuring the time schedules of the analog modules' outputs/status signals is shown in Figure 6.24.

Enabled / Disabled Enable or disable the output/status signal here. Disabled outputs are not activated by the time schedule either.

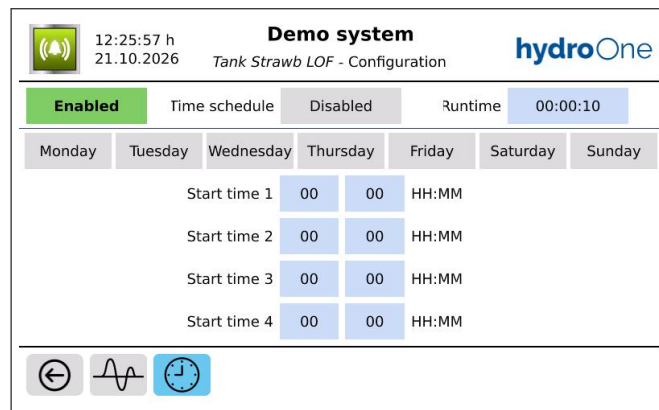


Figure 6.24: Outputs/status signals – Time schedule configuration

Time schedule Use this button to enable or disable the time schedule. If analog control or – for a source output – MIX control is also active, the requests are combined using logical OR.

Runtime Set the runtime of the time schedule in the displayed time format. The runtime starts at each active start time and should suit the connected function; it can be used, for example, for a regular forced run or a time-dependent auxiliary function.

Weekdays Select the weekdays on which the time schedule is active. On weekdays that are not selected, the associated start times are completely suppressed.

Start times Set up to four different start times here. Set a start time to 00:00 to disable it. When using several start times, check that runtimes do not overlap unintentionally and that the connected function is not requested more often than intended.

6.3.7 Outputs/status signals – Manual operation

The manual operation view for the outputs/status signals is shown in Figure 6.25.

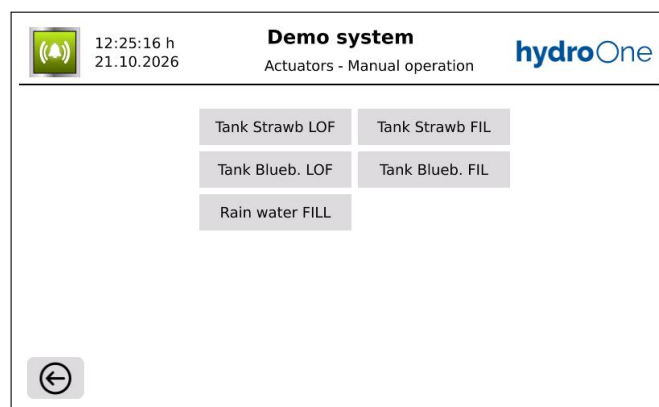


Figure 6.25: Outputs/status signals – Manual operation

Activate or deactivate an output/status signal by tapping the corresponding button. All manual activations end automatically when you leave this view. Disabled outputs or outputs blocked by an electrical interlock cannot be switched on in manual operation either; see Chapter 8.



Manual operation directly controls physical outputs. Automatic interlocks or process conditions may be restricted or ineffective. Only use manual operation under supervision and when the connected component can switch safely.

6.3.8 Outputs/status signals – Statistics

The statistics view for the outputs/status signals is shown in Figure 6.26.

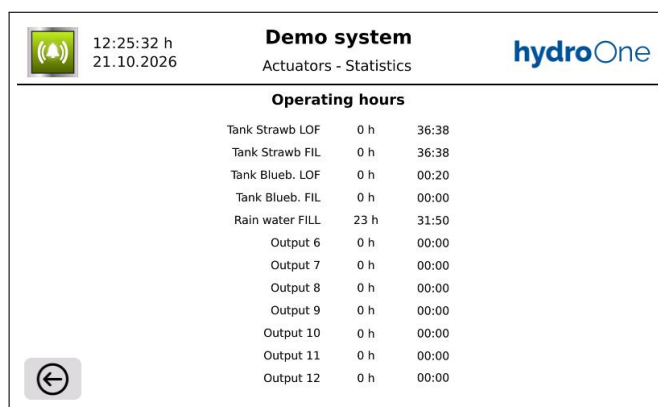


Figure 6.26: Outputs/status signals – Statistics

6.4 Water meters

6.4.1 Main view

The main view of the water meter configuration is shown in Figure 6.27.

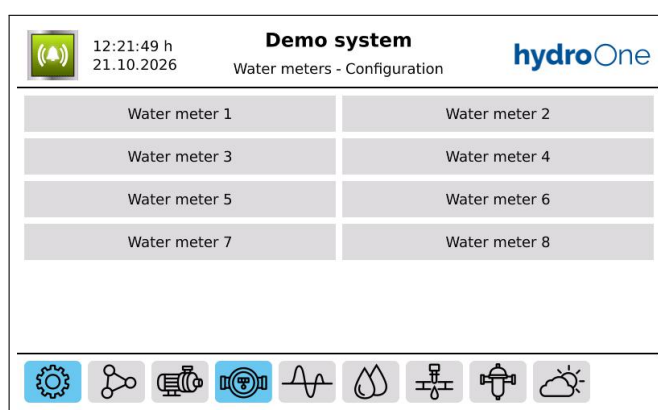


Figure 6.27: Water meter configuration – Main view

6.4.2 Pulse mode configuration

The configuration view for water meters in pulse mode is shown in Figure 6.28.

Enabled / Disabled Enable or disable the relevant water meter here. Only enable measurement points that are actually present. A water meter should be fully configured and its displayed values checked for plausibility before it is selected for flow monitoring, irrigation or dosing. When a water meter is disabled, the current flow rate is set to zero and no further volume is counted; the existing totalizer reading is retained.

Operating mode Select the water meter's operating mode (*Pulse* or analog mode, shown as *Analog input* or *Analog value*). The operating mode must match the signal actually connected. Configuration of analog mode is explained in Section 6.4.3.

Demo system	
Water meter 1 - Configuration	
Enabled	Operating mode: Pulse
	Analog input
Litres per pulse	10.000 l
Evaluation time	05 s
Debounce time	00.100 s
Actual flow rate	0.0 m³/h
Total volume	682.830 m³
Reset total volume	Execute reset

Figure 6.28: Water meters – Pulse mode

Litres per pulse 0.1 – 32000 [litres/pulse]

Enter the number of litres of water represented by one pulse from the contact water meter. Use the value specified for the water meter or its pulse transmitter. An incorrect entry falsifies both the accumulated total volume and the current flow rate calculated from it.

Evaluation time 1 – 59 [s]

Enter the maximum time the system waits for another pulse from the water meter. Once this time has elapsed, the system sets the current flow rate to 0 m³/h. Do not select too short a time. Otherwise, 0 m³/h will be displayed prematurely between two pulses at low flow rates. A very long time, on the other hand, retains the last calculated flow rate for longer even though water may already have stopped flowing. Base the setting on the longest expected pulse interval at a low but still relevant flow rate.

Debounce time Enter the contact debounce time here. Debouncing is particularly useful for mechanical or volt-free contacts that can produce several brief signal changes when switching. Select a value significantly shorter than the shortest actual pulse duration and pulse pause so that valid counting pulses are not suppressed. Even if the input remains on for longer, the same pulse is counted only once; the input must first switch off again before the next pulse can be counted.

Reset total volume Use the *Execute reset* button to reset the water meter's accumulated total volume. Only use this function deliberately, for example after replacing a meter or at the start of a new documented measurement period, as the previous totalizer reading will no longer be available on the display afterwards.

6.4.3 Analog mode configuration

The configuration view for water meters in analog mode is shown in Figure 6.29.

Enabled / Disabled Enable or disable the relevant water meter here. Only enable measurement points that are actually present. A water meter should be fully configured and its displayed values checked for plausibility before it is selected for flow monitoring, irrigation or dosing. When a water meter is disabled, the current flow rate is set to zero and no further volume is counted; the existing totalizer reading is retained.

Operating mode Select the water meter's operating mode (*Pulse* or *Analog value*). The operating mode must match the signal actually connected. Configuration of *Pulse* mode is explained in Section 6.4.2.

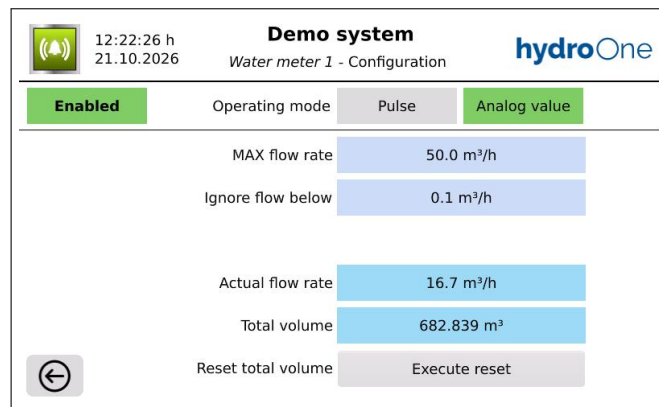


Figure 6.29: Water meters – Analog mode

MAX flow rate *Ignore flow below – 9999 [m³/h]*

Enter the water meter's maximum flow rate. Analog mode uses a 4–20 mA signal; 4 mA corresponds to zero flow and 20 mA to the maximum flow rate set here. Use the corresponding full-scale value from the flow meter's configuration or documentation. If the two values do not match, the flow rate is calculated incorrectly throughout the measuring range.

Ignore flow below *0 – MAX flow rate [m³/h]*

Enter the threshold below which the flow rate is suppressed. Use this function to filter out apparent low flows caused by slight inaccuracies or signal noise near zero. Keep the threshold low enough for genuine small water demands relevant to monitoring or volume measurement to still be detected.

Sensor error If the analog signal falls below the configured sensor error threshold, the system immediately sets the current flow rate to zero and suspends volume counting. If the faulty signal persists for longer than the configured delay, a sensor error is reported. Once the signal is valid again, evaluation resumes and the sensor error indication is cleared. The water volume that actually flowed during the fault cannot be determined retrospectively and is not added to the total afterwards.

Reset total volume The *Execute reset* button also resets the selected water meter's total volume in analog mode. The totalizers of the other water meters are unaffected.

6.5 Irrigation modules

6.5.1 Main view

The main view of the irrigation module configuration is shown in Figure 6.30.

6.5.2 Basic configuration

The basic configuration view for the irrigation modules is shown in Figure 6.31.

Enabled / Disabled Enable or disable the irrigation module here. Disable unused irrigation modules so that their programs, valves and displays are not shown unnecessarily. Only enable the module once its valves and, where applicable, water meters, pump modules and dosing modules have been set up.

If you only use one irrigation module, use irrigation module 1 and leave irrigation module 2 disabled.

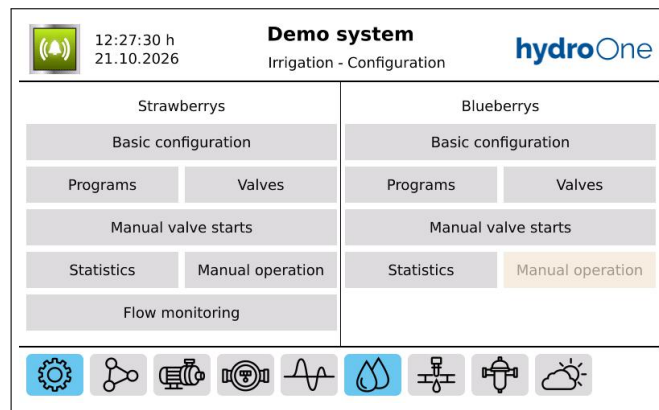


Figure 6.30: Irrigation module configuration – Main view

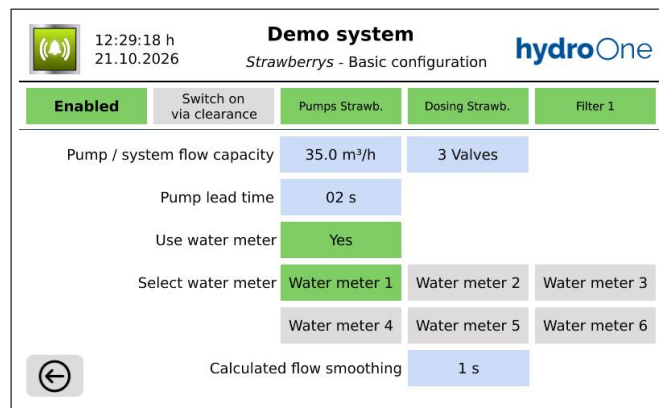


Figure 6.31: Irrigation modules – Basic configuration

Switch on via clearance The *Switch on via clearance* function can be enabled here for the irrigation module. Use this function if applying the external enable signal should also switch the module on so that it is ready for operation. Leave the function disabled if the enable signal should only prevent irrigation when the signal is absent, without switching the module on itself.

Use water meter Use this button to enable or disable the use of a water meter for the irrigation module. When the function is enabled, the water meter chosen under *Select water meter* is used for the irrigation module. This provides a flow display, volume statistics and flow monitoring. First check the water meter separately for plausible readings, as an incorrectly scaled measured value can otherwise result in incorrect statistics and false alarms.

Pump module Use this button to link a pump module to an irrigation module. Irrigation module 1 can only be linked to pump module 1, and irrigation module 2 only to pump module 2. Use the link if irrigation should request the required water supply itself and specify program-specific setpoints. The pump module should first be fully configured and tested independently. Enabling this function has the following effects:

- The linked pump module is switched on automatically as soon as an irrigation program or a manual valve start requests operation.
- In the irrigation program configuration, a separate setpoint can optionally be specified for each program. This is passed to the linked pump module while the program is running. While requested, this program-specific setpoint takes priority over *Set value 1* and *Set value*

2 of the pump module and is shown in the pump overview as the active setpoint specified by irrigation.

- Irrigation cannot start, or is stopped, if the linked pump module is not ready for operation, its enable signal is absent or an alarm is active.
- If the pipe filling function is active in the pump module, valves are not opened until the pipe filling phase has ended.
- The linked pump module can optionally be switched off again automatically after irrigation has finished.

Dosing module Use this button to link a dosing module to an irrigation module. Irrigation module 1 can only be linked to dosing module 1, and irrigation module 2 only to dosing module 2. Only enable this link if automatic dosing is required during irrigation programs and the dosing module has already been set up and tested separately. Enabling this function has the following effects:

- Use of the dosing module can be configured separately for each irrigation program.
- The recipe to be activated together with the irrigation program can be selected in the irrigation program configuration.

Filter module Use the button for the corresponding filter to link irrigation to filter flushing. Irrigation module 1 can be linked to filter 1, and irrigation module 2 to filter 2. When a flush request is active, no further irrigation valves are started. For a normal flush request, valves that are already open first complete their runs; flushing then takes place. After flushing, valves that are still requested can start. An urgent flush, however, does not wait for the running valves to finish. Setting up the filter function is described in Section 6.7.

If an associated pump, dosing or filter module is disabled, its link to irrigation is removed. Check and re-enable the required link when you put the module back into operation.

Pump / system flow capacity 0 – 99999 [m³/h] / 1–35 valves

Enter the maximum permissible flow rate, limited by pump capacity and the hydraulic conditions, and the maximum permissible number of simultaneously active valves for the irrigation module. The system considers both limits at the same time. Which limit is reached first depends on the nominal flow rates entered for the valves. Set both values according to the hydraulically available delivery capacity and the permitted number of simultaneous consumers. Excessive capacity settings can result in insufficient pressure or flow at the open valves; unnecessarily low settings extend the irrigation duration.

When deciding whether another valve may be switched on, *hydroOne* uses only the configured nominal flow rates and capacity limits. The actual flow measured by the water meter does not influence this decision; it is used for the display, volume recording and separately configurable flow monitoring. As soon as a valve is released for its preceding pause, its valve slot and nominal flow are already reserved. A valve that is still closed can therefore already occupy capacity.

Pump lead time 1 – 59 [s]

Enter the lead time for the main contact or the linked pump module before valves are actuated. This lead time applies both to programs and to manual valve starts. The same value also defines the minimum pause between the end of one irrigation run and the start of the next irrigation request. Choose a time that allows the pump, main valve or pressure build-up to be reliably ready before the first irrigation valves open. Times that are too short can cause pressure drops or implausible flow readings at startup.

If a pump module is linked, this time is the minimum pump lead time. If the pipe filling function is enabled for the pumps, the lead phase is extended until pipe filling has finished.

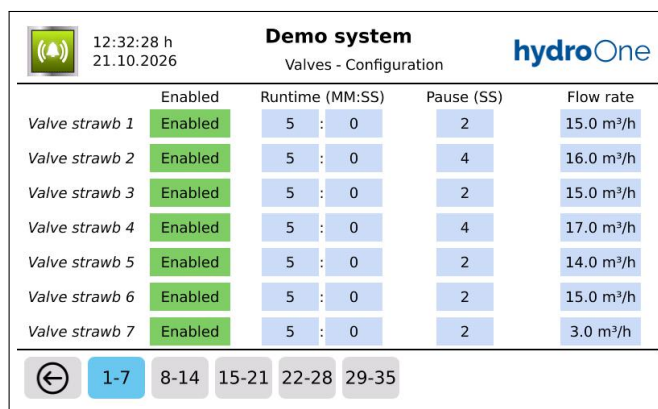
Select water meter Select the water meter to be assigned to the irrigation module. The meter should measure the flow of all valves whose operation is monitored by this irrigation module. Where pipework is shared, ensure that other consumers do not continuously distort flow monitoring.

Calculated flow smoothing Enter the smoothing time in seconds for the flow calculated from the nominal valve flow rates. This smooths sudden changes when valves open or close, for example when dosing uses the calculated flow as its measured value source. The smoothed value is also used as the reference for flow monitoring. A longer smoothing time produces a steadier value but also delays the response to changes; at 0 s, the calculated value is adopted immediately. Capacity checking continues to use the unsmoothed reservations.

24 V AC monitoring On suitably equipped systems, the 24 V AC supply of the irrigation module can be monitored. The relevant settings, displays and behavior when a short circuit is detected are described in Chapter 8.

6.5.3 Valves

The valve configuration view is shown in Figure 6.32.



	Enabled	Runtime (MM:SS)		Pause (SS)	Flow rate
Valve strawb 1	Enabled	5	0	2	15.0 m³/h
Valve strawb 2	Enabled	5	0	4	16.0 m³/h
Valve strawb 3	Enabled	5	0	2	15.0 m³/h
Valve strawb 4	Enabled	5	0	4	17.0 m³/h
Valve strawb 5	Enabled	5	0	2	14.0 m³/h
Valve strawb 6	Enabled	5	0	2	15.0 m³/h
Valve strawb 7	Enabled	5	0	2	3.0 m³/h

Figure 6.32: Valves – Basic configuration

Enabled / Disabled Enable or disable the respective valve here. Disable valves that are not installed, are temporarily out of service or are not permitted to operate for hydraulic reasons. Valves should be removed from irrigation programs before they are disabled.

Runtime (MM:SS) Minutes:Seconds

Enter the valve's basic runtime separately in minutes and seconds. The runtime actually used takes into account the runtime adjustment configured in the program or for manual valve starts. Wherever possible, enter the runtime for normal design conditions here; seasonal or short-term changes can then be made using the runtime adjustment without changing the basic valve data.

Pause time 0 – 59 [s]

Enter the pause to be observed before the valve starts within a running irrigation program. The pause can be used to stabilize hydraulic transitions or maintain a time interval between successive valves. It can be set correspondingly short on systems that do not need this. The first valve can start immediately after the module lead time; for subsequent valves, the configured pause is applied after capacity has been granted.

Flow rate 0 – 9999 [m³/h]

Enter the expected flow rate of the valve. This value is used to calculate expected flow, for irrigation statistics and to release further valves according to available capacity. Enter the actual flow rate or the hydraulically designed flow rate of the zone as accurately as possible. A value that is too low can allow more valves to be released simultaneously than the system can actually supply; a value that is too high unnecessarily reduces the number of valves that can operate in parallel.

If you are unsure of a valve's flow rate, you can, where appropriate, open it manually and read the flow from a connected water meter.

6.5.4 Programs – Basic configuration

The basic configuration view for irrigation programs is shown in Figure 6.33.

Figure 6.33: Irrigation programs – Basic configuration

Enabled / Disabled Enable or disable the respective irrigation program here. Disabled programs are not executed by time control or external start signals; this option disables the program completely. It is advisable to configure a new program fully before enabling it immediately before its functional test.

Priority of multiple requests Only one program run is executed at a time within an irrigation module. If several requests are present simultaneously, manually requested valve starts have the highest priority. The irrigation programs are then evaluated in ascending order: program 1 has the highest priority and program 8 the lowest. A lower-priority request therefore only starts when the module is ready for a new run after the previous program has ended and the request still exists at that time. Schedule automatic start times to avoid continuously competing requests wherever possible.

Weekdays mode Select *Weekdays* to choose the actual days of the week on which the irrigation program may start automatically. This selection provides calendar permission for start times, pulse irrigation and light sum starts. A manual program start, a start via external signals and anti-freeze irrigation are not tied to this day selection. When making seasonal changes in particular, check that the selected days still match the current irrigation schedule.

Runtime adjustment [%]

Enter the percentage change to the basic valve runtimes for the irrigation program. This setting adjusts the runtimes of all valves assigned to the program together, without changing each valve runtime individually. 0 % leaves the basic runtime unchanged, –30 % reduces it by 30 %, and

+20 % increases it by 20 %. The function is suitable, for example, for seasonal adjustments to the water volume. At –100 %, there is no valve runtime.

If a temperature adjustment is also used, the adjustment factors are multiplied. For example, a manual adjustment of +30 % and a temperature adjustment of +20 % result in $1.3 \cdot 1.2 = 1.56$ times the basic runtime, or an overall adjustment of +56 %. Selecting the temperature adjustment is described in Section 6.5.9.

6.5.5 Programs – Cycle

Cycle mode allows a repeating sequence of irrigation and rest days independently of the days of the week. The view is shown in Figure 6.34. Select either *Weekdays* or *Cycle*.

Figure 6.34: Irrigation programs – Cycle

Start date Enter a valid date that defines day 1 of the cycle. This date does not have to be a Monday. The day numbers refer to the cycle rather than to specific weekdays. The start date is a reference date: the pattern is also calculated for days before this date, so it does not block operation until a future start date. If a program should only become available later, leave it disabled until then.

Cycle length 1 – 14 days

Specify the number of calendar days after which the sequence repeats. After the final day, the cycle automatically starts again with day 1. The pattern continues independently of whether irrigation actually took place on an allowed day.

Select irrigation days Enable the day numbers on which automatic starts should be allowed. Only days within the configured cycle length are considered. For example, a cycle length of three days with day 1 and day 2 selected means: allow irrigation for two days, pause for one day, and repeat this sequence. For irrigation every five days, select a cycle length of five days and day 1 only.

The day selection does not itself trigger a start. Also configure the required start times, pulse irrigation or a light sum control. If no irrigation day is selected, these automatic starts are not permitted. Manual program starts, external start signals and anti-freeze irrigation are independent of the day selection.

6.5.6 Programs – Start times

The configuration view for irrigation program start times is shown in Figure 6.35.

12:30:03 h
21.10.2026

Demo system
Strawb summer - Time schedule

hydroOne

Disabled

Start time 1	10	:	00	HH:MM
Start time 2	00	:	00	HH:MM
Start time 3	00	:	00	HH:MM
Start time 4	00	:	00	HH:MM
Start time 5	00	:	00	HH:MM
Start time 6	00	:	00	HH:MM

← 1 2 3 4 5 6 7 8

Figure 6.35: Irrigation programs – Start times

Enabled / Disabled Enable or disable time-controlled execution of the irrigation program here. Only enable this function if the program should start automatically at the configured start times. Time control can remain disabled for programs that are only started by external signals or manually.

Please note that the program must also be enabled in its basic configuration before it can be started at the configured start times.

Start times Set up to six different start times here. Each start time is evaluated once at the beginning of the configured minute. If a program started this way is stopped immediately, the same start time does not trigger another start. Set a start time to 00:00 to disable that entry. Plan start times so that programs do not unnecessarily block one another and sufficient pump or system capacity is available at the intended irrigation times.

6.5.7 Programs – Pulse irrigation

The pulse irrigation configuration view is shown in Figure 6.36.

12:30:19 h
21.10.2026

Demo system
Strawb grow - Pulse irrigation

hydroOne

Enabled

Start time 10 : 00 HH:MM

Pause time between cycles 30 MM

Number of cycles 05 x

← 1 2 3 4 5 6 7 8

Figure 6.36: Irrigation programs – Pulse irrigation

Enabled / Disabled Enable or disable pulse irrigation here. This operating mode is useful when the intended water volume should be applied in several shorter irrigation phases with pauses in between rather than in one long run.

Start time Enter the start time for pulse irrigation. From this time onwards, the system requests the program cyclically. The start time marks the beginning of the entire pulse sequence; subsequent start times are determined by the configured interval and number of cycles.

Pause time between cycles 1 – 99 [min]

Enter the interval between the scheduled start times. This interval is measured from the beginning of the pulse sequence, not from the end of the previous program run. With a start time of 10:00 and an interval of 30 minutes, the next requests occur at 10:30, 11:00, and so on. Choose an interval longer than the program runtime if an actual rest period is required between irrigation runs. While a program is still running, additional complete program runs are not accumulated in a queue.

Number of cycles 1 – 99

Enter the number of irrigation cycles to be executed from the configured start time. The total water volume therefore depends on the program runtime per cycle and the number of repetitions. Check this setting particularly after changing the runtime adjustment.

6.5.8 Programs – External signals

The configuration view for irrigation controlled by external signals is shown in Figure 6.37.

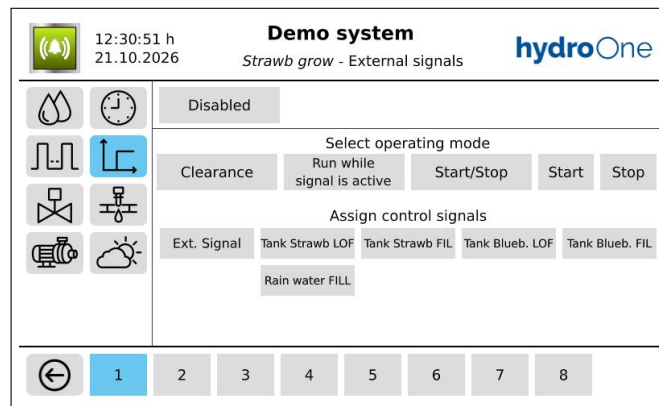


Figure 6.37: Irrigation programs – External signals

Enabled / Disabled Enable or disable evaluation of external signals for the irrigation program here. Use external signals if a program should depend on a pushbutton, a higher-level controller or a system condition. Before enabling this function, check that the selected signal is clearly and plausibly displayed at the operating level.

Select operating mode Select the required operating mode for the external signal. Depending on the selection, the behavior is as follows:

- *Clearance*: The signal acts as an additional enable condition. Existing automatic requests are retained only while the signal is active. If the signal is absent, automatic program starts via start times and pulse irrigation are also prevented.
- *Run while signal is active*: The signal automatically requests the program for as long as it remains active. When the signal is no longer active, the program stops immediately. If the signal is still active after the program has ended, the program starts again from the beginning.
- *Start*: A rising edge of the signal starts the program.
- *Stop*: A rising edge of the signal ends an automatic program request.
- *Start/Stop*: Each rising edge toggles between starting and stopping the automatic program request.

Assign control signals Select the signals to be evaluated for controlling the irrigation program. Status signals/outputs of the analog modules and a program-specific external input signal (*Ext. Signal*) can be used. Rain, frost and storm are configured separately in the program's weather view (Section 6.5.9). Only select signals whose purpose matches the chosen operating mode; for example, a continuously active signal behaves differently in *Clearance* mode than with an edge-triggered *Start* function. Several signals can also be selected; these are logically OR-linked.

6.5.9 Programs – Weather

This view defines which weather functions apply to the individual irrigation program. First configure and test the measured value sources and weather functions as described in Section 6.8.

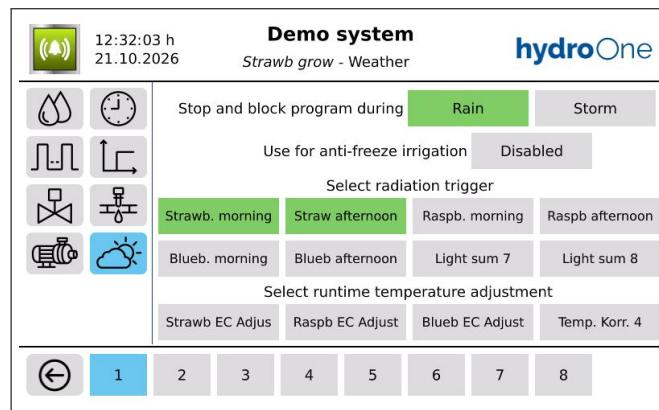


Figure 6.38: Irrigation programs – Weather

Stop and block program during rain or storm Select *Rain* and/or *Storm* to block automatic starts and abort running automatic irrigation when the corresponding central signal is active. After an abort, the program does not resume at the point where it was interrupted. A new automatic request is required once the signal ends. These two program-specific weather interlocks do not prevent manual program starts. Take account of the special priority of anti-freeze irrigation.

Use for anti-freeze irrigation When this function is enabled, the program is continuously requested while the central frost signal is active and is restarted after each run. Anti-freeze irrigation is independent of start times, day selection and light sum, and takes priority over rain and storm interlocks within the program request logic. Manually stopping the individual program does not permanently cancel an ongoing frost request. To end anti-freeze irrigation, disable the corresponding function or program, or switch off the irrigation module. The module enable conditions and shutdown conditions remain effective; an enabled external clearance mode for the program must also have its enable signal present.

Select radiation trigger Select one or more of the eight light sum controls whose start signals should request this program. Each selected control can trigger a start. The program's day selection and other enable conditions are taken into account. The light sum start signal is a single event; a request rejected while an interlock is active is not automatically made up simply because the interlock is later removed.

Select runtime temperature adjustment Select the required temperature adjustment from the four available controls. Its current adjustment is combined with the manual *Runtime adjustment*. If several temperature adjustments are selected, their factors are also multiplied together. A disabled temperature adjustment or an unusable temperature sensor produces no additional runtime change. The adjustment is applied when the valve request is accepted; a valve runtime that has already been accepted is not continuously recalculated during that run.

6.5.10 Programs – Valve selection

The valve selection view for irrigation programs is shown in Figure 6.39.

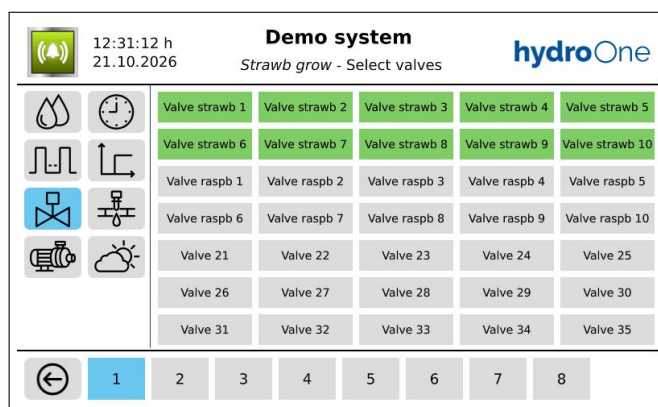


Figure 6.39: Irrigation programs – Valve selection

Valve selection Select the valves to be assigned to the irrigation program. The system automatically actuates the selected valves as part of the program. Depending on the irrigation module's configured capacity, several valves can operate simultaneously. Only assign valves to a program if their combined operation is hydraulically permissible and they belong to the same irrigation task.

6.5.11 Programs – Pump module link

The configuration view for linking a pump module to irrigation programs is shown in Figure 6.40.

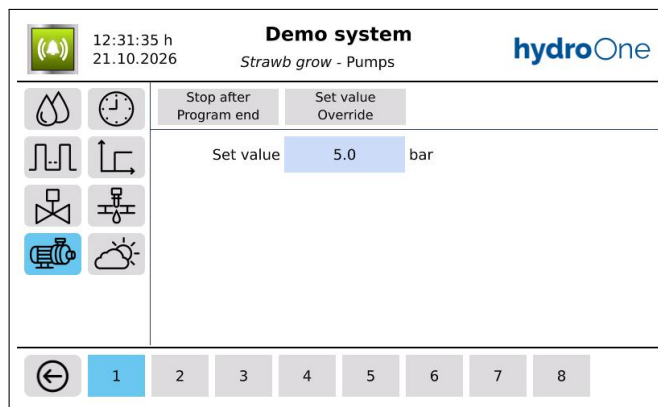


Figure 6.40: Irrigation programs – Pump module link

Stop after program end Specify whether the linked pump module should be stopped again after irrigation has finished. If the function is disabled, the pump module remains switched on after the program ends. Enable this function on systems where irrigation is the only process requesting the water supply. If the pump module is also needed by other functions, check whether automatically switching it off after the program ends is appropriate.

Set value override Enable this function to run the pump module at the setpoint entered under *Set value* during the irrigation program.

Set value Enter the setpoint at which the linked pump module should operate during the irrigation program. This allows different programs to operate with different pressure or delivery conditions. Choose the setpoint according to the hydraulically least favorable valve or consumer in the respective program and within the permitted system limits.

When the program-specific setpoint is active, it takes priority over the pump module's normal setpoint selection. Any *Set value 2* selected via an external contact is therefore ineffective during this time. The pump overview shows that the setpoint is currently specified by irrigation. When the program request ends, this override is removed and the pump module returns to *Set value 1* or, if setpoint switching is active, *Set value 2*.

6.5.12 Programs – Dosing module link

The configuration view for linking a dosing module to irrigation programs is shown in Figure 6.41.

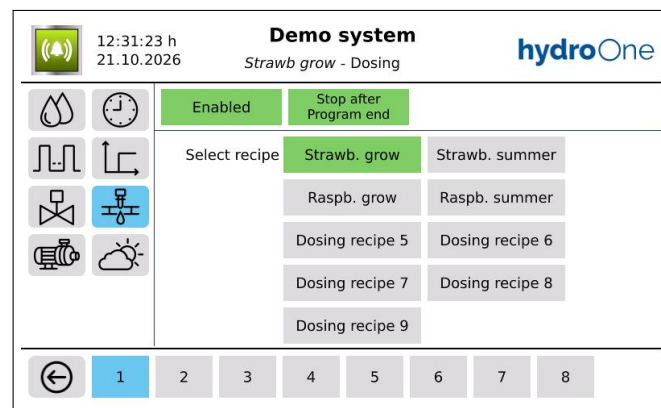


Figure 6.41: Irrigation programs – Dosing module link

Enabled / Disabled Enable or disable use of the dosing module for the respective irrigation program. Only enable this function for programs that actually require dosing. The selected dosing module and its recipe should have been checked separately before the first automatic program run.

Stop after program end Enable this function to switch off the dosing module after the irrigation program ends. This is useful if the dosing module is operated exclusively together with this irrigation program. If it should remain ready for other processes running simultaneously or immediately afterwards, check the intended overall operating logic before enabling this function.

Select recipe Select the recipe to be used during the irrigation program. Use clear recipe names and check the configured dosing values before the first automatic start, particularly after changes to the fertilizer solution, dosing pumps or water flow.

6.5.13 Manual valve starts

The configuration view for manual valve starts is shown in Figure 6.42.

12:32:42 h
21.10.2026

Demo system
Manual starts - Configuration

hydroOne

Enabled ☐ Ignore start request if capacity is unavailable

Days of the week

MO	TU	WE	TH	FR	SA	SU

Allow starts from 08 00 HH:MM

Allow starts until 16 00 HH:MM

Runtime adjustment Direct valve starts -90 %

←

Figure 6.42: Valves – Manual valve starts

Enabled / Disabled Enable or disable manual valve starts here. Each valve can be requested from the irrigation module overview or by an appropriately assigned external digital signal, such as a pushbutton. Disabling this function clears existing manual valve requests. This must be distinguished from direct switching in the separate manual operation mode.

Days of the week Use *MO* to *SU* to select the days on which manual individual valve starts via assigned digital inputs are permitted. These starts require both a selected weekday and the configured enable time window. If no weekday is selected, external individual valve starts are blocked. Starts from the irrigation module overview are independent of the day selection and time window, provided that manual valve starts are enabled and the required module enable conditions are met.

Allow starts from / Allow starts until Enter the time window for manual individual valve starts via digital inputs. Time windows crossing midnight are supported; the current calendar day applies. Identical start and stop times do not provide an enable window. The end of the time window or a change to a day that is not enabled does not stop irrigation already requested. Program starts via digital inputs are configured independently under *Programs – External signals* (Section 6.5.8).

Runtime adjustment – Direct valve starts [%]
Enter the percentage runtime adjustment for valves started manually. This adjusts all valve runtimes together. 0 % uses the basic runtimes; –90 % uses one tenth of them. Use this setting when manual starts should deliberately run for shorter or longer than the basic runtimes, for example for briefly wetting sports grounds.

Ignore start request if capacity is unavailable When this function is enabled, a manual valve request is discarded if there is insufficient flow or valve capacity. It is not stored for an unexpected later start. When the function is disabled, the request can wait for capacity to become available. An active start interlock, for example due to a requested filter flush, is a separate condition.

Conditions for manual starts Manual valve starts via external signals are only possible when the irrigation module has its enable signal. Without this signal, manual requests are cleared. If an external pushbutton does not respond, first check the module enable signal, selected weekday, permitted time window and input signal assignment before changing the valve configuration.

Pump module for manual valve starts A separate setpoint and switching off the linked pump module after irrigation ends can be configured for manual valve starts. The meaning of *Set value override*, *Set value* and *Stop after program end* is the same as in Section 6.5.11.



12:32:55 h
21.10.2026

Demo system

Manual valve starts - Pumps





Stop after
Program end

Set value
Override

Set value

5.0

bar



Figure 6.43: Manual valve starts – Pump module

Dosing module for manual valve starts Only enable dosing if dosing is also required during manual valve starts. Select the appropriate recipe and specify whether the linked dosing module should be switched off afterwards. The settings have the same meaning as in Section 6.5.12.



12:33:10 h
21.10.2026

Demo system

Manual valve starts - Dosing





Disabled

Stop after
Program end

Select recipe

Strawb. grow

Strawb. summer

Raspb. grow

Raspb. summer

Dosing recipe 5

Dosing recipe 6

Dosing recipe 7

Dosing recipe 8

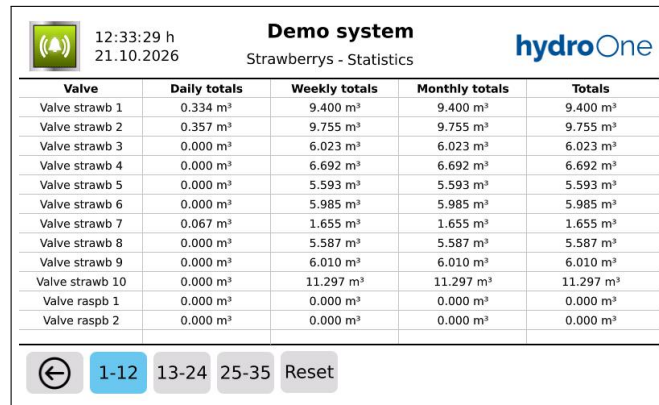
Dosing recipe 9



Figure 6.44: Manual valve starts – Dosing module

6.5.14 Statistics

The valve statistics view is shown in Figure 6.45. Daily, weekly, monthly and total volumes are recorded for each valve. The individual volumes displayed depend on whether the irrigation module uses a water meter.



The screenshot shows a web interface for 'Demo system' with the title 'Strawberrys - Statistics'. It includes a timestamp '12:33:29 h' and '21.10.2026'. The hydroOne logo is in the top right. Below the header is a table with five columns: 'Valve', 'Daily totals', 'Weekly totals', 'Monthly totals', and 'Totals'. The table lists 12 valves, including 'Valve strawb 1' through 'Valve strawb 10' and 'Valve raspb 1' through 'Valve raspb 2'. At the bottom, there are navigation buttons: a back arrow, '1-12' (highlighted), '13-24', '25-35', and 'Reset'.

Valve	Daily totals	Weekly totals	Monthly totals	Totals
Valve strawb 1	0.334 m³	9.400 m³	9.400 m³	9.400 m³
Valve strawb 2	0.357 m³	9.755 m³	9.755 m³	9.755 m³
Valve strawb 3	0.000 m³	6.023 m³	6.023 m³	6.023 m³
Valve strawb 4	0.000 m³	6.692 m³	6.692 m³	6.692 m³
Valve strawb 5	0.000 m³	5.593 m³	5.593 m³	5.593 m³
Valve strawb 6	0.000 m³	5.985 m³	5.985 m³	5.985 m³
Valve strawb 7	0.067 m³	1.655 m³	1.655 m³	1.655 m³
Valve strawb 8	0.000 m³	5.587 m³	5.587 m³	5.587 m³
Valve strawb 9	0.000 m³	6.010 m³	6.010 m³	6.010 m³
Valve strawb 10	0.000 m³	11.297 m³	11.297 m³	11.297 m³
Valve raspb 1	0.000 m³	0.000 m³	0.000 m³	0.000 m³
Valve raspb 2	0.000 m³	0.000 m³	0.000 m³	0.000 m³

Figure 6.45: Valves – Statistics

Determining volumes with a water meter If a water meter is enabled for the irrigation module, *hydroOne* uses the irrigation module's actual measured total flow. If several valves are open simultaneously, this shared measurement cannot be assigned directly to an individual valve. The measured total flow is therefore divided proportionally according to the configured nominal flow rates of the simultaneously active valves. For an individual active valve, the approximate relationship is:

$$Q_{\text{valve}} = Q_{\text{measured}} \cdot \frac{Q_{\text{nominal, valve}}}{Q_{\text{nominal, total}}}$$

Here, $Q_{\text{nominal, total}}$ is the sum of the configured nominal flow rates of all currently active valves. For example, if two valves with configured nominal flow rates of 4 m³/h and 8 m³/h operate simultaneously at a measured total flow of 12 m³/h, calculated flows of 4 m³/h and 8 m³/h are assigned to the two valves respectively. If the actual zone flow rates differ significantly from the configured nominal flow rates, the calculated allocation of volumes is affected accordingly.

Determining volumes without a water meter If no water meter is enabled for the irrigation module, the valve volume is not measured but calculated solely from the configured nominal flow rate and the actual valve runtime. In this case, the statistics are a calculated estimate of consumption.

Meaning of the individual volumes The valve statistics are used to evaluate operation and consumption. With a shared water meter, even when measurement is enabled, the figures are not separately measured volumes for each valve; they are a proportional allocation derived from the measured total flow. For meaningful values, the water meter, nominal valve flow rates and valve runtimes must therefore be configured correctly. The daily values restart at the change of day, the weekly values at the beginning of the week, and the monthly values on the first day of the month. The total value is a continuously accumulating totalizer and can be reset using the corresponding operating function if required.

6.5.15 Manual operation

The manual operation view for the irrigation modules is shown in Figure 6.46.

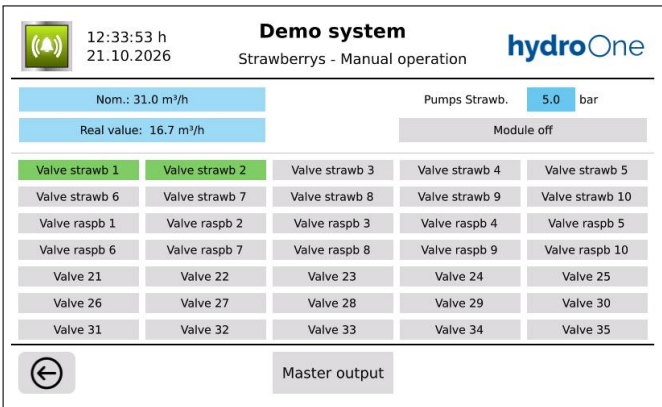


Figure 6.46: Irrigation modules – Manual operation

In manual operation, the valves and the irrigation module's main contact can be actuated manually. The expected and measured flow rates are displayed. If a pump module is linked, its status and actual value are also shown here.



In manual operation, valves and the main contact are actuated directly. Automatic program sequences, capacity logic and other operational interlocks may be restricted or ineffective. Only use manual operation under supervision and check before each switching action that the connected components can be operated safely.

6.5.16 Flow monitoring

The configuration view for irrigation flow monitoring is shown in Figure 6.47. Flow monitoring is only available if a water meter is enabled in the irrigation module's basic configuration.

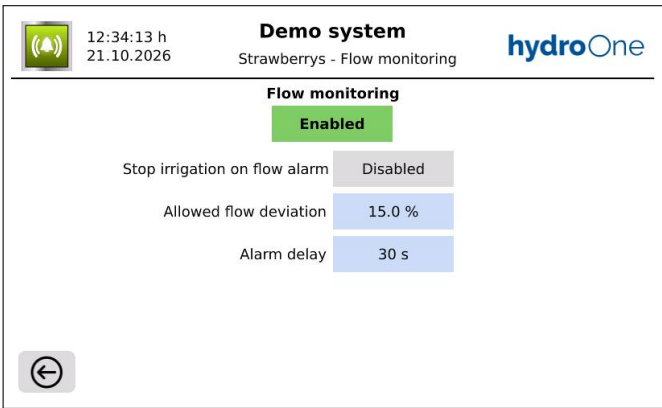


Figure 6.47: Irrigation modules – Flow monitoring

Enabled / Disabled Enable or disable flow monitoring here. Only enable it once the configured valve flow rates and the assigned water meter have been checked for plausibility.

Stop irrigation on flow alarm Enable this function to stop running irrigation when the flow alarm is triggered. The currently running irrigation program is aborted completely. It does not resume at the point of interruption after the alarm clears or is acknowledged. A restart only occurs in response to a new program request, for example manually, via an external signal or at the next

valid start time. This function is particularly useful where a significant flow deviation may indicate a burst pipe, a closed valve or a missing water supply and continued irrigation would be undesirable.

Allowed flow deviation 1 – 100 [%]

The expected flow is calculated from the configured flow rates of the valves that are actually actuated and permitted to operate, then smoothed according to the configured smoothing time. Waiting valves and valves in their preceding pause are not counted as consuming water. Enter the percentage by which the actual measured flow may deviate from the expected flow. Choose a tolerance large enough to accommodate normal pressure and flow fluctuations, but small enough to detect relevant deviations reliably. This requires realistic valve flow rates and a water meter providing plausible readings.

Alarm delay 1 – 59 [s]

Enter the delay time for the flow alarm. The system only triggers the alarm if the deviation persists for longer than this time. Take into account the time needed for the flow to stabilize after valves open or close. A delay that is too short can easily cause false alarms, particularly in large pipe networks.

6.6 Dosing modules

6.6.1 Main view

The main view for configuring the dosing modules is shown in Figure 6.48. Each dosing module provides basic configuration, nine dosing channels, nine recipes and manual operation. The four agitators are configured using the shared button.

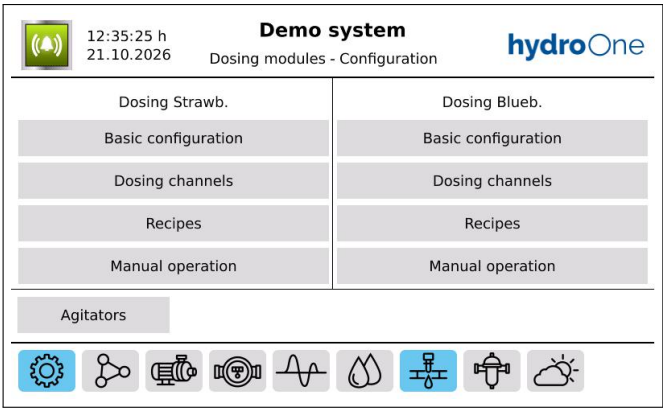


Figure 6.48: Dosing module configuration – main view

6.6.2 Basic configuration

The basic configuration view for the dosing modules is shown in Figure 6.49.

Demo system			
Dosing Strawb. - Basic configuration			
Enabled	EC measurem.	pH measurem.	Switch on via clearance
Select water meter	Water meter 1	Water meter 2	Strawberrys
	Water meter 3	Water meter 4	Water meter 5
Select temperature adjustment	Strawb EC Adjust	Raspb EC Adjust	Blueb EC Adjust
MIN flow for dosing	10.0 m³/h		
Booster pump follow-up time	05.000 s		
General EC pH			

Figure 6.49: Dosing modules – basic configuration

Enabled / Disabled Enable or disable the dosing module here. Only enable the module once the flow measurement, dosing channels and, where applicable, EC/pH sensors are providing plausible results. Disabling a module also disables its EC and pH measurements, both controllers and its associated dosing channels. If dosing is disabled globally at the installation level, this applies to both modules. After re-enabling a module, the measurements, controllers and channels actually required must be enabled again individually. Any existing coupling to the irrigation module is removed when the dosing module is disabled.

Switch on via clearance Enable this function if the dosing module is to switch on automatically when its enable signal is applied or restored. This function is suitable for systems where the external enable signal also represents an explicit request to operate. If the enable signal should merely prevent dosing when a required system condition is not met, without switching the module on itself, leave this function disabled. Note the fundamental distinction between the *enable signal (clearance)* and *Switch on via clearance* in Section 3.3.



Only enable *Switch on via clearance* if automatic restarting of dosing is permissible under the intended system conditions and the required protective measures have been implemented.

EC measurement Enable EC measurement if a suitable sensor is connected and its signal is to be evaluated. Before enabling alarms or control, check the displayed EC value against a suitable reference or as part of the specified sensor test. Otherwise, an incorrect measurement will directly affect EC control.

pH measurement Enable pH measurement if a suitable sensor is connected and its signal is to be evaluated. pH sensors are sensitive to their condition, calibration and installation conditions. Therefore, first check that the measured value is plausible before enabling pH-dependent dosing channels.

Select water meter Select the flow source for the dosing module. Use a water meter that measures the actual water flow to be treated. Alternatively, the calculated flow of the associated irrigation module can be used; this is derived from the configured flow rates of the actuated valves and smoothed. Select exactly one flow source.

The calculated irrigation flow is not a measured water flow. Incorrect valve flow rates, blocked pipes or a missing water supply are therefore not detected as actual flow deviations. For flow-proportional dosing, the configured values must consequently match the actual system.

Select temperature adjustment If required, select one of the temperature adjustments configured in the weather module. Temperature adjustment modifies the recipe's EC setpoint and the flow-proportional settings of automatic channels whose *Affects* setting is *EC* or *None*. Channels set to affect *pH* and fixed manual settings remain unaffected. If several temperature adjustments are selected, their adjustment factors are multiplied together.

For example, an adjustment of -20% reduces an EC setpoint of 2.0 mS to 1.6 mS and an associated recipe value of 5.0 L/m³ to 4.0 L/m³. The stored recipe values are retained. Temperature adjustment requires an enabled weather function and a valid temperature adjustment; its configuration is described in Section 6.8. It adapts dosing to crop conditions and must not be confused with temperature compensation in the EC measuring instrument.

MIN flow for dosing 0 – 99999 [m³/h]

Enter the minimum flow rate at which the dosing module is permitted to dose. Below this limit, automatic dosing requests remain inhibited; direct manual operation is independent of this. Select a value that permits dosing only once the water flow is stable and sufficient for mixing. The value should be above measurement noise or small residual flows, but not so high that normal operating conditions are unnecessarily inhibited. This function provides operational monitoring and limitation; it does not replace independent protective measures where these are required for the overall system.

Booster pump follow-up time The booster pump is requested when dosing is required and can continue running for the configured time after dosing ends. Enter the time in seconds according to the displayed time format. A follow-up time of 0 means that no timed run-on takes place. The dosing module's external enable signal must be present for automatic operation and the follow-up period. Direct manual operation of the booster pump is independent of this.

6.6.3 EC measurement and controller configuration

The configuration view for the dosing modules' EC measurement and EC controller is shown in Figure 6.50.

Demo system		hydroOne	
Dosing Strawb. - EC configuration			
EC MAX Alarm / delay	5.0 mS	30 s	
EC MIN Alarm / delay	0.5 mS	30 s	
Measurement smoothing	1 s		
EC control	Disabled	Control gain	1.0
Control cycle time	05.000 s	Dosing adjustment limits	
MIN flow for control	1.0 m ³ /h	Decrease	Increase
		50 %	50 %

Navigation: General | **EC** | pH

Figure 6.50: Dosing modules – EC measurement and controller

Measurement smoothing Measurement smoothing stabilizes the display and evaluation of the EC measurement during brief fluctuations. A higher value in seconds produces a steadier but slower-responding measurement. At 0 s, the measurement is used without smoothing. Select smoothing that still allows actual changes to be detected sufficiently quickly.

Sensor error If the input signal falls below the configured sensor error threshold, EC control is inhibited immediately and its control adjustment is removed; the sensor error message appears once the configured delay has elapsed. The sensor error message clears automatically when the signal becomes valid again. During a sensor error, no additional MIN/MAX alarms are generated from this measurement. Flow-proportional dosing according to the recipe can continue if the required enable signals remain present; a sensor error therefore does not automatically mean that all dosing outputs are switched off.

EC MIN Alarm / delay 0 – EC MAX Alarm [mS]

The EC MIN alarm defines the lowest permissible measured EC value. If the actual EC value remains below this limit for longer than the configured delay, an EC MIN alarm is triggered and the dosing module is switched off.

The delay prevents brief measurement or mixing fluctuations from causing an immediate shut-down. Set the alarm threshold sufficiently far from the normal control range, but within the limits permissible for the crop, water and system.

Too short a delay can cause unnecessary shutdowns. Too long a delay can result in a persistently low EC value being detected too late.

EC MAX Alarm / delay EC MIN Alarm – 10 [mS]

The EC MAX alarm defines the highest permissible measured EC value. If the actual EC value remains above this limit for longer than the configured delay, an EC MAX alarm is triggered and the dosing module is switched off.

The delay allows brief exceedances during mixing or control to pass without triggering an alarm. Select the alarm threshold so that impermissibly high conductivity is reliably detected, while normal brief fluctuations do not cause unnecessary shutdowns.

Too short a delay can cause unnecessary shutdowns. Too long a delay can result in a persistently high EC value being detected too late.

The dosing module can be switched on again even while the alarm message is still active. Another automatic shutdown occurs only after the respective alarm condition has first cleared and then been triggered again.



The EC alarm function provides operational monitoring and is not a safety-related interlock. If continued operation with an active EC alarm is not permissible for the particular system, suitable additional protective measures must be provided.

EC control Enable EC control to adjust the dosing rate of the EC dosing channels automatically and bring the measured value towards the EC setpoint specified by the currently active recipe.

Control operates only with a valid measurement, the required enable signal and sufficient flow for dosing and EC control. At least one enabled automatic EC dosing channel must have a recipe demand. A temporary reduction to zero does not prevent the controller from subsequently increasing the dosing rate again; channels in direct manual operation do not initiate an automatic control adjustment.

At intervals specified by the *Control cycle time*, the controller compares the current actual EC value with the specified EC setpoint. An adjustment to the dosing rate is calculated from the control deviation and the configured control gain.

The controller is intended to continually correct flow-proportional dosing that is already fundamentally set up correctly. It should therefore only need to make moderate adjustments to the dosing rate. If control regularly reaches its limits or the setpoint is reached only very slowly, first check the recipe, stock solution, actual dosing rate, mixing and sensor condition.

Control gain -100 – 100

The magnitude of the control gain determines how much the dosing rate changes at each controller evaluation. Its sign determines the direction of control.

With a **positive control gain**, the dosing rate increases when the actual EC value is below the setpoint and decreases when the actual value is above the setpoint. This is the usual control direction for a dosing medium whose addition increases the EC value.

A **negative control gain** reverses the control direction. The dosing rate then increases when the actual value is above the setpoint. A negative control gain must therefore only be used if adding the medium actually reduces the controlled measurement.

Start with a small control gain magnitude and observe the control response. Too large a magnitude can cause overshoot and unstable control. With an incorrectly selected sign, control amplifies the existing deviation.

Dosing adjustment limits – Decrease 5 – 99 [%]

This parameter specifies how far automatic EC control may reduce the dosing rate specified in the recipe.

For example, if the recipe specifies a dosing rate of 10 L/m³ and a decrease limit of 50 % is set, the controller can reduce the dosing rate to 5 L/m³.

Dosing adjustment limits – Increase 5 – 99 [%]

This parameter specifies how far automatic EC control may increase the dosing rate specified in the recipe.

For example, if the recipe specifies a dosing rate of 10 L/m³ and an increase limit of 50 % is set, the controller can increase the dosing rate to 15 L/m³.

Regardless of these adjustment limits, the actual permissible dosing rate is also restricted by the minimum and maximum dosing rates configured for the respective dosing channel.

MIN flow for control 0 – 99999 [m³/h]

Enter the minimum flow rate at which EC control is permitted to become active. Below this limit, automatic EC control remains inactive.

Select the value so that sufficient mixing is achieved and the EC sensor measures a representative value before control changes the dosing rate. The minimum flow for control can therefore be set higher than the minimum flow required for dosing alone.

6.6.4 pH measurement and controller configuration

The configuration view for the dosing modules' pH measurement and pH controller is shown in Figure 6.51.

The screenshot shows the 'pH configuration' screen for a 'Demo system'. At the top, it displays the time '12:36:09 h' and date '21.10.2026'. The title is 'Dosing Strawb. - pH configuration' with the 'hydroOne' logo. The settings are as follows:

Parameter	Value
pH MAX Alarm / delay	9.0 / 30 s
pH MIN Alarm / delay	3.0 / 30 s
Measurement smoothing	1 s
pH control	Disabled
Control gain	1.0
Control cycle time	05.000 s
MIN flow for control	1.0 m³/h
Dosing adjustment limits	Decrease: 50 %, Increase: 50 %

At the bottom, there are navigation buttons: a back arrow, 'General', 'EC', and 'pH' (which is currently selected).

Figure 6.51: Dosing modules – pH measurement and controller

Measurement smoothing Measurement smoothing stabilizes the display and evaluation of the pH measurement during brief fluctuations. A higher value in seconds produces a steadier but slower-responding measurement. At 0 s, the measurement is used without smoothing. Select smoothing that still allows actual changes to be detected sufficiently quickly.

Sensor error If the input signal falls below the configured sensor error threshold, pH control is inhibited immediately and its control adjustment is removed; the sensor error message appears once the configured delay has elapsed. The sensor error message clears automatically when the signal becomes valid again. During a sensor error, no additional MIN/MAX alarms are generated from this measurement. Flow-proportional dosing according to the recipe can continue if the required enable signals remain present; a sensor error therefore does not automatically mean that all dosing outputs are switched off.

pH MIN Alarm / delay **0 – pH MAX Alarm**

The pH MIN alarm defines the lowest permissible measured pH value. If the actual pH value remains below this limit for longer than the configured delay, a pH MIN alarm is triggered and the dosing module is switched off.

The delay prevents brief measurement or mixing fluctuations from causing an immediate shut-down. Set the alarm threshold sufficiently far from the normal control range, but within the limits permissible for the crop, water and system.

Too short a delay can cause unnecessary shutdowns. Too long a delay can result in a persistently low pH value being detected too late.

pH MAX Alarm / delay **pH MIN Alarm – 14**

The pH MAX alarm defines the highest permissible measured pH value. If the actual pH value remains above this limit for longer than the configured delay, a pH MAX alarm is triggered and the dosing module is switched off.

The delay allows brief exceedances during mixing or control to pass without triggering an alarm. Select the alarm threshold so that an impermissibly high pH value is reliably detected, while normal brief fluctuations do not cause unnecessary shutdowns.

Too short a delay can cause unnecessary shutdowns. Too long a delay can result in a persistently high pH value being detected too late.

The dosing module can be switched on again even while the alarm message is still active. Another automatic shutdown occurs only after the respective alarm condition has first cleared and then been triggered again.



The pH alarm function provides operational monitoring and is not a safety-related interlock. If continued operation with an active pH alarm is not permissible for the particular system, suitable additional protective measures must be provided.

pH control Enable pH control to adjust the dosing rate of the pH dosing channels automatically and bring the measured value towards the pH setpoint specified by the currently active recipe.

Control operates only with a valid measurement, the required enable signal and sufficient flow for dosing and pH control. At least one enabled automatic pH dosing channel must have a recipe demand. A temporary reduction to zero does not prevent the controller from subsequently increasing the dosing rate again; channels in direct manual operation do not initiate an automatic control adjustment.

At intervals specified by the *Control cycle time*, the controller compares the current actual pH value with the specified pH setpoint. An adjustment to the dosing rate is calculated from the control deviation and the configured control gain.

The controller is intended to continually correct flow-proportional dosing that is already fundamentally set up correctly. It should therefore only need to make moderate adjustments to the dosing rate. If control regularly reaches its limits or the setpoint is reached only very slowly, first check the recipe, stock solution, actual dosing rate, mixing and sensor condition.

Control gain -100 – 100

The magnitude of the control gain determines how much the dosing rate changes at each controller evaluation. Its sign determines the direction of control.

With a **positive control gain**, the dosing rate increases when the actual pH value is below the setpoint and decreases when the actual value is above the setpoint. A positive control gain is therefore intended for a dosing medium whose addition raises the pH value, for example an alkaline pH increaser.

If **acid is dosed to lower the pH value**, the control gain must be set **negative**. When the actual pH value is above the setpoint, acid dosing increases. As the pH value approaches or falls below the setpoint, the dosing rate is reduced again.

Start with a small control gain magnitude and observe the control response. Too large a magnitude can cause overshoot and unstable control. With an incorrectly selected sign, control amplifies the existing deviation.



Before automatic operation, always check that the sign of the control gain matches the chemical effect of the connected dosing medium. With the wrong sign, control amplifies the pH deviation and can drive the measured value into an alarm range. Therefore, carry out initial commissioning with a small control gain magnitude while observing the actual pH trend.

Dosing adjustment limits – Decrease 5 – 99 [%]

This parameter specifies how far automatic pH control may reduce the dosing rate specified in the recipe.

For example, if the recipe specifies a dosing rate of 10 L/m³ and a decrease limit of 50 % is set, the controller can reduce the dosing rate to 5 L/m³.

Dosing adjustment limits – Increase 5 – 99 [%]

This parameter specifies how far automatic pH control may increase the dosing rate specified in the recipe.

For example, if the recipe specifies a dosing rate of 10 L/m³ and an increase limit of 50 % is set, the controller can increase the dosing rate to 15 L/m³.

Regardless of these adjustment limits, the actual permissible dosing rate is also restricted by the minimum and maximum dosing rates configured for the respective dosing channel.

MIN flow for control 0 – 99999 [m³/h]

Enter the minimum flow rate at which pH control is permitted to become active. Below this limit, automatic pH control remains inactive.

Select the value so that sufficient mixing is achieved and the pH sensor measures a representative value before control changes the dosing rate. The minimum flow for control can therefore be set higher than the minimum flow required for dosing alone.

6.6.5 Dosing channel configuration

The configuration views for dosing channels in pulse and analog operation are shown in Figures 6.52 and 6.53.

12:36:41 h 21.10.2026		Demo system		hydroOne	
Dos. channel A - Configuration					
Enabled	Operating mode	Analog value	Pulse		
	Affects	EC	pH	None	
	Maximum dosing rate	400.0 l/h			
	Lower limit	2.0 l/h	Upper limit	400.0 l/h	
	Minimum on time	1.5 s			
	Minimum off time	1.5 s			
← 1 2 3 4 5 6 7 8 9					

Figure 6.52: Dosing channel configuration

12:39:45 h 21.10.2026		Demo system		hydroOne	
Dos. channel A - Configuration					
Enabled	Operating mode	Analog value	Pulse		
	Affects	EC	pH	None	
	Maximum dosing rate	400.0 l/h			
	Lower limit	2.0 l/h	Upper limit	400.0 l/h	
← 1 2 3 4 5 6 7 8 9					

Figure 6.53: Dosing channel – analog operation

Enabled / Disabled Enable or disable the respective dosing channel here. Disabled channels do not output a setpoint. Also disable unused channels or channels temporarily out of service even if a dosing value is still stored in the recipe; this keeps it clear which media can actually be dosed.

Operating mode Specify whether the channel is controlled by an analog or digital (pulse) signal. With analog control, the calculated dosing rate is scaled to a 4–20 mA signal. With digital control (pulse), the output is switched proportionally over time (PWM/pulse). The selection must match the dosing pump or dosing valve actually connected; an incorrect operating mode means that the calculated dosing rate will not be implemented correctly.

Select *Analog value* for *hydroOne dos* dosing pumps and *Pulse* for the channels of a *hydroOne dos* fertilizer mixer.

Affects Specify whether the channel affects EC or pH. If *None* is selected, the channel operates proportionally to flow without an EC or pH control adjustment; a selected temperature adjustment is still taken into account. Only assign media to a controller if adding them actually affects the relevant measurement in the intended direction. An incorrect assignment can cause control to amplify the deviation instead of correcting it.

Maximum dosing rate *Upper limit – 99999 [L/h]*

Enter the channel's maximum capacity or dosing rate here. This value is the reference for scaling the analog output and for time-proportional control of the digital output. Wherever possible, use the maximum delivery rate achievable by the connected dosing device under actual operating conditions. If the setting is too high or too low, the actual quantity dosed will not match the calculated demand.

Lower limit *0 – Upper limit [L/h]*

The lower limit specifies the smallest dosing rate at which the dosing channel is actuated. If the calculated dosing rate falls below this value, the dosing channel is **not actuated**; the output dosing value is set to 0.

The corresponding dosing value is output only when the calculated dosing rate reaches or exceeds the lower limit. Set the lower limit according to the smallest dosing rate at which the connected dosing pump or dosing valve can still operate reliably and usefully.

Upper limit *Lower limit – Maximum dosing rate [L/h]*

The upper limit restricts the channel's maximum permissible dosing rate. If the calculated dosing rate exceeds this value, the output dosing rate is limited to the upper limit.

The upper limit can be used to restrict the usable operating range of the connected dosing device independently of its configured maximum capacity. Set the value according to the maximum permissible dosing rate or the rate intended for the particular application.

Minimum on time and minimum off time These parameters are displayed only for channels in pulse operation and are entered in seconds. The minimum on time defines the shortest regular dosing phase; the minimum off time defines the shortest pause between two dosing phases. Both times must be greater than 0 and suitable for the connected valve or dosing device.

From the ratio between the requested dosing rate and maximum capacity, *hydroOne* calculates the required on and off times. At low demand, short dosing phases are separated by correspondingly long pauses. At higher demand, the on phase is extended so that the minimum pause can be maintained. At full requested capacity, the output can remain switched on continuously.

Example: With a maximum capacity of 400 l/h, a demand of 80 l/h and minimum times of 1.5 s each, constant demand results in an on time of 1.5 s and a pause of 6 s.

The pulse sequence takes changes in current flow and dosing demand into account even during an ongoing pause. If demand rises, the next pulse can begin earlier; if demand falls, the pause is extended accordingly. When demand falls, an ongoing on phase can end early once the minimum on time has elapsed. If demand disappears or automatic inhibition takes effect, the output switches off immediately, even if the minimum on time has not yet elapsed.

Short minimum times provide a finer distribution over time, but increase switching frequency. Select times that allow the dosing device to switch reliably and remain within its permissible switching frequency.

6.6.6 Recipes

The configuration view for dosing recipes is shown in Figure 6.54.

12:40:04 h 21.10.2026		Demo system Strawb. grow - Configuration		hydroOne	
Enabled		EC set value	1.0 mS	pH set value	7.0 pH
Dos. channel A	5.0 l/m³	Dos. channel B	4.0 l/m³		
Dos. channel C	3.0 l/m³	Acid	0.5 l/m³		
Dos. channel 5	0.0 l/m³	Dos. channel 6	0.0 l/m³		
Dos. channel 7	0.0 l/m³	Dos. channel 8	0.0 l/m³		
Dos. channel 9	0.0 l/m³				
← 1 2 3 4 5 6 7 8 9					

Figure 6.54: Recipes

Enabled / Disabled Enable the recipes to be used for the system. Assign clear names and, before selecting a recipe, check its setpoints and the settings of all dosing channels.

EC set value and pH set value The EC and pH setpoints are stored in the recipe. These setpoints are used by the respective controllers if measurement and control are enabled. Match the values to the water quality, crop and dosing media used. Changing the recipe therefore changes not only the basic flow-proportional dosing, but potentially also the target values of active EC/pH control.

Recipe values for dosing channels Each recipe stores the dosing values for the nine channels of a dosing module in l/m^3 . The recipe value specifies how many liters of the respective dosing medium are to be dosed per cubic meter of water. During operation, the system calculates the required basic dosing rate from the recipe value and current water flow:

$$\text{Dosing rate [l/h]} = \text{Recipe value [l/m}^3\text{]} \times \text{Water flow [m}^3\text{/h]}$$

Example: A recipe value of 2.0 l/m^3 and a water flow of $20 \text{ m}^3\text{/h}$ result in a requested dosing rate of 40 l/h . EC/pH control adjustments and the lower and upper limits of the respective dosing channel are then taken into account where applicable.

6.6.7 Manual operation

The manual operation view is shown in Figure 6.55. The upper area displays flow, EC, pH and the associated pump value.

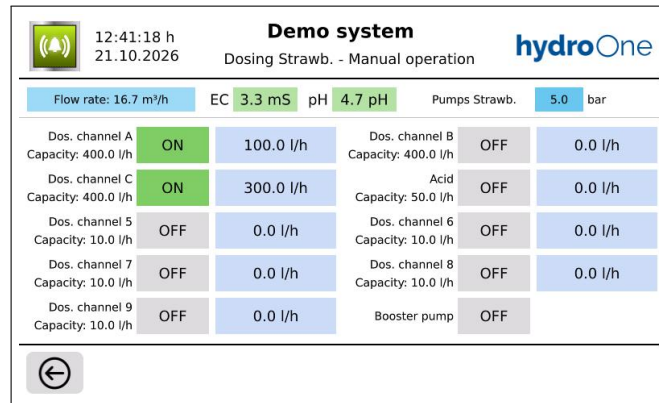


Figure 6.55: Dosing module – manual operation

Dosing channels Enter a fixed dosing rate in l/h for the required channel and switch its manual operation on or off using *ON / OFF*. The channel must be enabled in the configuration. The setting is output as an analog signal or pulse sequence according to the configured operating mode and remains limited to the channel's maximum capacity.



Direct manual operation bypasses automatic enable conditions, minimum flow, external signals, recipe and control adjustments, and the lower and upper dosing limits. Use it only under direct supervision and with the water and dosing paths prepared. Explicitly end all manual requests after testing.

Booster pump The booster pump can be switched on and off directly using its own button. This manual request is independent of automatic enable conditions and the follow-up time. Before switching it on, make sure that water is available to the pump and that the intended flow path is open.

6.6.8 Agitators

The agitator configuration view is shown in Figure 6.56. Up to four separate agitators can be configured.

	Start time	Pulse duration	Off time
Day	08 : 00 HH:MM	30 MM	30 MM
Night	22 : 00 HH:MM	90 MM	10 MM
During dosing		60 MM	0 MM
Manual runtime		01:00 HH:MM	

Figure 6.56: Agitator configuration

Enabled / Disabled Enable or disable the agitator here. Only enable agitators that are actually present and, before automatic operation, check the direction of rotation, tank level and freedom of mechanical movement.

Dosing modules Assign the agitator to one or both dosing modules here. The assignment determines which active dosing operation uses the *During dosing* operating mode. Only assign an agitator to dosing modules whose media are supplied from the respective tank or mixing system.

Agitator operation Agitators operate in three different modes: during dosing, during the day and at night. The start of daytime and nighttime can be set.

A pulse duration and off time are stored for each of the three operating modes. With a pulse duration of 0, the agitator is inactive during that period; with an off time of 0, it remains continuously active. Use different pulse/off times if the medium needs more intensive mixing during active dosing than during standby periods. The setting should prevent settling or separation without running the agitator continuously when unnecessary.

The *During dosing* mode takes priority over time-dependent day/night operation. As soon as at least one dosing module assigned to the agitator is actually dosing, the agitator uses the pulse duration and off time configured for dosing operation. After dosing ends, it automatically returns to the day or night mode applicable to the current time of day.

Manual runtime Each agitator can be requested manually from the dosing module overview or using an external pushbutton. It then runs for the time configured here. Select the time so that, for example, sufficient homogenization can take place before dosing without an accidentally triggered manual start causing unnecessarily prolonged operation.



A manual agitator request can start the agitator immediately. Before making the request, make sure that the tank, agitator and working area are prepared for operation and that no one can be endangered by moving parts or escaping medium.

6.7 Filter modules

The filter modules control automatic flushing of up to two filter systems, each with up to five chambers. A main valve, individual chamber valves and two pressure measurements are available for each filter system. The pressure difference between the filter inlet and outlet provides the request for automatic flushing.

Filter module 1 can be coupled to irrigation module 1, and filter module 2 to irrigation module 2. Coupling is enabled in the basic configuration of the respective irrigation module (Section 6.5). It coordinates the flushing sequence with the irrigation valves in operation; it does not replace the hydraulic supply required by the filter during flushing.

6.7.1 Main view

The main filter configuration view is shown in Figure 6.57. Select *Basic configuration*, *Flush times* or *Manual operation* for the required filter module. Operation while the system is running is described in Section 7.7.

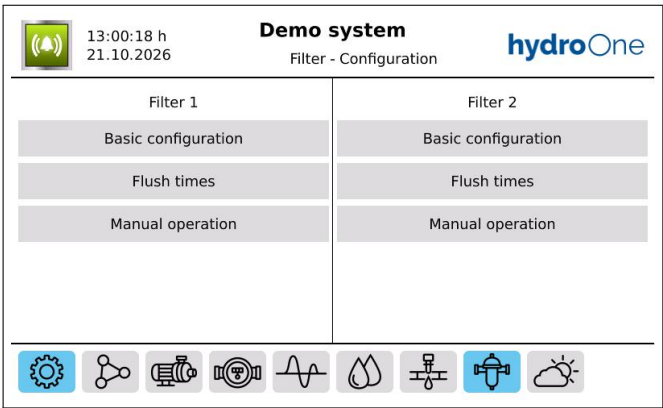


Figure 6.57: Filter configuration – main view

6.7.2 Basic configuration

The filter module's basic configuration is shown in Figure 6.58.

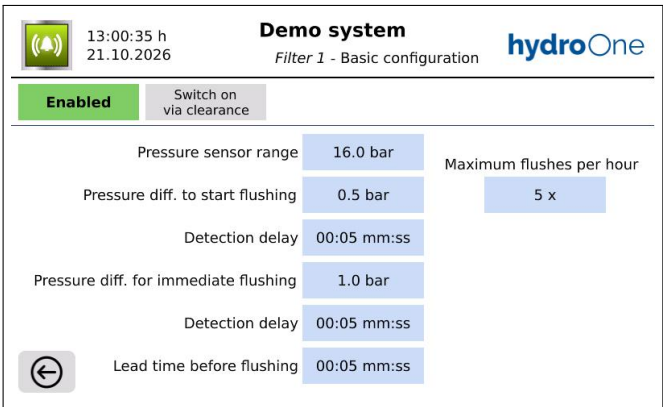


Figure 6.58: Filter module – basic configuration

Enabled / Disabled Only enable filter modules that are actually present. A disabled module does not perform automatic flushing. Disabling ends any ongoing automatic flush and clears any stored flush request; existing coupling to the irrigation module is removed. After re-enabling the

module, any required coupling must be configured again. Direct manual operation of the valves must be distinguished from automatic operation.

Switch on via clearance Enable this function if the filter module is to switch on automatically when its external enable signal is applied or restored. Without this selection, the module is switched on at the operating level while its enable signal is present. Note the distinction between the *enable signal (clearance)* and *Switch on via clearance* in Section 3.3.

Pressure sensor range Enter the measuring range of the connected pressure sensors in bar. The pressure measurements at the filter inlet and outlet are evaluated as 4–20 mA signals and use the same configured measuring range. Therefore, check that both sensors are designed for the same range and correctly assigned. Before enabling automatic flushing, both pressure displays must match the actual system condition.

Pressure diff. to start flushing and detection delay If the pressure difference reaches or exceeds the configured value for the entire delay, a flush is requested. If it falls below the threshold before the delay has elapsed, the delay starts again from the beginning when the threshold is next exceeded. Enter the delay in the displayed *mm:ss* format.

With coupled irrigation, no further irrigation valves are started from the moment a flush is requested. Valves already running are allowed to complete their irrigation. As soon as no irrigation valve is running, the filter flushing lead time begins. Without coupling to an irrigation module, the lead time begins immediately after the flush request.

Select the threshold according to the filter manufacturer's specifications and actual operating conditions. The delay should allow brief pressure fluctuations to pass without unnecessarily postponing required cleaning.

Pressure diff. for immediate flushing and detection delay This threshold permits urgent flushing when irrigation is coupled. If the configured pressure difference is reached or exceeded for the associated delay, the flushing lead time begins even if irrigation valves are still running. Any existing wait for irrigation to end is thereby terminated.

Immediate flushing means that the system does not wait for the irrigation valves currently running to finish; the configured detection delay and lead time still apply. Irrigation valves already running are not switched off by this function. Further valve starts remain inhibited while the flush request is active. The system must therefore be able to provide sufficient flushing water and pressure even while irrigation is running at the same time.

The threshold for immediate flushing should normally be set higher than the normal flushing threshold. The urgent flushing function is evaluated only when coupled to the associated irrigation module.

Lead time before flushing During the lead time, the main valve is actuated before the first enabled chamber is flushed. Enter the time in *mm:ss*. Set the lead time to allow the hydraulic conditions required for flushing to become established.

Maximum flushes per hour This value limits the permissible number of flushing cycles started. The monitoring window begins with the first counted start and lasts 60 minutes. Chamber changes and pauses within the same flush do not count as further starts. A value of 0 disables this monitoring.

If another flush start would exceed the configured number, an alarm is set and automatic filter operation is switched off. Before acknowledging the alarm, check the cleaning effect, pressure

measurement and configured flushing thresholds in particular. Insufficient flushing water, a filter that remains dirty or an incorrectly set threshold can cause repeated requests.

Pressure sensor error When the filter is switched on and its enable signal is present, both pressure inputs are monitored for signals below the configured sensor error threshold. If at least one input signal remains faulty for the configured delay, a shared sensor error message is set. This message inhibits further normal and urgent pressure-dependent flush starts.

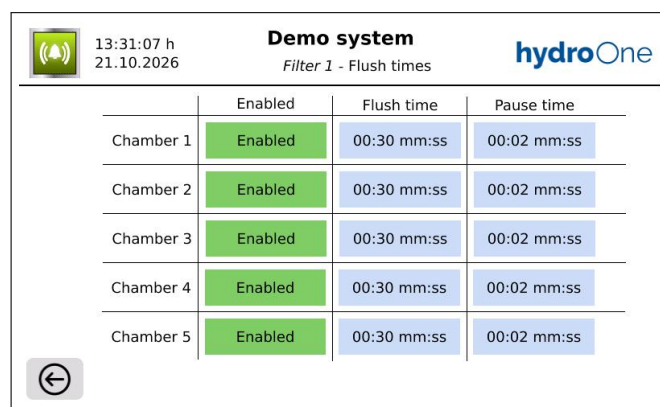
This sensor alarm alone does not cancel flushing that has already been requested or is in progress; an intentionally triggered flush start and direct manual operation remain possible. Eliminate the cause and acknowledge the sensor error before using pressure-dependent automatic operation again.

External signals and 24 V AC monitoring External signals can be assigned to the filter module and switch off automatic filter operation after the configured delay. The flush request is reset in the process. Whether the module switches on again after the signal clears depends on the external signal configuration and the enable conditions still present. Direct manual operation of the valves takes priority over these automatic operating conditions.

If 24 V AC monitoring is configured for the system, also refer to Chapter 8. It describes the assignment of monitored loads, the response to a power supply failure and the handling of possible overloads.

6.7.3 Flush times

The chambers and their times are configured in the *Flush times* view (Figure 6.59).



	Enabled	Flush time	Pause time
Chamber 1	Enabled	00:30 mm:ss	00:02 mm:ss
Chamber 2	Enabled	00:30 mm:ss	00:02 mm:ss
Chamber 3	Enabled	00:30 mm:ss	00:02 mm:ss
Chamber 4	Enabled	00:30 mm:ss	00:02 mm:ss
Chamber 5	Enabled	00:30 mm:ss	00:02 mm:ss

Figure 6.59: Filter module – chamber activation and flush times

Enabled Enable the chambers that are present and connected. Automatic flushing processes the enabled chambers in order from 1 to 5. Disabled chambers and their associated pauses are skipped. No pressure-dependent flush start takes place if no chamber is enabled.

Flush time The flush time determines how long the valve of the respective chamber is actuated during the automatic sequence. Enter the time for each chamber in *mm:ss* format and follow the filter manufacturer's specifications. Too short a flush time can cause inadequate cleaning and frequent subsequent requests.

Pause time Each flushed chamber is followed by its configured pause before the next enabled chamber begins. The associated pause is also observed after the last enabled chamber. During the pauses, no chamber valve is actuated by the automatic sequence; the main valve remains requested until the flushing sequence ends.

After the lead time, flushing of all enabled chambers and the final pause, the filter returns to standby. The flush request ends and the inhibition of further valve starts in the coupled irrigation module is lifted. If automatic filter operation is switched off or its enable signal is withdrawn, the automatic sequence ends completely; it does not resume at the chamber where it was interrupted.

6.7.4 Manual operation

In the *Manual operation* view, the main valve and chamber valves can be actuated individually. The current pressure values and pressure difference remain visible for checking (Figure 6.60).

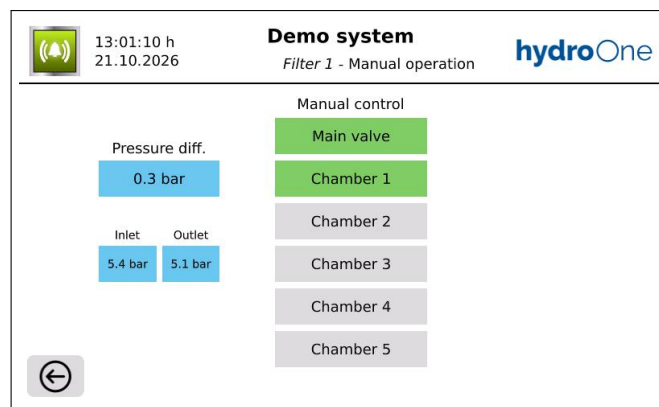


Figure 6.60: Filter module – direct manual valve control

Tap *Main valve* or the required *Chamber* to switch the respective manual request on or off. A green button indicates an active manual request. Manual control switches the selected valves directly; it does not automatically run through the lead time, chamber sequence and pauses. To initiate a complete flushing sequence, use the flush start function at the operating level instead.



Direct manual control operates independently of automatic enable conditions and external signals. It can also request several chamber valves at the same time. Use this function only under supervision and in accordance with the filter manufacturer's specifications. Explicitly end all manual requests after testing; switching off automatic filter operation does not replace this.

6.8 Weather

The weather functions provide local measurements and signals for irrigation and dosing. Rain, frost, indoor and outdoor temperature, wind speed and solar radiation can be evaluated. Eight independently configurable radiation-based irrigation controllers generate irrigation requests; four temperature adjustments provide corrections for irrigation program runtimes and for the dosing functions selected for this purpose. The effect of a weather function is specified in the respective irrigation program or dosing module.

6.8.1 Main view

The main weather configuration view is shown in Figure 6.61. First configure the measurement sources and sensors before enabling radiation-based irrigation, temperature adjustment and storm detection.

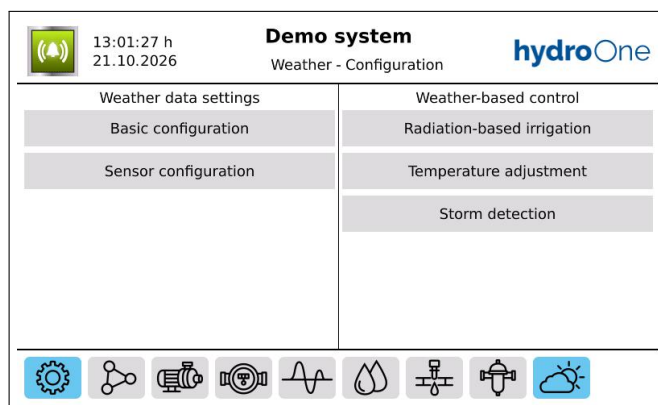


Figure 6.61: Weather – configuration

6.8.2 Basic configuration

The view for selecting local measurement sources is shown in Figure 6.62. The weather function must be enabled at the installation level, and the required inputs and outputs must be correctly assigned.

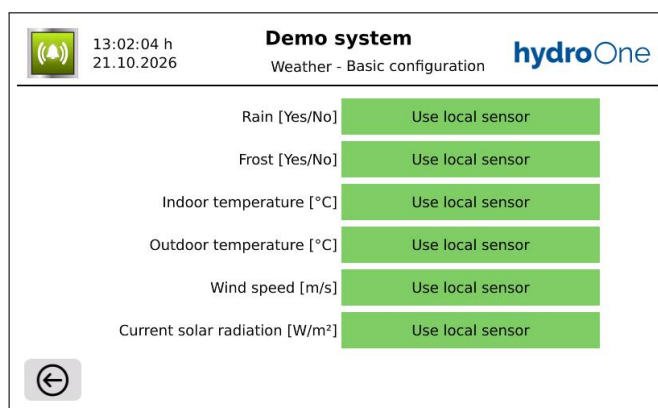


Figure 6.62: Weather – basic configuration

Use local sensor Enable each sensor or contact being used individually. Use only measurement sources that are actually connected and checked. The selection is available separately for *Rain*, *Frost*, *Indoor temperature*, *Outdoor temperature*, *Wind speed* and *Current solar radiation*.

Rain and frost are recorded as yes/no signals via digital inputs. Both temperatures, wind speed and solar radiation are evaluated using analog sensor signals. Wind speed is displayed in m/s and current solar radiation in W/m². Selecting a sensor alone does not start or stop irrigation; the corresponding weather function must also be assigned to the program.

6.8.3 Sensor configuration

The sensor configuration view is shown in Figure 6.63. Set the values according to the data of the sensors actually connected. Incorrect scaling also affects all weather functions that depend on

those measurements.

	Sensor type	Sensor range
Temperature sensors	4-20mA	-20.0 °C - 80.0 °C
Wind speed sensor	4-20mA	8.0 m/s
Solar radiation sensor (pyranometer)	4-20mA	2000.0 W/m ²

Figure 6.63: Weather – sensor configuration

Sensor type Select the signal used, 0–20 mA or 4–20 mA, for the temperature sensors, wind speed sensor and solar radiation sensor. The temperature sensor setting applies jointly to indoor and outdoor temperature; both sensors must therefore use the same signal type and measuring range.

Sensor range Enter the lower and upper measuring range values for the temperature sensors in °C. The lower value corresponds to the start of the signal range at 0 or 4 mA, and the upper value to 20 mA. For wind speed and solar radiation, specify the full-scale value at 20 mA; the start of the signal range corresponds to 0 m/s and 0 W/m² respectively.

Sensor error For enabled 4–20 mA sensors, a signal below the configured sensor error threshold is reported after the specified delay. With 0–20 mA sensors, however, a small input current can be a valid measurement and does not trigger this low-signal check. If a sensor message appears, first check the sensor supply, connection, signal type and input assignment. The effects on radiation-based irrigation, temperature adjustment and storm detection are described in the following sections.

6.8.4 Radiation-based irrigation

Radiation-based irrigation accumulates the solar energy received over time as a radiation sum (light sum) and can request irrigation once the configured threshold is reached. This allows irrigation frequency to be adapted to the solar radiation actually measured. Eight separately configurable controllers are available, for example for different crops or periods of the day.

Enabled / Disabled and sensor source Enable the required radiation-based irrigation controller and select the local sensor as its measurement source. The solar radiation sensor must also be enabled in the basic weather configuration. Give the controller a clear name so that it can be identified reliably when assigning it to programs.

Start time / End time **HH:MM**

Define the daily time window during which radiation may be accumulated and start signals issued. Time windows extending across midnight are possible. Identical start and end times do not create an active time window. Outside the time window, the radiation sum and pause times are reset; accumulation starts again from zero the next time the window is entered.

Figure 6.64: Weather – radiation-based irrigation

MIN pause **hh:mm**

This time limits how soon the radiation-based irrigation controller can issue another start. Even if the radiation sum is reached earlier, it waits until the minimum pause has elapsed. Radiation continues to accumulate in the meantime.

MAX pause **hh:mm**

After the maximum pause has elapsed, a start can be issued within the time window even if the configured radiation sum has not yet been reached. The minimum pause must also have elapsed. A setting of 00:00 disables the maximum pause as an additional start condition. The pause times run from the beginning of the time window or from the last start signal issued; they do not wait for the actual end of an irrigation program.

Run first irrigation at start time If this function is enabled, the radiation-based irrigation controller issues a start signal immediately at the beginning of its time window. The first irrigation therefore does not have to wait for the radiation sum or pause times. Enabling the controller within a time window that is already active also counts as entering the time window.

Radiation sum to start irrigation **[J/cm²]**

Enter the accumulated radiation at which a start signal is to be issued. The unit J/cm² describes the energy per unit area measured over time; it must be distinguished from instantaneous solar radiation in W/m². After a start is issued, the radiation sum is reset to zero and a new accumulation period begins. The function generates a program request and does not specify an irrigation volume; that results from the valve runtimes of the selected program.

Assignment to irrigation programs Select the radiation-based irrigation controller in the weather view of the required programs (Section 6.5.9). A start signal can request several programs. The programs take their day selection and other start conditions into account; competing requests are processed according to their priority. A suppressed start signal is not stored for an additional irrigation later.

Behavior during a sensor error If the solar radiation signal is invalid, no further radiation is accumulated. However, the pause times continue running: a configured maximum pause and the *Run first irrigation at start time* function can still trigger a start. Therefore, select these settings deliberately if irrigation is to continue during a sensor failure. Other program inhibitions are not removed by this.

6.8.5 Temperature adjustment

The four temperature adjustments each calculate a percentage correction from the indoor or outdoor temperature. A temperature adjustment can be used in several irrigation programs. In irrigation programs, it changes valve runtimes; in dosing modules configured accordingly, it is used for the dosing adjustments provided there (Section 6.6).

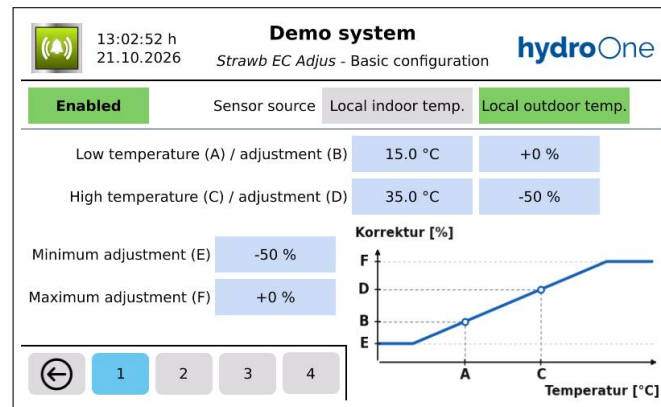


Figure 6.65: Weather – temperature adjustment

Enabled / Disabled and sensor source Enable the required temperature adjustment and select either *Local indoor temp.* or *Local outdoor temp.*. The associated sensor must be enabled in the basic weather configuration and ready for operation. Temperature adjustment requires exactly one usable measurement source.

Low temperature (A) / adjustment (B) Define the first point of the curve with the lower temperature and its associated adjustment. The adjustment is specified as a change: 0 % means unchanged, negative values reduce the quantity being adjusted and positive values increase it.

High temperature (C) / adjustment (D) Define the second point of the curve. The adjustment is calculated linearly between the two temperature points. The adjustment at the higher temperature may be greater or smaller than that at the lower temperature; this allows both increasing and decreasing adjustments. The two temperature points must be different. The graphic in the view illustrates the meaning of the points and limits.

Minimum adjustment (E) / Maximum adjustment (F) Set the smallest and largest permissible adjustments here. Outside the two temperature points, the curve is initially extrapolated as a straight line and then restricted to these limits. The minimum adjustment must be less than or equal to the maximum adjustment. These limits must be distinguished from the direction of the curve: a descending curve is also possible with minimum and maximum limits in their normal order.

Example With 15 °C at 0 % and 35 °C at –50 %, the adjustment at 25 °C is –25 %. When this adjustment alone is used, a valve with a basic runtime of ten minutes runs for seven and a half minutes. If a manual runtime adjustment is also configured in the program, the factors are multiplied together.

Behavior without a usable measurement If temperature adjustment or the weather function is disabled, no unambiguous local measurement source is selected, or a sensor error is present, a neutral adjustment of 0 % is used. The program's manual runtime adjustment remains effective. A sensor error therefore does not automatically cause a complete irrigation stop.

6.8.6 Storm detection

Storm detection derives a central signal from the measured wind speed, with separate thresholds and delays for triggering and resetting. The view is shown in Figure 6.66. Here, *storm* refers to the operational wind limit set by the user, not a fixed meteorological wind force.

Demo system	
Storm detection - Configuration	
Enabled	Sensor source: Local sensor
Storm detection threshold	5.0 m/s
Storm detection delay	00:30 mm:ss
Wind speed for reset	3.0 m/s
Reset delay	00:30 mm:ss

Figure 6.66: Weather – storm detection

Enabled / Disabled and sensor source Enable storm detection and use the local wind speed sensor. This sensor must be enabled in the basic weather configuration and scaled correctly. The shutdown response is then selected for each irrigation program by selecting *Storm* under *Stop and block program during*.

Storm detection threshold and storm detection delay Enter the wind speed in m/s above which the signal is to be triggered. The speed must remain continuously above the threshold for the configured delay. Brief gusts shorter than this time do not trigger the signal.

Wind speed for reset and reset delay The signal clears when the wind speed remains continuously below this limit for the configured reset delay. Select a reset value below the triggering value so that the signal does not continually change state when the wind fluctuates. Between the two limits, the previous signal state is retained. Times are entered in minutes and seconds (mm:ss).

Behavior during a sensor error A reported error of the wind speed sensor being used also sets the storm signal. Once a valid signal returns, the reset condition, including its delay, must be satisfied. Disabled storm detection does not generate a wind-related inhibition. The special treatment of anti-freeze irrigation and the effect on manual program starts are described in Section 6.5.9.

7 Operating level

The operating level brings together the setpoints, actual values and status displays relevant to daily operation. Where the meaning of a display depends on a parameter setting, the relevant section includes a cross-reference to the corresponding configuration section described above.

7.1 System overview

Two alternative layouts are available for the main view: the classic system overview (Figure 7.1) and the mainline flow overview (Figure 7.2). The layout is selected at the installation level. The system icon in the navigation bar opens the main view selected there. Settings that affect the entire system are described in the system configuration in Section 6.1; the event and alarm log is described in Section 6.1.3.

Classic system overview The classic system overview provides a quick overview of the entire system. It brings together the current actual values and status messages of the individual modules.

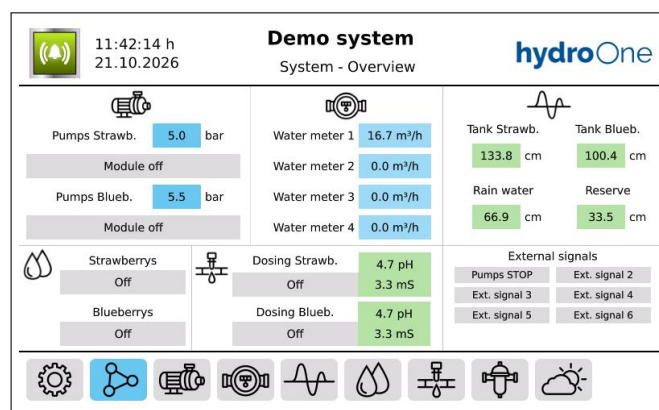


Figure 7.1: Main view – classic system overview

Mainline flow overview The mainline flow overview (Figure 7.2) shows the two irrigation lines with their pumps, filters, water meters and dosing equipment. It displays the associated pressures, nominal and measured flow rates, and EC, pH and dosing values. The current irrigation status or the name of the active program appears below each line. The analog values and external signals are grouped on the right. The labels correspond to the names assigned in the configuration.

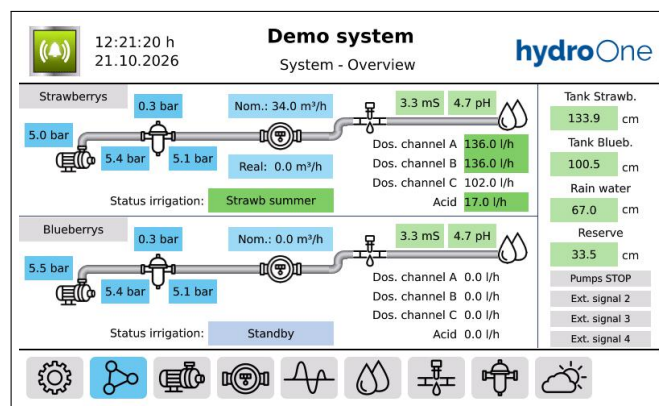


Figure 7.2: Main view – mainline flow overview

7.2 Pump module overview

The pump module overview (Figure 7.3) contains the main process data and status messages for monitoring the operation and status of the pump module or modules.

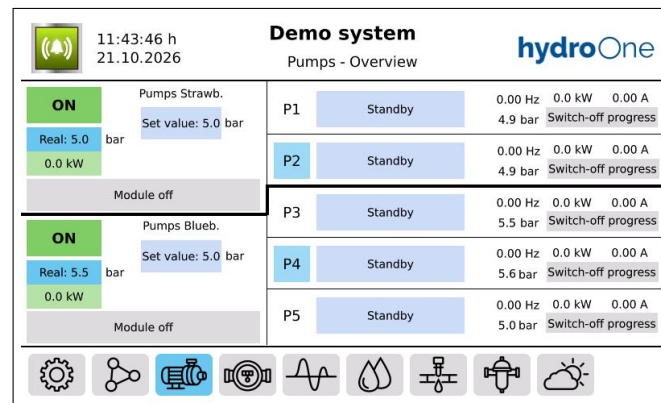


Figure 7.3: Pump module overview

Setpoint 0.1 – Sensor range

Use the *Set value*: input field to enter the setpoint for a pump module. If *Set value switching* is enabled in the settings, the system overview also displays the second setpoint. A blue border around the input field identifies the active setpoint. If a linked irrigation program is currently providing the setpoint, this program-specific setpoint is also displayed in the pump overview; it takes priority over setpoint 1 and setpoint 2 for the duration of the request. The basic pump module settings, including pump activation, sensor range and switch-on deviation, are described in Section 6.2.2.

Always set the setpoint within limits that the connected pumps can reliably achieve. If the connected pumps can generate a maximum pressure of 6 bar and the setpoint is set to 7 bar, the system cannot shut down normally. If the configured switch-off factor indicates that the pumps should stop and the setpoint has not been reached, the pumps stop with the *Dry running* message.

Actual value The *actual value* is the average of all available sensor readings. If a pump is not enabled, or if the associated pump or frequency converter reports a fault, its connected sensor is not taken into account.

If no valid sensor reading is available, the system sets the displayed actual value *Real*: to 0. If the displayed actual value differs significantly from the actual system conditions, first check which pumps or sensors are currently considered valid before changing setpoints or controller parameters.

Operation Use the *ON/OFF* control to switch a pump module on or off. A module fault that inhibits operation prevents the module from entering automatic mode. The control is disabled if the enable signal is absent.

Module status The *module status* display, at the bottom of each pump module area, shows the current pump module status in plain text. Table 7.1 lists the possible status messages and their colours.

Alarm messages appear in red text on a yellow background. Tap the status display to reset an acknowledgeable fault message after its cause has been rectified. The *External fault* and *Lack of water* messages follow their triggering signals; subsequent restarting depends on the respective configuration. The associated limits and delays are configured, depending on the message,

in Sections 6.2.3, 6.2.6 and 6.2.7. Further guidance on investigating causes is provided in Section 10.3.

Table 7.1: Module status messages

Status message	Meaning
No clearance	The pump module has no enable signal. Automatic operation is only possible once the required enable condition is met.
Module off	The pump module is switched off. The pumps are not controlled automatically. However, the module can be switched on automatically, for example by the irrigation system.
Automatic standby	The pump module is switched on and is waiting for a setpoint deviation that triggers a start.
Jockey pump active	The configured jockey pump is active and supplies water when demand or pressure deviations are small.
Pre-feeding pump lead time	The pre-feeding pump has started. The system waits for the configured lead time before enabling the main delivery pumps.
Pipes are being filled	The system is in the pipe-filling phase. The pumps operate according to the configured pipe-filling function before switching to normal control mode.
Automatic operation	The pump module is in normal automatic operation. At least one pump is controlled according to the current demand.
External fault	One of the external signals is active and affects the pump module.
No pumps available	None of the pumps configured for the pump module is available for operation, for example because an enable signal is absent or a pump fault is present.
Lack of water	The configured lack-of-water detection is active. The pumps are prevented from starting or are stopped to protect them from operating without an adequate water supply.
MIN Alarm	The monitored process value has remained below the configured MIN limit for longer than the set delay.
MAX Alarm	The monitored process value has remained above the configured MAX limit for longer than the set delay.
Maximum runtime exceeded	The maximum permitted runtime of the pump module or a monitored operating phase has been exceeded.
Maximum starts per hour	The permitted number of pump starts within one hour has been exceeded.
General sensor error	The sensor readings from the different pumps differ too much, so a plausible actual value cannot be calculated.
Flow alarm	The configured flow monitoring has detected an unacceptable deviation.

Pump overview The pump overview shows the status and process values of all pumps on the right-hand side of the display. Table 7.2 lists the possible pump status messages. Tap the status display to acknowledge a fault message.

The frequency, current consumption, power consumption and actual value measured by the frequency converter are displayed for each pump. Depending on the system configuration, this can help identify a possible sensor error.

Switch-off progress The *Switch-off progress* display shows how far the pump's current frequency-dependent power consumption is from the switch-off threshold. A completely grey

display means that the power-based switch-off condition has been reached; depending on the operating state, the associated switch-off or dry-running delay then runs. A green indication means that the pump is still operating above the calculated switch-off threshold.

In simple terms, the display can therefore be understood as a frequency-compensated load indicator: high power consumption produces a larger green indication, while low power consumption moves the display towards switch-off. The power must always be considered together with the current frequency.

Increasing the switch-off factor raises the calculated switch-off threshold. Under otherwise identical operating conditions, this moves the indication closer to switch-off. The setting, practical determination and complete calculation of the switch-off factor are described in Section 6.2.10.

Base load In multi-pump operation, the current base-load pump is highlighted in blue (the background behind the *P1* label is coloured). If *P1 always base load* is enabled (see Section 6.2.2), pump 1 is highlighted in turquoise; the pump that starts after pump 1 is highlighted in blue. Settings for automatic base load change are described in Sections 6.2.4 and 6.2.5.

Cross-references The operating parameters of the pump module are described in Section 6.2. The individual pump values displayed during operation are particularly relevant to the start and stop behaviour (Section 6.2.10), pump parameters (Section 6.2.11) and, for multi-pump systems, additional functions and additional pumps (Sections 6.2.4 and 6.2.8).

Pump status Table 7.2 lists the possible pump status messages.

Table 7.2: Pump status messages

Status message	Meaning
Not enabled	The pump is not enabled for automatic operation. The pump module does not consider it available for delivering water.
Standby	The pump is enabled and ready for operation, but is not currently required.
Filling pipes	The pump is operating within the configured pipe-filling function. Normal pressure control is not yet active.
Automatic operation	The pump is active in automatic mode and is controlled according to the current system demand.
Maximum speed	The pump is operating at the maximum permitted or configured frequency. The delivery rate cannot be increased further by raising the speed.
Dry running	Dry-running detection has identified an unacceptable operating condition. The pump has been stopped for protection. Check the water supply, suction conditions and switch-off parameters.
Sensor error	The sensor assigned to the pump is not providing a valid or plausible reading. The sensor is not taken into account for control.
Overcurrent	The monitored pump current has exceeded the permitted limit. Check the pump, motor, mechanical load and electrical supply.

Table 7.2 continued

Status message	Meaning
Converter fault	The frequency converter reports a fault. The pump is not available for automatic operation. Also refer to the fault message on the frequency converter.
Communication error	Communication with the assigned frequency converter or communication device is faulty or interrupted. The required operating data is not fully available.
Communication error (P)	Transmission of a pump parameter to the frequency converter or verification of the value read back has failed.

7.3 Water meter overview

This view displays the current water meter values (current flow rate and total volume). Water meter parameters are described in Section 6.4. Depending on the connected water meter, configure pulse operation as described in Section 6.4.2 or an analog signal as described in Section 6.4.3.

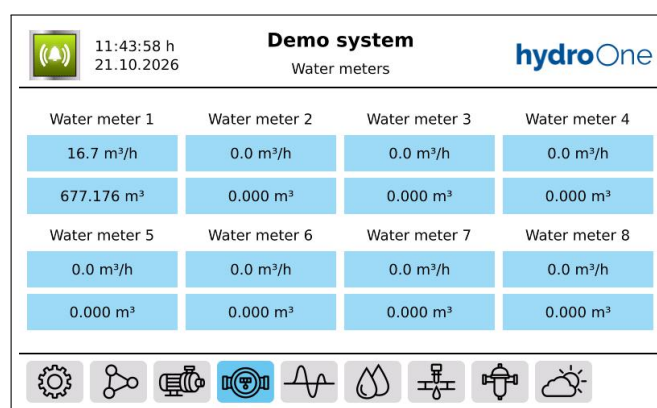


Figure 7.4: Water meter overview

If an analog input signal is invalid, the current flow rate is set to zero and volume counting is interrupted. The sensor error is reported after the configured delay. Water that was not recorded during the signal failure is not added retrospectively when the signal returns; see Section 10.5.

7.4 Analog module overview

This view displays the current status of the analog modules.

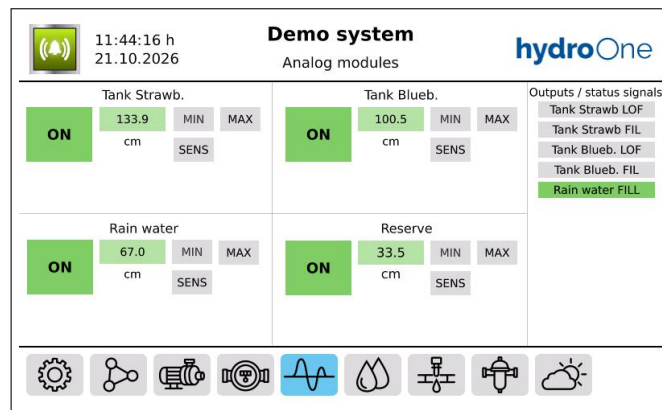


Figure 7.5: Analog module overview

Operation Use the *ON/OFF* control to switch an analog module on or off. If an analog module is only used to acquire an analog value, it does not need to be switched on. Switch the analog module on to activate its alarm functions and enable the assigned outputs/status signals. The control is disabled if the enable signal is absent. Activation, sensor type, measuring range and alarm limits are set in Section 6.3.2.

Alarms The alarm status is displayed for each analog module. An alarm indicates that a configured limit has been exceeded, the value has fallen below a limit, or a measurement signal has been identified as faulty. If an alarm occurs, first check the displayed reading and the actual system conditions.

Outputs / status signals This area displays the status of the configured outputs/status signals. The associated measuring ranges and alarm limits are set in Section 6.3.2. The switching functions of the outputs/status signals are described in Section 6.3.5, and time-dependent functions in Section 6.3.6. An active output is shown in green.

MIX control If *MIX control* is enabled for an analog module, the analog module overview also shows which of the two sources is currently requested and the flow rate measured for each source. The basic water-blending function is described in Section 6.3.3; source outputs, water meters and flow monitoring are configured as described in Section 6.3.4.

7.5 Irrigation module overview

The irrigation module overview is shown in Figure 7.6.

Operation Tap the *ON/OFF* button to switch an irrigation module on or off. Only a module that is switched on and has an enable signal processes automatic or manual irrigation requests. The module's basic configuration, including water meter and module assignments, is described in Section 6.5.2.

Nominal flow rate *Nom.*: This displays the expected flow rate based on the flow rates configured for the currently active valves. It is a calculated reference value, not the actual measured flow rate.

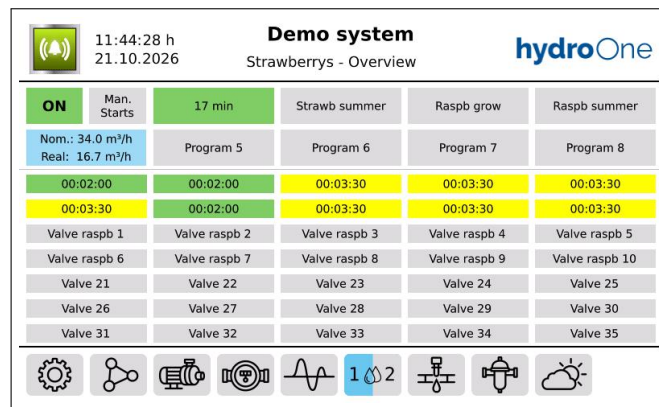


Figure 7.6: Irrigation module overview

Actual flow rate *Real*: This displays the flow rate measured by the assigned water meter. The display is only visible if operation with a water meter is enabled in the configuration. Comparing the nominal and measured flow rates helps identify incorrectly opened valves, unusual water demand or water supply problems. The associated flow monitoring and its tolerances are described in Section 6.5.16.

Programs This area displays the status of the irrigation programs. Tap a program's display field to request it manually. If an irrigation program is active, tapping its display field cancels the program request or stops the active program. The basic program settings are described in Section 6.5.4; start times, pulse irrigation and external signals are described in Sections 6.5.6, 6.5.7 and 6.5.8.

Irrigation programs have an implicit priority within their module. Manually requested valve starts have the highest priority. Next, irrigation program 1 has the highest and irrigation program 8 the lowest priority in the first module; the same order applies to programs 9 to 16 in the second module. This order is taken into account when several requests are present simultaneously. A flush request from the linked filter can temporarily inhibit further valve starts; see Section 7.7.

Program status is indicated by the following colours:

Table 7.3: Irrigation program status

Inactive / not requested
Requested
Lead time active
Active / irrigation running

Runtimes and remaining time Depending on the display state, the associated times are shown instead of the names. The calculated remaining program time takes account of valve runtimes and pause times, valves running simultaneously, and the configured flow and valve limits. It is a forecast based on current conditions; additional waiting times caused by inhibits, external signals or filter flushing can delay the actual completion time.

Manual runtime adjustment and any assigned temperature-dependent runtime adjustment are taken into account. A display of +0 % means that the basic runtime is unchanged. Calendar and weather conditions for automatic starts are set in Sections 6.5.5 and 6.5.9.

Next / skip active valves An external *Next* push-button can be used to skip the currently running valves of an irrigation module. The control unit evaluates this signal as *skip active valves*. When the button is pressed, the system stops the currently active valves and continues the program with the next valves that have not yet run. This function allows individual areas to be skipped as required without stopping the entire irrigation program.

Valves This area displays valve status. Tap a valve's display field to request it manually (only possible if *manual valve starts* are enabled). If a valve has been requested manually and is active, tapping its display field switches it off again. Runtime, pause time and expected flow rate are set in Section 6.5.3; enabling manual valve starts is described in Section 6.5.13.

Valve status is indicated by the following colours:

Table 7.4: Valve status

Inactive / not requested
Requested, waiting to run
Pause time running
Active / irrigation running
Valve has completed its run in the active program
Manually requested

The operating configuration of the irrigation module, programs, valves, manual starts and flow monitoring is described in Section 6.5. Program-specific pump setpoints and dosing recipes are assigned as described in Sections 6.5.11 and 6.5.12; valve selection for each program is described in Section 6.5.10.

7.6 Dosing module overview

The dosing module overview is shown in Figure 7.7. It displays the current operating state of the dosing modules and their associated dosing channels.

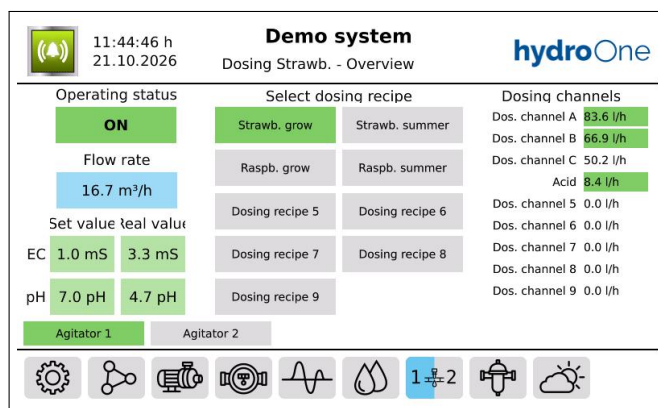


Figure 7.7: Dosing module overview

Operation Tap the *ON/OFF* button to switch a dosing module on or off. The control is disabled if the enable signal is absent. A dosing module only doses if it is activated and switched on, the enable signal is present and the minimum flow rate for dosing has been reached. Activation, flow assignment and the basic enable conditions are set in Section 6.6.2.

Flow rate This displays the flow rate used as the basis for proportional dosing calculations. The dosing rate of the channels is calculated from the recipe value and this flow rate.

EC and pH values If EC or pH sensors are configured, the current setpoints and actual values are displayed as *Set value* and *Real value*. The readings are used for monitoring and, depending on the configuration, can be used to control the assigned dosing channels. EC control settings are described in Section 6.6.3, and pH control settings in Section 6.6.4.

Select dosing recipe The active recipe specifies the requested dosing rate for the dosing channels and the EC and pH setpoints. The recipe values are explained in Section 6.6.6. If the dosing module is used by an irrigation program, the recipe selected in that program is applied automatically; the assignment in the irrigation program is described in Section 6.5.12.

Dosing channels This area displays the currently requested dosing rate for each activated channel. During commissioning, compare this display with the actual response of the dosing pump or dosing valve, especially after changing capacities, limits or recipes. The operating mode, capacity, limits and minimum on and off times of the individual channels are described in Section 6.6.5.

Agitators This area displays agitator status. Tap the display/control field to run an agitator manually for the configured runtime, for example while preparing a stock solution. An *M* appears in the display/control field during manual operation. Assignment, pulse/pause times and the runtime of the manual request are set in Section 6.6.8.

The operating configuration of the dosing module, EC/pH control, dosing channels, recipes and agitators is described in Section 6.6.

7.7 Filter overview

The filter overview (Figure 7.8) shows both filter modules with their current sequence states, pressure values and the times of the individual flushing steps. The configuration is described in Section 6.7.

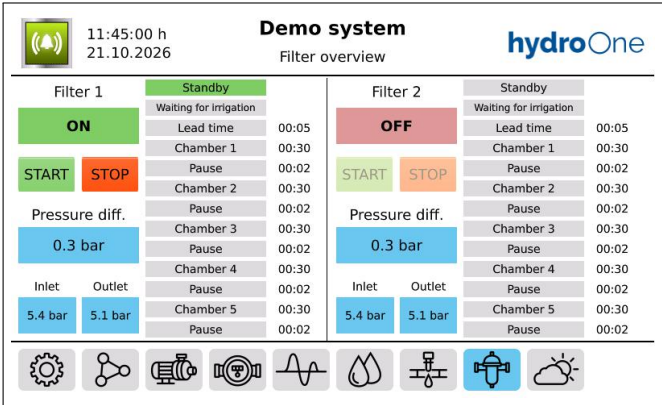


Figure 7.8: Filter overview

Operation Use *ON/OFF* to switch automatic filter operation on or off. The control is locked if the external enable signal is absent. Switching off stops the automatic flushing sequence and cancels any pending flush request.

START and STOP Use *START* to request a flushing sequence when the filter is switched on and enabled. Use *STOP* to stop the current sequence. Automatic operation remains switched on, so an automatic start condition that is still present can trigger another flush. To keep automatic flushing switched off, use *ON/OFF*.

Sequence display *Standby* indicates that the filter is switched on without a flushing sequence running. For a normal flush request, a filter linked to irrigation waits for the valves already running to finish; further valve starts are inhibited while the flush request is present. This state is displayed as *Waiting for irrigation*. It is followed by *Lead time*, the activated chambers and their configured pauses. An urgent pressure-dependent flush can start while existing irrigation valves are still running.

Pressure values The *Inlet* and *Outlet* displays show the pressures upstream and downstream of the filter. The *Pressure diff.* forms the basis for automatic flush requests. An increasing value can indicate that the filter is becoming dirty; always assess it together with the current flow rate and filter settings.

Manual operation and faults Direct manual operation of individual filter outputs is set in the configuration and is separate from the automatic flushing sequence. It takes priority even when automatic operation is switched off or an external signal is present. If a valve is unexpectedly open, therefore also check the manual operation settings. Information on starts-per-hour and sensor errors is provided in Section 10.9, and electrical monitoring in Chapter 8.

7.8 Weather overview

The weather overview (Figure 7.9) brings together local weather data, eight light sum controls and four temperature adjustments. Sensors and evaluation functions are configured in Section 6.8.

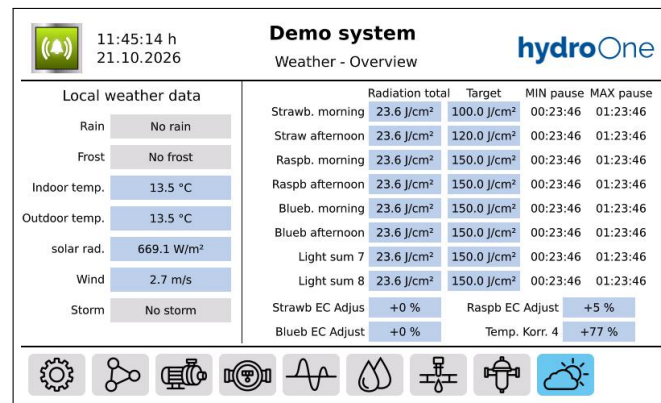


Figure 7.9: Weather overview

Local weather data The activated measurements and signals are displayed on the left: rain, frost, indoor and outdoor temperature, solar radiation, wind speed and storm. Units appear directly beside each value. The effects of rain, frost and storm on irrigation are set individually for each program; a weather indication alone therefore does not mean that all programs are stopped or started.

Light sums Each light sum control displays the accumulated *Radiation total*, the *Target* and the times for *MIN pause* and *MAX pause*. The light sum is given in J/cm². The minimum pause limits the frequency of start signals; the maximum pause can trigger a start when radiation is low. The associated time windows and conditions are described in Section 6.8.4.

Temperature adjustments The four adjustment values are displayed as percentages with a sign. +0 % leaves the runtime unchanged; positive values extend it and negative values shorten it. An adjustment only affects irrigation programs to which that temperature adjustment is assigned. Its calculation and limits are described in Section 6.8.5.

8 24 V AC supply monitoring

8.1 Function and requirements

Optional 24 V AC supply monitoring helps detect a supply failure or a possible overload at connected valves and other loads. It is available for the irrigation modules, filter modules and appropriately assigned outputs of the analog modules.

Monitoring must be configured at the installation level to match the hardware. In addition, the irrigation and filter modules and individual analog module outputs supplied by the monitored 24 V AC supply must be specified. Loads connected to another supply must not be assigned to this monitoring solely on the basis of their function. The electrical assignment is determined by the project-specific wiring diagram.

On versions with a PTC-protected transformer, an overload can cause the 24 V AC supply to shut down or its voltage to collapse. After the load is removed and the transformer cools down, the supply can return automatically. Software monitoring supplements this electrical protection; it does not replace appropriate protective devices or correct sizing of the transformer, cables and outputs.



The *Overload?* message means that the relevant output was detected as energised when the monitored supply failed. It identifies a possible cause but does not prove that this particular load has a short circuit. Several loads may be flagged if several outputs were energised simultaneously. An interrupted supply can also trigger the message.

8.2 Behaviour on supply failure and return

If the monitored supply fails, the assigned irrigation valves are inhibited and automatic operation of the assigned filters is switched off. Irrigation valves, filter chambers and monitored analog module outputs detected as energised during the supply failure are flagged as possible causes and deactivated in their configuration.

After the supply returns, automatic operation remains inhibited for the configured waiting time. The operating level displays *Waiting for clearance after 24 V AC loss* and the remaining time in *mm:ss* format. This waiting time prevents immediate re-energisation after a fault.

The return of the supply does not clear a load's stored flag. Affected loads remain deactivated until the cause has been checked, the message reset and the loads activated again. Unflagged irrigation valves and outputs that remain enabled can be energised again according to their requests once the inhibit time has elapsed. A filter module that has been switched off must be switched on again for automatic operation.



Monitoring does not provide electrical isolation for work on the system. Direct manual operation of filter chambers overrides the automatic enable conditions and remains effective even when automatic filter operation is inhibited. Before troubleshooting, cancel manual requests and properly isolate the affected circuits.

8.3 Indication and reset for irrigation valves

Affected valves are marked *Overload?* in the irrigation overview. The display at the bottom of the screen indicates the remaining time until re-enabling. In the main configuration view, a coloured marker on the *Valves* button indicates that valves are affected.

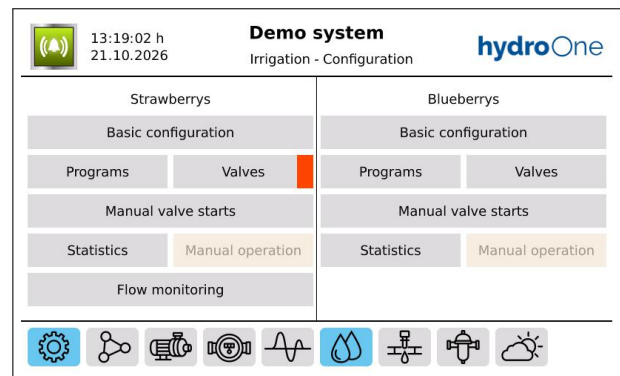
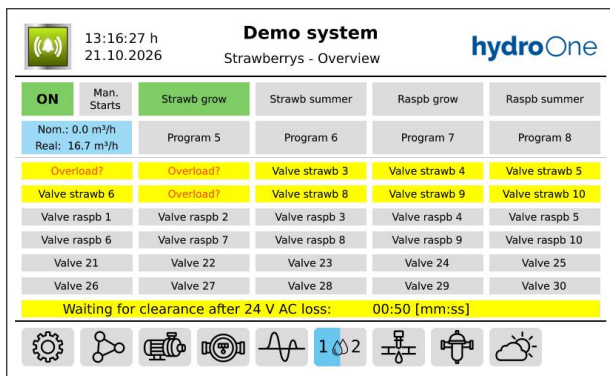


Figure 8.1: 24 V AC monitoring – irrigation overview and access to valve configuration

Open the valve configuration. For an affected valve, the message *Possible overload detected. Tap to reset, then enable again.* appears in place of the normal setting fields. After checking and rectifying the cause, tap this message and then activate the valve again.

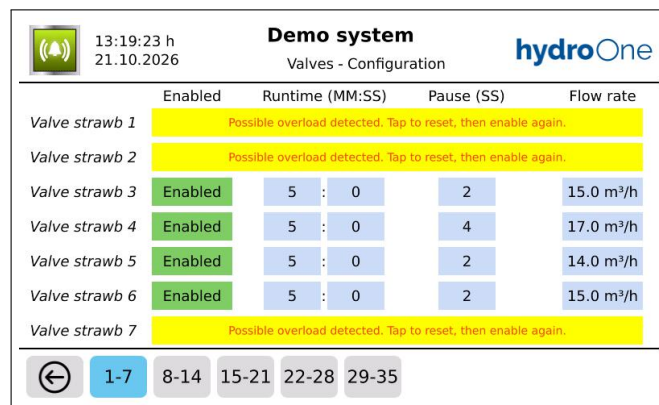


Figure 8.2: 24 V AC monitoring – resetting affected irrigation valves

Acknowledging an alarm display alone does not replace this reset and reactivation. A deactivated valve is not operated during subsequent irrigation sequences; after a fault, therefore also check that all intended valves are activated again.

8.4 Indication and reset for filter chambers

The filter overview identifies affected chambers with *Overload?*. In the main configuration view, the marked *Flush times* button opens the affected chambers.

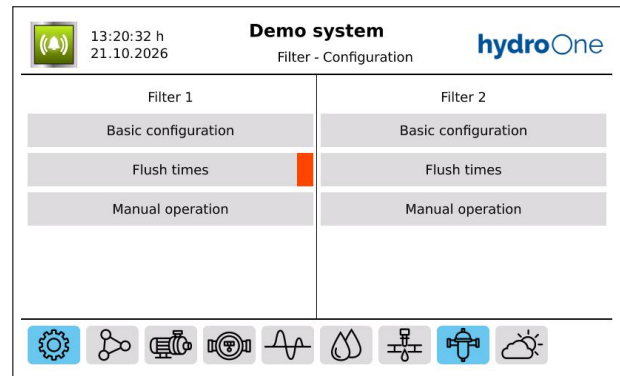
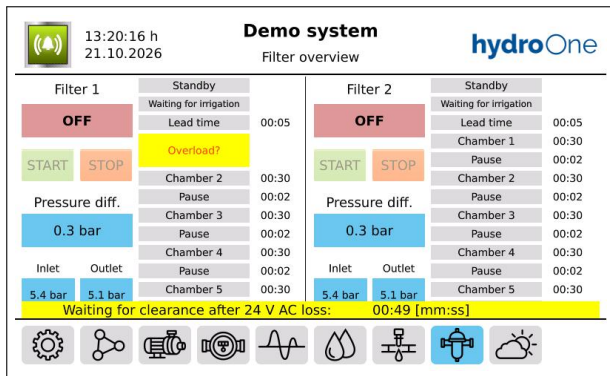


Figure 8.3: 24 V AC monitoring – filter overview and access to flush times

After checking and rectifying the cause, tap the message in the *Flush times* view to reset it and then activate the affected chamber again. Also check the other chambers and, once the re-enabling time has elapsed, switch the filter module on again if automatic operation is to continue.

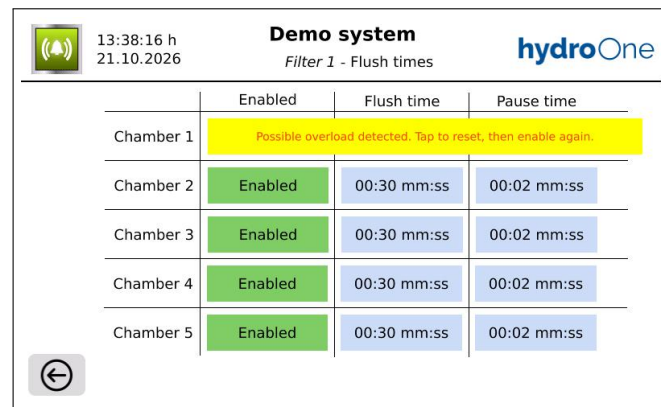


Figure 8.4: 24 V AC monitoring – resetting an affected filter chamber

8.5 Indication and reset for analog module outputs

In the analog module overview, affected outputs are marked *Overload?* under *Outputs / status signals*. A coloured marker in the main configuration view identifies the affected output. Monitoring applies to the assigned output and is separate from an analog module sensor error.

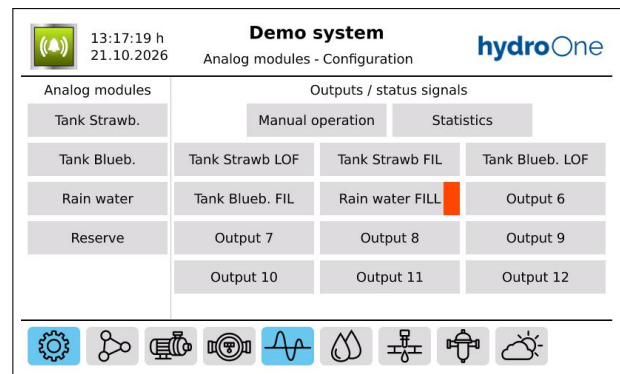
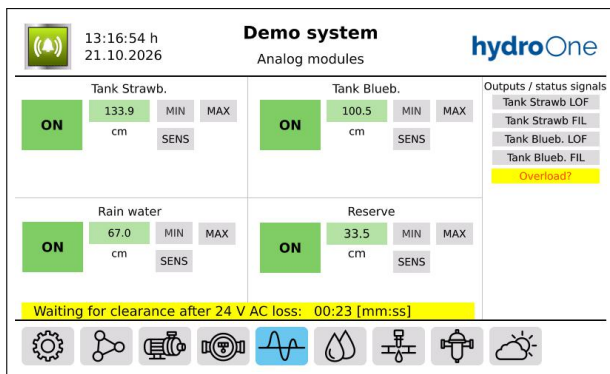


Figure 8.5: 24 V AC monitoring – analog module overview and selection of an affected output

Open the configuration of the affected output. After checking and rectifying the cause, tap the message *Possible overload detected. Tap to reset, then enable again.* and then activate the output again.

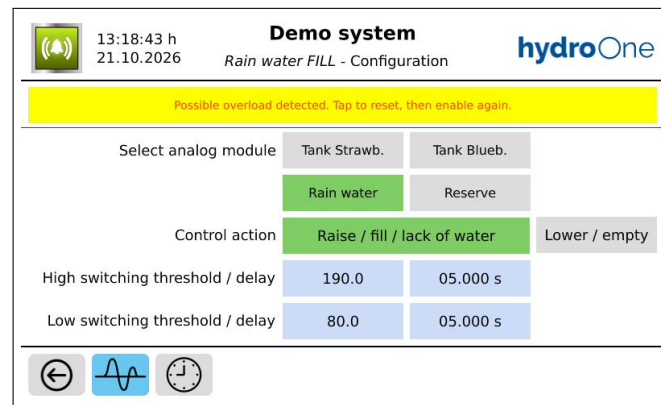


Figure 8.6: 24 V AC monitoring – resetting an affected output

8.6 Procedure after a message

1. Cancel manual requests and prevent unintended restarting during the checks.
2. Have appropriately qualified personnel check the monitored supply, wiring and flagged loads; consider all outputs flagged at the same time.
3. Rectify the cause and restore the correct supply.
4. Wait until the displayed re-enabling time has elapsed.
5. Reset the message at each affected load and activate it again; switch any modules that were switched off back on if required.
6. Check the operation of the affected loads under controlled conditions, then check the intended automatic sequences.



Repeatedly resetting and switching on without investigating the cause can trigger the overload again. Do not disable monitoring to bypass an active message. Once operation is re-enabled, automatic starts can occur in response to requests that are still present.

9 Cloud connection and remote access

9.1 General

For suitably equipped and enabled *hydroOne* systems, cloud access is provided through the *UniCloud* platform from *Unitronics*. The portal can be accessed in a browser at ando.unitronics.io. The cloud supplements local operation with access to stored process data, alarm notifications and direct remote access to the user interface.

Cloud functions require a working internet connection for the control unit and a configured user account. An interruption to the internet connection does not normally affect local operation of the control unit; however, cloud data, push notifications and remote access are unavailable during the interruption.



Direct VNC remote access permits the same operating actions as local operation at the system. Before switching, starting or changing setpoints, make sure that the system state is known and that remote operation cannot create a hazardous situation.

9.2 User account and registration

The user account is created in the cloud portal by ANDO Technik or an appropriately authorised dealer. The intended user's email address is entered and the control units the user may access are specified.

After the user is created, *Unitronics* sends a registration email to the registered email address. Open the registration link in that email and complete the account setup.

Once registration is complete, the user can sign in to the *UniCloud* portal. For two-factor sign-in, a verification code is sent to the registered email address. In a browser, another code may be required, particularly after a session expires or when signing in again.

9.3 Home page and control unit selection

After sign-in, the home page displays the control units the user is authorised to access. Select the required control unit to open its dashboard.

9.4 Dashboard

The dashboard brings together remote access and recorded process data for the selected control unit. Depending on the system configuration, these may include pump module setpoints and actual values, analog values, energy consumption, water meters and EC/pH values.

The process data shown is stored as data points at intervals of approximately five minutes. The charts are therefore intended for reviewing trends, analysis and diagnosis; they do not provide a continuous real-time display. Use VNC remote access for immediate live operation.

Stored process data can be viewed retrospectively for up to one year. The available curves depend on the system configuration.

9.5 Process data time range

Use the time range selector at the top of the dashboard to change the period displayed. Depending on the current portal view, predefined periods are available, such as the last day or the last 7, 30, 90, 180 or 365 days, as well as a custom period.

9.6 Direct remote access via VNC

A direct VNC connection to the selected *hydroOne* control unit can be opened from the dashboard. Use the VNC password **Cc12345** to establish the connection. Once connected, the same user interface is displayed as on the local touch display.

VNC remote access is separate from the recorded chart data: the VNC view shows the current state of the control unit and allows immediate operation, while the charts are stored as periodic data points.

9.7 UniCloud app

The *UniCloud* app is available for Android and iOS devices. Sign in with the same user account used in the browser. The app provides access to the dashboard and VNC remote access for the authorised control units.

After setup, biometric sign-in can be used on supported mobile devices. This option is not available when signing in through a browser, where a new verification code sent by email may be required.

9.8 Alarm notifications

When a cloud connection is configured, alarm messages are sent in plain text to the email address specified for the user or system. If the *UniCloud* app is installed and push notifications are permitted on the mobile device, alarms can also appear as push notifications.

Operators who need to be made aware of faults promptly are advised to use push notifications in addition to email notifications. However, cloud notifications do not replace independent alarm signalling or a safety device if these are required by the risk assessment for the overall system.

9.9 Access rights and changes

Users are created and assigned to the intended control units by ANDO Technik or an appropriately authorised dealer. Changes to users, email addresses or access rights should only be made by authorised parties and agreed with the operator.

When personnel change or an authorisation ends, cloud access rights and any other remote access permissions must be reviewed and adjusted promptly.

10 Alarm and troubleshooting guide

10.1 Using this troubleshooting guide

This chapter helps you interpret alarm messages and identify possible causes. It does not replace an inspection of the actual installation, the circuit diagram, the installation manual or the manufacturers' documentation for the connected components.



Only acknowledge an alarm or restart a module that has shut down after checking the cause and establishing that the installation can continue operating safely. Work on electrical, hydraulic or chemical parts of the installation requires the appropriate expertise and protective measures.

When troubleshooting, it is often useful to look beyond the most recently displayed alarm. Several messages may have the same cause or occur in sequence. Also consult the event and alarm log under *System -> Event and alarm log*; see Section 6.1.3. The white entries recorded there can help reconstruct the sequence of events before a fault.

10.2 Recommended procedure in the event of a fault

Where possible, proceed in the following order:

1. Note the first alarm that occurred and the affected part of the installation.
2. Check the event and alarm log for operating events immediately preceding the alarm.
3. Check common causes such as supply voltage, enable signals, water supply, sensor readings and communication before replacing individual components or changing parameters.
4. Compare the displayed measurements with the actual condition of the installation. A reading that looks plausible may still be incorrect if the measuring range or scaling is wrong.
5. Eliminate the cause and then check that the associated signals and measurements are plausible again.
6. Only then acknowledge the alarm and observe the installation during its first restart.

If several alarms occur at the same time, address any common cause first wherever possible. For example, a pump communication failure may also trigger the *No pumps available* message in the pump module. Depending on the configuration, an incorrect flow signal may cause flow alarms in pump, irrigation or MIX functions.

10.3 Pump modules

10.3.1 Flow alarm

Meaning: The measured flow has remained outside the permissible range for the pumps currently running for longer than the configured alarm delay. The permissible MIN values and MAX values of the active pumps are added separately; the totals define the expected range for the current operating state. The calculation is described in Section 6.2.7.

Checks and possible remedies: First check whether the displayed flow is plausible. Then check the water meter or flow meter, its scaling and signal, open valves, filters, shut-off valves, water source and the actual delivery rate of the running pumps. Low flow may be caused by a restricted water supply, a dirty filter, a closed valve or a pump that is not delivering water. Excessive flow may indicate unexpectedly open outlets, a burst pipe, an incorrectly scaled water meter or unsuitable nominal pump flow values. If flow alarms occur in other modules at the same time, check the shared flow measurement first.

10.3.2 No pumps available

Meaning: The pump module is ready or has been requested, but none of its enabled pumps is available for automatic operation.

Checks and possible remedies: Check the status display of each pump. On *hydroOne eco* Series 100, 200 or 300, the Manual-O-Automatic switches must be set to *Auto*. Also check the pump enable signals, frequency converter status and any communication or converter faults. If several pumps are unavailable at the same time, first check for a common cause such as the power supply, MODBUS connection or a shared enable signal.

10.3.3 MIN Alarm

Meaning: The pump module's process value has remained below the configured lower limit for longer than the associated delay. Depending on the main function, this may be pressure, level or another process value.

Checks and possible remedies: Compare the displayed actual value with an independent measurement, if available. Check the water supply, pump performance, valve positions and sensor. Also check the measuring range, unit and limit. Do not eliminate a MIN Alarm simply by lowering the limit if the installation is genuinely failing to reach the required process value. Typical causes include a burst pipe, empty pipes during filling (use the *Pipe filling* function) or an alarm delay that is too short.

10.3.4 MAX Alarm

Meaning: The pump module's process value has remained above the configured upper limit for longer than the associated delay.

Checks and possible remedies: Check the actual process value, the sensor display and the configured limits. In pressure control applications, possible causes include rapidly closing valves, unsuitable controller parameters, excessive pump capacity or inappropriate multi-pump control settings. In level control applications, check the inflow, switch-off conditions and sensor operation.

10.3.5 Maximum runtime

Meaning: The pump module's actual operating time has reached the configured maximum runtime. Time spent on standby after switching on does not count as pump runtime.

Checks and possible remedies: Check for unusually prolonged water demand, a leak or a missing switch-off condition. In pressure boosting systems, for example, a pump may run continuously if the setpoint is not reached. In filling applications, check the level sensor, inflow and switch-off level. If the long runtime is required during normal operation, the limit may be adjusted to suit the actual application; it should not simply be increased without investigating the cause.

10.3.6 Maximum starts per hour

Meaning: The pump module has started more often within one hour than permitted by its configuration.

Checks and possible remedies: In pressure boosting systems, check the diaphragm pressure vessel, pre-charge pressure and possible small continuous leaks. Insufficient usable storage volume often causes short runtimes and frequent starts. Also check the switch-on and switch-off thresholds and, where applicable, the hysteresis. In other applications, check whether external requests or enable signals are changing unusually often. An excessively high switch-off factor may also be the cause. Adjustment and practical testing of the switch-off factor are described in Section 6.2.10.

10.3.7 Sensor error / general sensor error

Meaning: A sensor value required by the pump module is implausible, or the permissible deviation between multiple sensors has been exceeded. The alarm may occur following signal loss, an incorrect 4–20 mA signal or an excessive difference between the evaluated sensor readings.

Checks and possible remedies: Compare the individual sensor readings with one another and, if possible, with an independent reference. Check the sensor supply, connectors, wiring, signal current, channel assignment, measuring range and unit. Where several sensors are used, also check the permissible deviation configured in the installation level. If several sensors deliver implausible readings at the same time, a shared power supply or common wiring is a particularly likely cause.

10.3.8 Lack of water

Meaning: The lack-of-water signal configured for the pump module is active. It originates from one of the analog module outputs or status signals selected in the lack-of-water configuration. The pump module is switched off when lack of water is detected.

Checks and possible remedies: Check the water source, level, inflow and the signal triggering the lack-of-water condition. Check the analog module reading, its switching thresholds and the assigned outputs/status signals. If an external float switch or fault contact is used, check the corresponding general external signal; this contact is evaluated as an *External fault*. If *Automatic restart* is enabled for lack of water, a previously switched-on pump module may restart automatically once all blocking conditions have cleared. A simultaneous external signal without automatic restart, or an internal module fault, may prevent this. If automatic restart is not enabled, the module must be switched on again after the cause has been eliminated.

10.4 Individual pumps and frequency converters

10.4.1 Communication error

Meaning: The frequency converter assigned to a pump cannot be reached via MODBUS, or communication has been interrupted for longer than permitted.

Checks and possible remedies: First check that the frequency converter is powered and ready for operation. Then check the MODBUS connectors, bus cable and, where applicable, the connections between several converters. If only one pump is affected, the cause is often its converter, connection or bus address. If several converters are affected, first check the shared bus cable, the control unit's RS-485 module or a common power supply. The MODBUS diagnostics in the installation level can also be used for service work.

10.4.2 Communication error (P)

Meaning: When a pump or converter parameter was transferred, the intended value could not be written correctly to the frequency converter or could not subsequently be read back with the expected value. This alarm therefore relates specifically to parameter transfer from the pump parameter configuration, rather than simply to general converter communication.

Checks and possible remedies: First check whether a normal *Communication error* is also active. If so, restore the MODBUS connection first. If the converter is generally reachable, repeat the parameter transfer only after checking communication. Then check that the converter supports the parameter concerned and that the stored value is within its permissible range. If the same parameter repeatedly causes the error, have qualified personnel check the converter parameters and the project-specific configuration. Do not attempt to force parameters by repeatedly writing unchecked values.

10.4.3 Dry running

Meaning: The operational dry-running detection configured for the pump has been triggered.

Checks and possible remedies: Check the water source, level, suction side, shut-off valves, filters and, where applicable, pump venting. Also check that the pump is actually delivering water. Repeated starts without water can damage the pump. Only after confirming that the hydraulic system is in order should you check whether the dry-running detection parameters are plausible. An excessively high switch-off factor may cause an incorrect shutdown. After changing the switch-off factor, always verify that normal pump shutdown operates correctly. Use the adjustment and test procedure described in Section 6.2.10.

10.4.4 Sensor error

Meaning: A sensor value assigned to an individual pump is unavailable or implausible.

Checks and possible remedies: Check the sensor, supply and sensor connections at the frequency converter. If a sensor signal is passed through several converters, check the entire signal chain and ensure that all converters required to pass the signal on are ready for operation. If possible, compare the displayed value with the sensor reading at another converter or an external measuring instrument.

10.4.5 Overcurrent

Meaning: The motor current has exceeded a permissible value, or the frequency converter has detected an overcurrent condition.

Checks and possible remedies: First check for hydraulic or mechanical blockages and unusually high loads. If the error occurs during acceleration or braking, unsuitable ramp times may be the cause. Motor, mains and converter connections and motor parameters may only be checked or changed by appropriately qualified personnel. Do not reset recurring overcurrent faults without investigating them.

The most common cause is a braking time set too short in the pump parameters.

10.4.6 Converter fault

Meaning: The frequency converter itself is reporting a fault condition.

Checks and possible remedies: Read the error code directly on the frequency converter. The *Converter fault* message in *hydroOne* covers various converter faults; the exact cause is therefore identified by the error code displayed on the converter.

Table 11.1 lists possible error codes, typical causes and remedies. Also check whether mains, motor, sensor or communication problems occurred at the same time.

For recurring errors and electrical or motor-related faults, also consult the original documentation for the frequency converter used.

10.5 Water meters

10.5.1 Sensor error

Meaning: The input current of an analog water meter is below the configured sensor error threshold. Flow is immediately set to zero and volume counting is interrupted; the alarm appears after the configured delay.

Checks and possible remedies: Check the flow meter's power supply, wiring, signal current and measuring range. Evaluation resumes automatically and the sensor error message clears once the signal is valid again. Volumes not recorded during the signal failure are not added retrospectively. Also check the effect on linked pump, irrigation and dosing modules, as these may use this meter's flow value.

10.6 Analog modules

10.6.1 MIN Alarm and MAX Alarm

Meaning: An analog module's measured value has remained below the configured lower limit or above the upper limit for longer than the configured delay. An alarm switches off the output-s/status signals assigned to the analog module unless *Always active* is enabled for the individual output.

Checks and possible remedies: Compare the displayed reading with the actual condition of the installation. Check the sensor, 4–20 mA signal, measuring range, unit and alarm limits. For level measurements, also check the inflow and outflow and the switching points of the connected actuators. If an output assigned to the analog module remains active despite the alarm, check whether *Always active* has deliberately been enabled for that output.

10.6.2 Sensor error

Meaning: The input current of an analog module configured for 4–20 mA is below the configured sensor error threshold. A low measured value in correctly configured 0–20 mA operation does not trigger this lower-limit monitoring.

Checks and possible remedies: Check the sensor supply, wiring, connectors and actual signal current. In particular, check that the correct signal type, 0–20 mA or 4–20 mA, is selected and that the measuring range matches the sensor. If the fault occurs immediately after a change, check the channel assignment and parameter settings first.

10.6.3 MIX source flow alarm

Meaning: With MIX control enabled, the measured flow of a source has deviated from its nominal flow beyond the configured tolerance for longer than the configured delay.

Checks and possible remedies: Check that the source concerned is actually being requested and that its assigned output is enabled. Check the source valve or pump, water meter, nominal flow, tolerance and hydraulic availability of the source. If both sources report an error at the same time, check for a shared measurement or supply problem. Remember that the source outputs may also be requested by analog control or time control; these operating modes are OR-linked.

10.7 Irrigation modules

10.7.1 Flow alarm

Meaning: The measured flow has deviated from the expected flow of the valves currently open for longer than the configured delay.

Checks and possible remedies: First check that the valves expected by the program are actually open. Then check the water meter, configured valve flow rates, filters, pump supply and hydraulic installation. Low flow may be caused by a valve that has not opened, blocked filters or insufficient pump capacity. For excessive flow, also check for unintentionally open valves, leaks or incorrect valve flow rates in the configuration. The actual flow does not determine whether additional valves may be switched on; this decision uses the configured valve flow rates and system capacity.

If *Stop irrigation on flow alarm* is enabled, the running irrigation program is completely aborted when the alarm is triggered. It does not resume at the interrupted point when the alarm clears or is acknowledged. A new run starts only following a new program request or at the next valid start time.

10.8 Dosing modules

10.8.1 EC MIN Alarm and EC MAX Alarm

Meaning: The measured EC value has remained below the configured lower alarm limit or above the upper alarm limit for longer than the configured delay. The dosing module is switched off when the alarm is triggered.

Checks and possible remedies: Check that the EC reading is plausible, then check the sensor, calibration, water flow, recipe, dosing agents and dosing rate. For a high EC value, in particular check for excessive dosing or an excessively high initial concentration in the water. For a low EC value, possible causes include the dosing agent supply, suction line, dosing pump, dosing valves and actual dosing rate.

The dosing module can be switched on again even while the EC alarm remains active. Another automatic shutdown occurs only after the alarm condition has first cleared and subsequently been triggered again. The alarm is therefore an operational monitoring function, not a safety interlock.

10.8.2 pH MIN Alarm and pH MAX Alarm

Meaning: The measured pH value has remained below the configured lower alarm limit or above the upper alarm limit for longer than the configured delay. The dosing module is switched off when the alarm is triggered.

Checks and possible remedies: Check the reading, sensor condition and calibration. Then check the recipe, dosing agent used, flow, dosing pump and actual dosing rate. When dosing acid or alkali, also ensure that the correct agent is connected to the intended channel. Restart behaviour is the same as for the EC alarm and likewise does not constitute a safety interlock.

10.8.3 EC or pH sensor error

Meaning: The signal from an enabled EC or pH measurement is below the sensor error threshold. The associated control function is blocked as soon as the invalid signal is detected; the alarm message appears after the configured delay.

Checks and possible remedies: Check the transmitter, sensor supply, electrode connection, current signal and configuration. A sensor error does not necessarily mean that all dosing has stopped: flow-proportional recipe dosing may continue without the affected EC or pH adjustment. Check the actual dosing operation and switch off the module if the measurement issue remains unresolved. Also consider direct manual operation of the dosing channels. Controller settings and behaviour are described in Sections 6.6.3 and 6.6.4.

10.9 Filter modules

10.9.1 Maximum starts per hour

Meaning: The permissible number of flush starts within the monitoring period has been reached and another flush has been requested. The filter is switched off and the additional automatic flush is blocked.

Checks and possible remedies: Check filter contamination, inlet water quality, differential pressure measurement and flushing effectiveness. Also check the flush duration, pauses, pressure thresholds and operation of the flushing valves and drain. A continuously high differential pressure may trigger the next request immediately after a flush. Eliminate the cause before resetting the stored alarm and switching the filter on again. Direct manual operation of individual filter outputs is independent of the automatic block.

10.9.2 Pressure sensor error

Meaning: While the filter is switched on and enabled, at least one of the two pressure signals has remained below the sensor error threshold for longer than the configured delay. The alarm is stored and prevents further normal and urgent pressure-dependent flush starts.

Checks and possible remedies: Compare inlet and outlet pressure and check both sensors, their power supply, wiring and signal currents. The shared message does not distinguish between the two sensors. Flushes already requested or running, and manual starts, remain possible; this alarm therefore does not mean that all filter outputs are completely shut down. Reset the stored alarm after eliminating the cause. Settings are described in Section 6.7.

10.9.3 External signal or electrical interlock

Meaning: An assigned external signal or enabled electrical monitoring has switched off automatic filter operation.

Checks and possible remedies: Check the assigned external signals and electrical supply. Direct manual operation remains independent of automatic-operation shutdown. For information on 24 V AC supply monitoring and the behaviour of marked outputs, see Chapter 8.

10.10 External signals

10.10.1 External signal 1 to 6

Meaning: An external signal configured as an alarm has remained active for longer than the configured trigger delay. Its actual function depends on the project-specific assignment, for example an empty-tank indication, leak, pressure switch or external fault.

Checks and possible remedies: First check the name assigned in the configuration and the project-specific documentation. Then check the associated sensor or contact and the installation condition it monitors. If modules are linked to the external signal, the signal may switch them off. Also check which modules are assigned and whether *Automatic restart* is enabled. Acknowledgement alone is insufficient: the input must actually return to its normal state. Where several signals are active, a restart is possible only after all assigned blocking conditions have cleared. A signal without automatic restart that occurs while the module is blocked leaves the module switched off afterwards; see Section 6.1.4.

10.11 Weather

10.11.1 Rain, frost and storm

Meaning: One of the central weather signals is active. Its effect is configured separately in each irrigation program. Rain and storm can abort automatic irrigation or block its start. Frost can request repeated anti-freeze irrigation runs.

Checks and possible remedies: Compare the sensor readings or contact states with the actual conditions. Check the selection of local sensors, the assignment in the program concerned and, for storm detection, both wind thresholds and delays. A storm block clears only after wind speed has remained below the reset threshold for long enough. A manually started program and requested anti-freeze irrigation are not subject to the same rain and storm conditions as a normal automatic start; see Section 6.5.9.

10.11.2 Temperature, radiation or wind sensor error

Meaning: The signal of an enabled local 4–20 mA weather sensor has remained below the sensor error threshold for longer than the configured delay. This lower-limit monitoring does not apply to 0–20 mA sensors.

Checks and possible remedies: Check the sensor supply, wiring, signal type, input current and measuring range. A faulty temperature measurement provides no additional change to the run-time adjustment that depends on it. If radiation measurement fails, no light sum is accumulated from invalid readings; however, the configured pause timers continue to run and the maximum pause can still trigger a start signal. With storm monitoring enabled, a reported wind sensor error activates the storm block. After the wind signal is restored, the reset threshold and reset delay must also be considered. Weather configuration is described in Section 6.8.

10.12 Electrical monitoring and short-circuit messages

A failure of the monitored 24 V AC supply or a detected output fault can block valves, automatic filter operation or monitored outputs. Check the supply and the affected load, including its wiring, before enabling a marked output again. Simply acknowledging a message does not eliminate the electrical cause. The displays, assignments and behaviour after supply restoration are described in Chapter 8.

10.13 History entries that are not alarms

The event and alarm log stores operating events as well as alarms. These entries have a **white background**. They do not trigger an alarm and are used only to reconstruct the sequence of events and the installation's behaviour afterwards. Alarms, in contrast, have a yellow background.

Typical events include:

- the start or activity of *Pump module 1* and *Pump module 2*,
- starts of irrigation programs *Program 1* to *Program 16*,
- manual valve starts in the irrigation modules.

These events are particularly helpful for fault analysis. For example, if a flow alarm occurs shortly after a particular irrigation program starts, first check that program's valves and their configured flow rates. If a pump alarm occurs immediately after a pump module starts, the recorded events help establish the timing between the start and the fault.

10.14 Typical combinations of messages

Communication error in one or more pumps and *No pumps available* In this case, the pump module alarm is often a consequence of the communication error. First restore communication with the affected frequency converters, then check pump availability.

Several communication errors at the same time If several converters become unreachable at the same time, a common cause is more likely than several independent converter failures. In particular, check the shared bus cable, RS-485 interface, connectors and power supply of the affected devices.

Flow alarms in several modules If flow alarms occur simultaneously in the pump module, irrigation module or a MIX source using the same flow measurement, first check the shared water meter or flow meter and its scaling. Only then investigate individual hydraulic functions.

Sensor error together with a MIN/MAX alarm A faulty or incorrectly scaled sensor can cause a subsequent limit alarm. Investigate the sensor error first. Only when the reading is plausible again can you determine whether the MIN or MAX alarm is genuinely caused by the condition of the installation.

External signal and a switched-off module If an external signal is assigned to a pump, irrigation, analog, dosing or filter module, that module may be stopped by the signal. Check the external cause first and then the *Automatic restart* setting. Automatic restart after the signal clears may only be used where it is intended and permissible for the installation concerned.

Alarm immediately after a parameter change If a fault occurs immediately after a configuration change, first check the most recently changed values and how they relate to the actual installation. This is particularly important for measuring ranges, signal types, limits, pump parameters, flow values, nominal valve flows and dosing limits. Do not change several parameters at once while the cause remains unclear, as this makes subsequent troubleshooting more difficult.

11 Frequency converter error codes

The following table provides an initial guide to the error codes shown on the frequency converter display. Codes may differ depending on the device version and firmware. Also consult the manufacturer's documentation for the frequency converter actually installed.

Table 11.1: Frequency converter error codes

Code	Description	Possible cause	Possible remedy
OC (2)	Overcurrent detected by hardware	Ramp times too short; output short circuit; damaged motor or blocked drive; incorrect parameter settings	Increase ramp times; check motor wiring; free the drive; reduce voltage boost; enter correct motor parameters
OC1 (16)	Overcurrent detected by software	Ramp times too short; output short circuit; damaged motor or blocked drive; incorrect parameter settings	Increase ramp times; check motor wiring; free the drive; reduce voltage boost; enter correct motor parameters
OC2 (67)	Overcurrent detected by hardware	Ramp times too short; output short circuit; damaged motor or blocked drive; incorrect parameter settings	Increase ramp times; check motor wiring; free the drive; reduce voltage boost; enter correct motor parameters
GP (26)	Earth fault	Short circuit to PE	Check motor and wiring
OL1 (5)	Converter overload	Frequency converter overloaded	Reduce load
OL2 (8)	Motor overload	Motor overloaded	Check sizing
OE (3)	DC link overvoltage	Mains overvoltage; moment of inertia too high; deceleration ramp too short; incorrect speed control parameters	Check mains voltage; check converter settings; use a braking resistor if necessary; increase deceleration time
PF1 (4)	Input phase fault	One of the three input phases is interrupted	Check power supply and mains connection
PFO (17)	Output phase fault	Motor phase interrupted; defective motor cable	Check connection to motor; check motor phases and motor cable
LU (6)	Undervoltage	DC link voltage too low	Check power supply
OH (7)	Converter overtemperature	Ambient temperature too high; insufficient heat dissipation from control cabinet; dirty converter or heat sink; carrier frequency set too high; motor cable too long	Check ambient temperature; observe specified ambient conditions; check or clean cooling and air passages; check parameter settings; ensure correct installation
OH1 (35)	Motor overtemperature	Motor PTC has tripped	Check motor sizing and cooling
AErr (18)	Analog signal wire break	Analog signal below the configured limit	Check control wiring, setpoint source and parameter settings
EP (20)	Converter underload / no load	No load or lack of water; interrupted drive train	Check drive unit; ensure water supply
EP2 (20)	Converter underload / no load	No load or lack of water; interrupted drive train	Check drive unit; ensure water supply
EP3 (19)	Converter underload / no load	No load or lack of water; interrupted drive train	Check drive unit; ensure water supply

Continued on the next page

Table 11.1 continued

Code	Description	Possible cause	Possible remedy
nP (22)	Pump control: pressure outside permissible range	Pressure outside the configured limits; converter enters sleep mode	Set control parameters correctly; check water demand and installation condition
CE (45)	Modbus timeout	Modbus signal absent for longer than permitted	Check Modbus connection, bus cable and connected devices
CE1 (53)	Keypad disconnected	No connection to keypad	Check wiring and connection to keypad
ESP (11)	External emergency shutdown	ESP input has been triggered	Check the cause of the external shutdown and the input signal
ERRO	Parameter setting error	Parameter not accepted by converter	Put converter into STOP mode and check parameter settings again
ERR1	Incorrect password	No password or incorrect password entered	Enter correct password
ERR2 (13)	Motor parameter measurement error	Motor was not free to run during dynamic AUTOTUNING	Disconnect motor from driven mechanical components and repeat AUTOTUNING
ERR3 (12)	Overcurrent at standstill	Hardware fault; overcurrent at standstill	Contact manufacturer's service department
ERR4 (15)	Current measurement error	Current measurement hardware fault	Contact manufacturer's service department
ERR5 (23)	PID parameter error	Controller error due to incorrect parameter settings	Check and correct controller parameters as necessary
ERR6 (49)	Watchdog	Watchdog input receives no signal	Check watchdog signal and associated wiring
EEP (47)	EEPROM error	EEPROM read/write error	Have control board checked or replaced
PG (27)	Encoder (option)	Encoder error	Check encoder and wiring
PCE (32)	PMSM error	PMSM tuning error	Check parameters and motor configuration