



HortiMaX CX500

The new standard in adaptive greenhouse technology



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The new standard

The acceptance and success of an automation solution is determined by the extent to which that solution is geared to the needs of the customer. The use of 'Dutch' horticultural technology frequently proves unsuccessful outside the Netherlands, because the technology is either unsuitable for the climate conditions in those countries, or it does not fit the knowledge level or culture of the user. Every country and climate requires a particular solution. This concept is also referred to as the 'adaptive greenhouse'.

Based on these insights, we developed the HortiMaX CX500. This computer, which controls both the greenhouse climate and irrigation processes, can be adapted to any type of greenhouse, climate conditions or level of expertise. Our configuration software allows installers, in any country or region, to customise the computer to the specific needs of the grower. Since the system is based mainly on the plug-and-play principle, it is also easy and straightforward to install.

The HortiMaX CX500 features a modular design, so it is suitable for operations of all sizes and easy to expand in the future. In short, the HortiMaX CX500 combines both versatility and simplicity, making it the ideal solution for a wide variety of countries, climate zones and growers.

This product description provides detailed functional information on the HortiMaX CX500 and is intended for dealers, sales consultants and growers. This document contains the following information:

- For whom is the HortiMaX CX500 designed?
- The added value of the HortiMaX CX500
- A detailed description of the water, climate and energy controls
- A short description of how the HortiMaX CX500 is customised to a grower's needs
- Operating the HortiMaX CX500 with Synopta Lite

Designed for whom?

There are many greenhouse automation solutions on the market today. In practice, these products often fail to deliver what the customer actually wants. Many products are too specialised, lack functionality (control options), or are suitable for controlling only the climate, irrigation, or energy-related processes, rather than all of these aspects together. In addition, a lot of products use outdated technology, are too complicated, have a user interface that is either too limited or too complex, cannot be expanded or include too many unwanted features.

The HortiMaX CX500 is what a grower is looking for if the answer to one of these questions is 'Yes':

- Do you want to start off with a basic automation solution that is easy to use?
- Are you looking to replace your current environmental controller (or 'process computer')?
- Do you want to upgrade your process computer with additional climate, irrigation or energy-related controls in the future?
- Do you want to expand your business at some point, without having to buy a new process computer?
- Are you planning to build a new greenhouse later?
- Are you not sure yet what greenhouse technology you want to install in the future?
- Do you want a solution that you can modify later, so it continues to meet your needs?

- Do you want to be less dependent on a supplier?
- Would you like to turn your dealer into a business partner?
- Do you want to choose a process computer that is based on the latest hardware?
- Most growers use only a fraction of the functionality that their process computers offer. Do you only want to pay for the controls you intend to use?

The HortiMaX CX500 is generally the ideal solution in the following situations:

1. Growers who want to start off with a basic process computer.
2. Growers who already own a process computer, but:
 - which is outdated and
 - which they want to replace with a modern and affordable solution.
3. Growers who need a process computer that is easy to upgrade as their needs change.

The HortiMaX CX500 is not the right choice in every situation. For instance, the computer is not suitable for growers at the top end of the market who need to control or manage complex electricity processes, closed greenhouses, or a variety of heat sources. For these growers, we offer the MultiMa process computer. In most cases, however, the HortiMaX CX500 will be more than capable of meeting a grower's needs.

The added value for growers

The HortiMaX CX500 is based on over 50 years of experience in climate, irrigation and energy control. The HortiMaX CX500 offers growers the following benefits:

- Customised and affordable
- Integrated technology for climate, irrigation and energy-related processes
- Suitable for any climate, greenhouse, crop or grower
- Simple, transparent and versatile
- Modern IT technology that is future-proof
- Easy to expand as a nursery grows

To offer these benefits, the HortiMaX CX500 was developed based on 8 unique factors:



HortiMaXimum
flexibility

Together with one of our dealers, a grower selects the desired controls. This depends on the grower's needs, the type of crop grown and the local climate. The grower only pays for the controls that are used. And if the grower wants more functionality later, there is no need to invest in a new process computer. The HortiMaX CX500 is easy to upgrade thanks to our user-friendly software. This allows the dealer to simply add new controls to the grower's configuration.

HortiMaXimum
ease of installation

The installation process is fast and easy, which keeps costs down and minimises questions afterwards. Thanks to the use of local digital hardware, installing the HortiMaX CX500 couldn't be more simple or affordable.

HortiMaXimum
ease of use

The HortiMaX CX500 can be customised to the requirements of any grower. Since the system hides control options that are not used, configurations are kept as simple as possible. The HortiMaX CX500 comes with the Synopta Lite software, enabling the grower to display and analyse every stage of the crop's development.

HortiMaXimum
ease of operation

The HortiMaX CX500 is operated remotely with a basic PC. This allows us to offer remote support if necessary and means the grower can check on their greenhouse environment while they are away (on holiday, for instance).



HortiMaXimum
ease of maintenance

Our Easy Update System makes it a breeze to install the latest software updates. These software updates are free of charge and ensure that the HortiMaX CX500 is always running the latest software. The HortiMaX CX500 contains advanced hardware and a minimum number of technical components, so it requires very little maintenance.

HortiMaXimum
scalability

The HortiMaX CX500 is equipped with CompactiMa I/O hardware. These I/O modules are easy to install, using a bus system. These components can be installed in both new or existing switch cabinets.

HortiMaXimum
affordability

Our main goal in designing the HortiMaX CX500 was to make it as affordable as possible. This means the grower only pays for the functionality needed, installation is easy and cost-effective, and Synopta Lite is included free of charge. In addition, the grower will own a top-brand system that is easy to expand as their business grows.

HortiMaXimum
reliability

A reliable solution starts with a configuration that is geared to the local situation. Well begun is half done, as they say. And that's exactly what the HortiMaX CX500 offers. The easy installation, modern hardware and tried-and-true Synopta Lite software have resulted in an advanced and dependable process computer. The new standard has been set.

Dealer requirements

When we launched this new standard in adaptive greenhouse technology, we set additional dealer requirements to ensure that the HortiMaX CX500 is kept simple and affordable for growers.

This means that all HortiMaX CX500 dealers are officially certified by HortiMaX and meet the following requirements:

- Skilled in using Windows operating systems
- Successfully completed the HortiMaX CX500 training course
- Possess extensive installation expertise

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Climate controls

A wide range of climate controls are available for the HortiMaX CX500. Since every HortiMaX CX500 is customised, many of these controls are optional. Using the HortiMaX CX Assistant software, a grower selects the desired controls together with one of our dealers. Underlying control elements that are not needed are disabled, but can be enabled free of charge if the grower wants to expand their configuration later.

Blocks

The HortiMaX CX500 control software allows you to pre-set the heating setpoint, ventilation setpoint and humidity setpoint for each block (compartment) in the greenhouse. (Target values are called 'setpoints' in the HortiMaX CX500.)

The desired temperature may vary greatly over the course of a day depending on the pre-set setpoints and influence values. These influence values are applied to the pre-set setpoints to determine the 'calculated setpoints'. Based on these calculated setpoints, the computer can trigger temperature alarms. However, it is also possible to set 'absolute alarm thresholds'. This allows the computer to generate temperature alarms regardless of whether a block includes heating, cooling or ventilation control. You can set absolute minimum and maximum alarm temperatures for each individual block. The current alarm thresholds are available as readouts.

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Control based on multiple sensor units

Greenhouse blocks are becoming increasingly large. To obtain measurements representative of the entire block, many blocks are equipped with multiple sensor units. The HortiMaX CX500 allows you to assign sensor units to a particular block, so the block will be controlled based on the measurements from those sensor units. You can also set a weighting factor for each sensor unit and set different weighting factors for ventilation, screen and heating control. This is an advanced option.

Dew point control

To avoid condensation on the crop, the computer can automatically raise the minimum pipe temperature or minimum vent position. This prevents the plant temperature from approaching the dew point temperature too closely.

Pest control

This control ensures that overrides are applied to the pipe temperature, vent position, CO₂ enrichment system and sensor unit fans in a particular block during a pest control cycle. The pest control cycles can be set to occur on certain days of the week or each day of the week.



Ventilation

Ventilation groups

The Ventilation module includes controls to automate ventilation groups with single-sided or double-sided vents. Each ventilation group or motor can be assigned to a particular vent position measurement, or programmed to respond to changes in wind direction (the latter is done based on influence settings).

This module can be used universally to control roof, ridge or side-wall ventilation motors. The calculated vent position is applied based on the open and close run times, set by the dealer. In addition to setting the ridge direction, it is also possible to rename the relevant ventilation group (for instance, to 'side-wall ventilation blocks two and three') so it is easier to identify.

Each ventilation group includes the following settings:

- P-band and I-factors
- Radiation and wind speed influences on the vent position
- Gradual wind changeover (to prevent the windward and leeward sides from constantly switching when the wind is blowing parallel to the greenhouse ridge)

- External low humidity wind influences
- Windward side lag control based on the temperature, % vent position, or P-band
- Gale and frost protection
- Limits during intense rainfall, screening, roof sprinkling, fogging, pad & fan use, etc.
- Fixed and automatically calculated minimum and maximum vent positions

Response to deviating vent position

If the measured vent position fails to react to vent adjustments, this could be due to a number of reasons. For instance, the vent position sensors may be malfunctioning or the vents themselves may not be responding as they should. You can select which action the computer must take should the measured vent position become unresponsive. These actions are switching to vent control based on run time, locking the vents (thus preventing further vent adjustments) or closing the vents.



Fans

The Fans module is designed to control various types of fan system (such as recirculation fans). You can program the conditions under which the fans are to be activated (called ‘start conditions’) according to your specific needs. This means that fans can be used for a wide range of applications, such as improving the horizontal heat distribution or circulating humidified air. The Fans module allows you to set periods when the fans run continuously and periods when the fans are only activated based on the pre-set start and stop conditions.

You can set the following start and stop conditions:

- | | | |
|-------------------|---------------------------|--------------------|
| - Air temperature | - Humidity level | - Pipe temperature |
| - Screen position | - Minimum CO ₂ | - Minimum run time |
| - Vent position | - Minimum delay time | |

Supplementary lighting

The HortiMaX CX500 supplementary lighting module offers immense versatility in lighting control, even more so than the old Clima 500. It allows growers to control their lighting systems not only based on time, but also the radiation level and radiation sum. Using graphs, growers can program different lighting settings over the course of a day. To prevent greenhouse light emission at night, the software also enables the lighting system to be linked to the screens. As a result, the screens will automatically close before the lighting systems are switched on. The computer can also be programmed to automatically switch off the lighting system when a blackout period starts or the ambient temperature rises too high. To prevent the lighting system from switching on and off too frequently, lowering the lifespan of the system, delay times can be set for switching the lighting on and off. The operating time readout allows growers to accurately determine when the lamps need to be replaced.

Heating

Hot water pipe heating

The Pipe Heating module can be used to control various types of pipe heating system, such as a bottom circuit or top circuit, tube heating or side-wall circuits. Each pipe heating group can be renamed (for instance, to ‘heating block 1’), so it is easier to identify. The Pipe Heating module can control either one- or two-speed pumps, or frequency-controlled pumps.

The Pipe Heating module includes the following settings:

- Influences of outside conditions
- Influences of humidity level and CO₂
- Limits while pest control or lighting is active
- Control during screen use

Hot air heating

The Hot Air Heaters module includes settings for using hot air heaters as the main heating system, in combination with a pipe heating system, or as a CO₂ enrichment system. Although the hot air heaters are controlled based on the block settings, you can set a different heating setpoint for the hot air heaters. If the hot air heaters are controlled based on the block heating setpoint, it is possible to use temperature integration. Multiple hot air heaters can be assigned to a hot air heater group, which enables cascade control for switching hot air heaters on or off one by one. You can set a different interval time between the activation and deactivation of two heaters. A hot air heater group is dedicated to a single block in the HortiMaX CX500.

Cooling

Greenhouses can be cooled in various ways, the most common of which is by opening the air vents. More and more modern greenhouses, however, are equipped with active cooling equipment. The HortiMaX CX500 is able to control a variety of active cooling equipment, including pad and fan and roof sprinkling systems. As with heating and ventilation control, you can set a block temperature setpoint (or ‘cooling setpoint’ in this case) as well as a range of start/stop conditions and influence settings for each cooling circuit.

Pad and fan

The Pad and fan module is suitable for the most advanced evaporative cooling systems. As such, it can be configured to fit virtually any situation. You are free to set up any number of groups, valves or fans. The module can also control various types of louvres. By assigning a pad and fan system to a block or ventilation group, you can program how pad and fan and ventilation control interact in order to maximise cooling efficiency. Pad and fan control operates entirely based on the cooling setpoint. If the air temperature exceeds the setpoint value, the pad and fan system is activated to cool the greenhouse. Safeguards ensure that the ventilation overrides are cancelled should the pad and fan system fail for some reason.

Roof sprinkling

Roof sprinkling can be used for various purposes, the most common of which is to cool the greenhouse. The roof sprinkling system can be activated based on a number of start conditions between the pre-set start and end times. These start conditions include the relative humidity (RH), radiation intensity and air temperature.

Fogging

The Fogging module can be used to control low- or high-pressure fogging or misting systems. If fans are used to distribute the humidified air, a separate fan group needs to be added to the Fans module.

This module includes the following settings for each group:

- Start and end times
- Minimum and maximum fogging durations
- Automatic influence based on difference between the humidity measurement and humidity setpoint
- Minimum pause between fogging starts
- Minimum air temperature for activating fogging
- Minimum light intensity for activating fogging
- Influence on the pre-set humidity setpoint

This module also includes a safeguard to prevent clogging (caused by algae growth) if one of the fogging or misting systems has not been used for a certain number of days. This is done by briefly activating the fogging group at the pre-set time.



CO₂

CO₂ enrichment can be controlled based on both the measured CO₂ concentration and a variable CO₂ quantity that is pre-set using a graph. This enables two CO₂ enrichment sources to be used simultaneously. The CO₂ quantity is expressed in kilograms to provide you with a more accurate impression of the absolute quantity of CO₂ to be released. The CO₂ quantity of each CO₂ group is converted into a demand in kg per hour. Please note that quantity-based CO₂ enrichment requires modulating CO₂ sources. The CO₂ quantity is expressed in kg/ha/hour.

Limits

The CO₂ concentration setpoint is the maximum CO₂ concentration that may be reached during CO₂ enrichment. If the CO₂ demand is 0, then the CO₂ quantity calculated by the computer will also be 0 (in other words, no CO₂ will be released). As the measured CO₂ concentration approaches the pre-set maximum CO₂ concentration, a lower rate of CO₂ enrichment is required. To gradually lower the release of CO₂, an influence setting has been added to CO₂ quantity control. CO₂ enrichment can be programmed to stop when the air temperature exceeds a pre-set value.



Influence settings

The CO₂ concentration setpoint can be 'influenced' by the incoming radiation (or sunlight), vent position, wind speed, supplementary lighting and humidity. A trajectory can be set for each of these influences, except supplementary lighting. After these influences have been applied to the CO₂ quantity, the resulting value is called the 'calculated CO₂ quantity'. If this value is not between the pre-set minimum and maximum CO₂ quantities, then the calculated CO₂ quantity is adjusted to the closest of these two limits.

CO₂ fans

A CO₂ manifold enables a number of fans to draw CO₂ from the same boiler or one or more fans to draw CO₂ from multiple sources. The HortiMaX CX500 registers the amount of CO₂ released into the greenhouse by each source and fan.

CO₂ supply station

A CO₂ supply station is used to supply pure CO₂. There are two types of supply station: those fitted with an open/close valve and those fitted with a modulating valve. A CO₂ supply station is usually subject to a maximum hourly capacity (connection value), or a maximum daily volume.

Screens

The Screens module can be used to control blackout, shade and thermal screening. If a screen system is used for more than one of these applications, the various setpoints are processed in the above-mentioned order of priority.

In blackout screening, the computer closes the screens as soon as the blackout start time is reached. This differs from thermal or shade screening, since the screens close based on a number of pre-defined conditions and influences between the pre-set start and end times. If the screens are used for blackout purposes, you can set the duration and start times of the blackouts and even a humidity gap to be applied during the blackouts.

If the screen system is used for shading purposes, the software comes with settings for four screen positions. This includes the ability to freely modulate between settings. The screens can either be closed in four stages, or in percentages between two consecutive light intensity values.

If the screen system is used for thermal purposes (i.e. to save energy by preventing heat loss), the Screens module will include settings for controlling the screens based on the outside temperature, minimum pipe temperature, maximum light intensity and influences on light intensity and supplementary lighting.

The Screens module includes the ability to apply a desired screen gap or open a screen in stages. Both these features are based on various settings, so you can control the humidity level and ambient temperature as needed while the screen system is in use. The HortiMaX CX500 help files contain detailed information on all these settings, including many examples on how to configure them.

The Screens module also features a gale protection function and, provided a screen position sensor is fitted, an alarm threshold setting to indicate that the screen has failed to reach the desired position within the time limit.

Fixed screen position

The 'fixed screen position' option allows you to set a period during which the screens must remain in the pre-set fixed screen position. This period is defined with start and end time settings and only applies if 'Yes' has been selected for the 'Fixed screen position active' setting. If so, the screens are adjusted to the graphically set 'Fixed screen position' when the start time is reached, regardless of the other screen settings.

You can also specify whether the pre-set start and end times are absolute or should shift in relation to sunrise and sunset.

Statistical information

To determine the length of time that the screens were closed, the computer keeps track of the cumulative screen duration of each screen. This value is reset daily. The Tables program is able to display the number of hours that the screens were closed over a particular period.

Side-wall screens

The side-wall screens option is designed to control one side-wall screen motor. It includes open / stop / close outputs that are used in slave / master screen control. In slave / master control, a side-wall screen uses the same values set for the horizontal screen it is linked to. It is not necessary to configure all the start conditions available; just the ones you wish to use. This option includes the ability to set periods during which a side-screen must remain closed or open. You can also program a side-wall screen to close when the supplementary lighting switches on.



Additional options for Screens module

Sensor unit above the screen

While a screen is closed, cold air accumulates above the screen if it is cold outside. To prevent a sudden drop in temperature when the screen opens, it should open gradually (in stages) or remain closed. If a sensor unit is installed above the screen, the computer can measure how cold the air is above the screen and determine whether such a precaution is necessary. The thermal screen may only start to open if the difference between the block's heating setpoint and the air temperature measured above the screen is smaller than the pre-set value. If the temperature difference is sufficiently small, the screen will open immediately at normal speed, rather than in stages.

Pyrgeometer

A Pyrgeometer measures the outgoing heat radiation emitted to the sky. Since the heat loss from the greenhouse is greater when the outgoing radiation is high, it may be desirable to close the screen earlier. Using a graph, you can set an influence that manipulates the 'Maximum outside temperature for closing screen' setting based on the outgoing radiation. Please note that this influence setting is only available if a pyrgeometer has been configured.

Contact start for screen group control

Screen group control can be expanded with a contact start. When the contact start is activated, the screen motor in the group is adjusted to the desired position.

Lighting

A screen may be linked to one or more supplementary lighting sectors. You can set a minimum screen position that becomes active when one of those lighting sectors switches on. This enables a screen to be fully or partially closed while the lighting is activated. This setting is especially useful if light emission restrictions apply during the night. This minimum screen position can be set using a graph and can be set based on absolute time or astronomical time (i.e. time in relation to sunset and sunrise).



Irrigation controls

A wide range of irrigation controls are available for the HortiMaX CX500. Since every HortiMaX CX500 is customised, many of these controls are optional. Using the HortiMaX CX Assistant software, a grower selects the desired controls together with one of our dealers. Underlying control elements that are not needed are disabled, but can be enabled free of charge if the grower wants to expand their configuration later.

Irrigation groups general

Irrigation valves can be assigned to irrigation groups, which can be activated based on a range of start conditions. Each irrigation group includes the following standard features:

- Program valves by time, litres, cc and mm/m²
- Operate up to 12 valves simultaneously with automatic flow adjustment
- Monitor flow based on time or litres
- Program EC and pH setpoints individually for each valve

- Sort valve order by increasing EC, decreasing EC, valve number or priority
- Discharge the irrigation water if the EC setpoints of consecutive valves differ too much
- EC influence based on light/radiation measurement
- Assign valves to any irrigation group
- Irrigation boom control (specifically for sprinkler irrigation)
- Start times for each day of the week and weekly start times
- Cyclic start with min./max. pause time
- Light sum start with min./max. transfer between periods
- Manual valve opening (or 'manual valve start')
- External start
- Readouts showing the irrigation volume applied, EC/pH of each valve/cycle and 24-hour totals/averages

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Sprinkler irrigation

The HortiMaX CX500 controls sprinkler irrigation in irrigation cycles, which can be divided into phases. These, in turn, can be divided into sub-phases, or can be repeated. Each irrigation phase can be given a name, such as 'pre-rinsing', 'irrigation' or 'post-rinsing'. A fertigation recipe can be assigned to each phase. These phases are completed sequentially.

A phase can be divided into sub-phases (the total irrigation time or irrigation volume will remain the same) or repeated a pre-set number of times. Repetitions can be used for frost prevention sprinkling, for instance. A delay time can be set between repetitions or sub-phases. During a delay time, the unit remains unavailable and cannot be used by another irrigation group.

Ebb and flow systems

To supplement the general irrigation options, a specific control is available for ebb and flow systems (also called 'flood and drain' systems). This control lets you set the expected water requirement and the offset for an alarm for each flood valve. You can also determine whether to apply water by time, litres, cc or mm, and set the desired duration, volume and EC and pH. There are also settings for programming the flood duration (i.e. the time between closing the flood valve and opening the drain-off valve) and drain duration.

Drip irrigation

To supplement the general irrigation options, drip irrigation control can be expanded with return group control. This return group option is specifically designed for drip irrigation and ebb and flow systems.

Irrigation

The Irrigation module includes a number of options for manipulating the outlet water used by the valve groups.

Fertigation recipes

One or more fertigation recipes can be set for each irrigation unit and a different recipe can be selected for each period and phase. You can also select one or more influences for each valve, period and phase, which enables different setpoints to be configured for every valve. Recipes are programmed individually for each unit, because the setting options available depend on the unit's configuration.

Pre-mixing EC

This pre-mixing control allows you to set the pre-mixing EC setpoint of an irrigation group, including the relevant alarm thresholds. An open/stop/close valve is operated based on the EC measurement and EC setpoint to mix the drain water and fresh water from two storage tanks. If the difference between the EC measurement and EC setpoint exceeds the pre-set maximum, two sensor inputs are available to reposition the valve. These sensor inputs are connected to the valve's open and close limit position contacts. The pre-mixing EC can be influenced based on the water levels in both storage tanks. This prevents the water storage tanks from containing either too little or too much drain or fresh water.

Mixing based on flow

The mixing based on flow control enables you to set the ratio in which up to five types of water are mixed. You can set a different ratio for each irrigation group. The types of water are mixed based on flow measurements, which means that a flow-controlled supply valve is needed for each type of water used in the mixing process. In principle, this option allows water to be mixed from up to five water storage tanks.

Practical experience has shown that flow-based control (for instance, in a ratio of 1:1:1:5:3) is difficult to achieve with butterfly valves, which are often used for this purpose, due to their poor control characteristics. If three butterfly valves are used, however, flow-based control is feasible, provided the valves have the correct dimensions. If you require flow control for more than three types of water (i.e. three water storage tanks), please contact our sales department to find out what type of control valve is most suitable for your needs.

EC control

The EC setpoint (or desired EC value) is set for each valve as well as each period and phase. The fertiliser tank from which fertiliser solution is drawn is selected in the irrigation group to which the active valve has been assigned. These settings ensure that the EC dosing group achieves the EC setpoint. The EC dosing group also includes alarm settings.

A different fertiliser tank and dosing ratio can be selected for each irrigation group, period and phase, providing immense versatility in fertigation control. An option that can be added to the system is 'parallel A and B tank control', which is useful if there is a significant difference in density between the fertiliser solutions in the A and B tanks.

A second EC measurement is available to monitor and safeguard the accuracy of the primary EC measurement. This option includes the ability to set a maximum difference between the two measurements and an alarm delay time. The second EC measurement (or 'monitor' measurement) can also be used as the basis for EC control. This not only means that you can delay cleaning the primary sensor until the irrigation cycle is finished, but also, in the worst case, that EC control will continue should the primary sensor fail for some reason.

Another option is a minimum fluid level safeguard for any of the fertiliser tanks. This fluid level safeguard includes a second contact sensor for determining the status of the EC valve. If the valve is closed while it should be open (or vice versa), the computer will generate an alarm message and discontinue irrigation. It is also possible to add a linear fluid level measurement for any of the fertiliser tanks. This lets you view data on the current fertiliser supply and set a minimum fluid level (as a percentage of the tank's total volume). If the fluid level drops below the pre-set minimum, an alarm is triggered.

pH control

The pH setpoint (or desired pH value) is programmed for each valve. You then select which pH tank (containing either acid or alkali) the valve should draw solution from in the irrigation group that the valve has been assigned to. These settings ensure that a pH dosing group achieves its pH setpoint. Each pH dosing group also includes various alarm settings. One pH dosing group is required for each greenhouse area where you wish to control or measure the pH level. You can connect one or two pH sensors for control based on either one or two sensors. If you choose to connect two sensors, one sensor will be used for control purposes and the other for monitoring purposes.

A minimum fluid level safeguard can be added for any of the pH tanks. This fluid level safeguard includes a second contact sensor for determining the status of the pH valve. If the valve is closed while it should be open (or vice versa), the computer will generate an alarm message and discontinue irrigation.

The computer can also show the current supply in each pH tank and generate an alarm based on a minimum fluid level measurement (set as a percentage of the tank's total volume).



Irrigation start options

Time start

A time start is a feature that triggers irrigation when a pre-set time is reached. You can set a time start to occur on a particular day every week (i.e. cyclically), every day of the week (for instance, every day at noon), or only once (for instance, on Friday at 10 a.m.).

Radiation start

One of the most frequently-used start conditions for irrigation is the radiation start. After all, the more radiation (or sunlight) the crop plants receive, the more the plants transpire and the greater their need for water. Using a graph, you can set a radiation sum that triggers an irrigation cycle. Different settings can be programmed for each period. The pre-set radiation sum can also be influenced by the drain water, enabling you to set the desired decrease of the radiation sum based on the measured drain water percentage.

Pause start

This allows you to set a pause time, after which irrigation starts automatically. You can set a different pause time for each period.



Manual valve start

An irrigation group can also be activated by means of a manual valve start. When a manual valve start is performed, only the pre-selected valves will open. You can also set the periods in which these valves may open.

External start contact

This option expands the start conditions of an irrigation group with external start contact.

Moisture measurement

This option expands the start conditions of an irrigation group with a moisture measurement in the substrate slab. The moisture percentage that triggers irrigation can be set over a 24-hour period using a graph. This allows you to set the precise course of the slab's moisture content over 24 hours. This sensor input is suitable for any type of moisture sensor.

Irrigation System

Water storage tanks

The water storage tank option allows you to manage and register the various types of water and water supplies used in the greenhouse. Each tank can be assigned its own distinctive name, such as 'reservoir', 'drain water tank', 'day storage' or 'discharge pipe manifold'.

To monitor and activate pumps and irrigation groups, you can add minimum, maximum and refill level measurements (these are level contacts) for each water storage tank. Also available is a linear level measurement which includes all of the above-mentioned options in addition to showing how much water is currently stored in the tank.

A further option is an output which activates a pump or irrigation group to automatically refill a storage tank.

Return groups

Return groups can be used for two purposes:

1. To register the quantity and EC and pH values of the return or drain water
2. To select which storage tank is to be used to store a particular type of water (so the same types of water are stored together)

A return group can be assigned to an irrigation group or irrigation valve. The ratio between the drain water measurement and irrigation volume applied (both converted to l/m²) determines the drain water percentage. This drain water percentage can be used to influence the irrigation start times and the radiation sum to be reached.

If multiple crop varieties are grown, it may be useful to completely separate the water flows. This can be achieved with the selection option in the return measurement. This option lets you select which tank should be used to store the return or drain water and lets you select a different tank for each irrigation group.

Mixing tank

A mixing tank is used to blend fertilisers with irrigation water. A mixing tank can be equipped with a fluid level measurement, which may consist of three contacts or a linear level measurement. This level measurement is necessary if you want the mixing tank to be emptied at the end of an irrigation cycle.

This measurement option is not required if you do not intend to use the control functionality of the mixing tank. In such systems, the mixing tank is equipped with a pneumatic float.

Emptying and circulating water in the mixing tank

If fertigation recipes are used, you can program the mixing tank to be emptied when the last valve has finished, at the end of an irrigation cycle (or irrigation phase). You can also program this to occur at the end of every irrigation cycle, or only after a recipe switch. Once it has been emptied, the mixing tank is refilled with water, which is then circulated until it reaches the desired EC and pH values.

System pumps

System pumps are used to transport water to the valves. The computer activates the necessary system pump during irrigation. The dealer can set a pre-run and post-run time to build and maintain the system pressure, so the valves will operate correctly.

If a contact sensor is present, the computer can check whether the system pump has actually switched on after instructing it to do so. If the system pump is still switched off, an alarm message is generated specifying which pump has failed to activate. An optional external activation contact can then switch on the system pump without the aid of the valve group.

Filling pumps

The filling pumps control enables you to regulate the fluid level in one or more mixing tanks. If a contact sensor is present, the computer can ensure that a filling pump has actually switched on during irrigation. If not, the computer can generate an alarm long before a valve alarm is triggered.

Filters

Filter groups control the filter cleaning process, which starts once the pre-set number of operating hours are reached or the pre-set number of litres have passed through the filter in question. The computer can be programmed to interrupt an irrigation cycle or wait until an irrigation cycle has finished before cleaning the filter. Filter cleaning can also be delayed until evening, for instance, by setting the start and end times between which cleaning may occur.

A filter group includes options for activating the cleaning process by means of a contact start from a pressure or other type of clogging sensor and an adjustable circulation duration.

One filter group is needed for each filter to be back-flushed. An additional option is the ability to control an extra circulation valve. This allows water to be circulated through the filter for a pre-set duration following the cleaning process prior to irrigation, so the irrigation water will



reach the desired EC and pH levels. This control option can also be used to open a circulation valve on the mixing tank or a discharge valve, for instance. Once the pre-set circulation duration has elapsed, the computer will open the first valve in the irrigation group.

A filter set consists of one or more filters. A filter set can be linked to a pump. During filter flushing, all the filters in a filter set are flushed consecutively.

A filter set can be flushed automatically based on operating time as well as the number of litres of water that have passed through it.

The computer can be programmed to circulate water through the ring main of a mixing tank and/or filter set when an interrupted irrigation cycle is resumed or at the start of the next irrigation cycle, after filter flushing is complete. This is done to achieve the desired EC and pH levels in the irrigation water. A readout shows you when filter flushing last occurred.

Water transport groups

Water transport groups are designed to monitor and register the amount of water drawn for an irrigation cycle. A pulse sensor or HortiMaX F15 flow sensor can be used to measure the flow rate.

Additional options

Valve control

This valve option allows you to set the expected water requirement and the offset for an alarm for each valve. You can also program whether the valve should supply water based on time, litres, cc or mm as well as the desired duration, volume and EC and pH levels.

Discharge valve control

This option includes settings for selecting whether or not to discharge the irrigation or drain water, discharging based on time/litres and the discharge duration. If this option is added, you can select whether or not to discharge the irrigation or drain water and, if so, which discharge valve is to be used for each irrigation group.

Period settings

The number of periods that can be set for ebb and flow and drip irrigation groups can be expanded up to 3 periods. A maximum of 2 periods can be set for sprinkler irrigation groups.

Phase setting for irrigation

Two phases can be used for a sprinkler irrigation group. Irrigation settings, such as EC, pH, fertiliser ratio, activating pulse dosing pumps, pre-mixing EC, etc., can be set individually for each phase.

Activation output for irrigation group

An activation output can be added to control an additional dosing pump for each irrigation group.

Status measurement of valve position

A contact sensor can be added for each valve to confirm whether the valve is responding correctly to computer control. This option is designed specifically for businesses where successful crop production depends on fast and accurate irrigation. If the valve position does not correspond with the control output, the computer immediately generates an alarm. As a result, this alarm is generated prior to the flow alarm.

External stop contact

This option expands the stop conditions of an irrigation group with a contact stop. A stop action takes priority over a start action. If a stop contact is activated during an irrigation cycle, an alarm is generated and the irrigation cycle can only be resumed manually (provided 'Stop if valve contact alarm generated' is set to Yes).

Energy controls

A wide range of energy controls are available for the HortiMaX CX500. Since every HortiMaX CX500 is customised, many of these controls are optional. Using the HortiMaX CX Assistant software, a grower selects the desired controls together with one of our dealers. Underlying control elements that are not needed are disabled, but can be enabled free of charge if the grower wants to expand their configuration later.

Different types of heating system

A wide range of controls are available for heat sources and buffer tanks. To choose the right selection of controls and configure them correctly, you first need to determine the type of heating system to be controlled. For this purpose, we distinguish between two types of heating system:

- 1. A conventional system, which utilises the boiler to meet a heat demand. Any excess heat (generated during CO₂ production, for instance) is stored in the heat buffer.
- 2. An open buffer system, which utilises the heat buffer to meet a heat demand. The heat buffer distributes the heat demand among the heat sources it is connected to.

It defeats the purpose of this document to name the specific benefits and drawbacks of these two types of heating system. What should be mentioned, however, is that each of these systems requires a totally different type of control configuration, both of which the HortiMaX CX500 can provide. Please note that it is not possible to interlink the controls of conventional buffer systems to those of open buffer systems or vice versa, unless expressly stated otherwise.

For an overview of the most common combination of controls for a boiler, boiler pump, burner and heat buffer (elements in both conventional and open buffer systems), please see the end of this chapter that includes a number of diagrams with the various system elements.

An option is available that enables third parties, such as an energy supplier, to remotely manage the grower’s heating system. This ‘boiler takeover’ control allows an energy supplier to adjust control variables, such as the desired heat output for CO₂ and the highest temperature demand. The boiler takeover control can be added to the system along with other programs, so the grower can easily to switch to third-party management of their heating system while retaining the ability to monitor one of their nursery’s most critical control processes.



Heat sources

Boilers

Conventional boiler

The conventional boiler control regulates the boiler temperature within an adjustable minimum, maximum and delta temperature. The delta temperature is the highest calculated pipe temperature increased by a delta temperature calculated based on the heat demand of the pipe heating circuits linked to the boiler.

The cascade control (also called boiler sequence control) enables a number of boilers in a heating system to be switched on and off independently of one another. When there is a heat demand, the boiler switches on based on the manifold temperature. When there is a CO₂ demand, the boiler programmed to switch on for CO₂ enrichment switches on first.

Boiler in Open Buffer (BiOB)

In an open buffer configuration, the desired boiler output is calculated by the Energy Control module. The BiOB control only contains settings for programming the specific characteristics of the boiler, such as the minimum and maximum boiler temperatures.

As long as the boiler temperature stays within these pre-set limits, the calculated boiler output is relayed immediately to the burner system. The mixing valve control ensures that the boiler temperature setpoint is achieved.

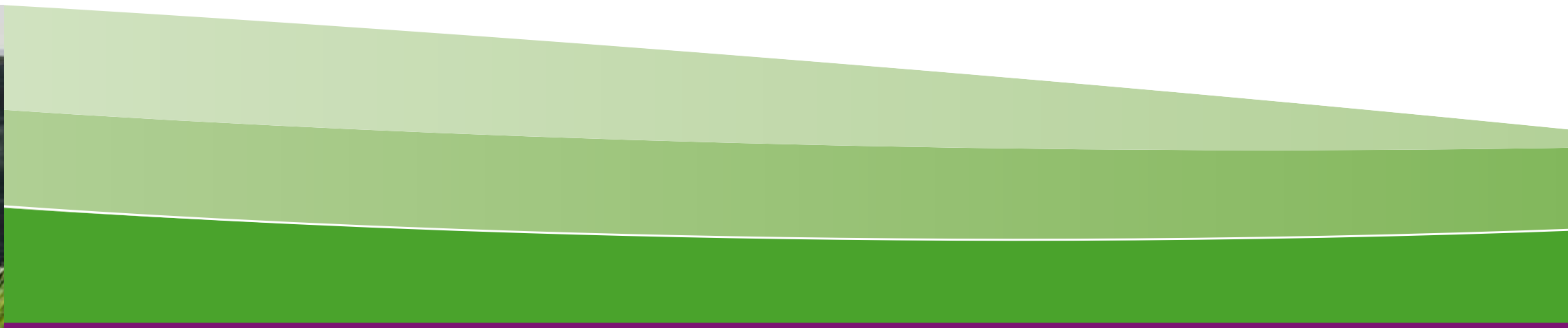
Boiler temperature measurement with inhibit output (not a boiler control)

In addition to registering the boiler temperature, this option enables you to set the air temperature above which the boiler switches off.

Alarm control for boiler CO detector

This control allows you to program the computer off the CO₂ unit and generate an alarm, if dangerous CO levels are detected.





Boiler pump control (open buffer)

This control is only suitable for open buffer systems. It calculates the position of the mixing valve based on the measured and calculated water temperatures. It includes open/stop/close outputs for the mixing valve and one control output for the circulation pump. It also comes with the following sensor inputs: one for measuring the mixing valve position, one suitable for a boiler pump alarm and one for displaying the water temperature. Certain configurations can use the boiler temperature measurement as the water temperature. However, since the measured boiler water temperature does not always reflect the actual water temperature, a separate sensor input is available to set a more accurate control trajectory.

This boiler pump control can be expanded with a high/low speed output or frequency-controlled pump output, which is configured based on the calculated position of the burner valve.

Boiler pump control

The boiler pump control has two purposes: The first is to determine the volume of water flowing back to the boiler to keep the boiler temperature just below the pre-set maximum over the entire burner control trajectory. The second is to calculate the optimum boiler temperature setpoint and, with it, the buffer filling temperature.

Boiler shock pump control

This control is only suitable for open buffer systems. The computer switches on the boiler shock pump together with the burner and keeps the pump running for the pre-set duration after the burner switches off (this is called post-run control).

Burners

Burners are controlled from the Boiler module. The heat output calculated by the Boiler or Energy Control module is relayed immediately to burner control. All the burner controls listed below include one 'link output' (which allows the computer to take over the burner's output control), one boiler activation output, one sensor input for a burner status readout and one general alarm message for the burner panel. Each of the burner controls includes dealer settings to configure the specific burner characteristics.

On/Off control

This control is designed for a burner with a fixed high output position and fixed low output position. In addition to the standard control outputs and sensor inputs, this option comes with one additional control output to adjust the burner to high output.

Modulating control

This control is designed for a burner with a modulating burner valve and a 1-speed fan with or without an autonomously-controlled frequency controller. If the burner is equipped with a frequency-controlled fan, we assume that it includes its own control mechanism based on the burner valve position. In addition to the standard control outputs and sensor inputs, two additional control outputs are included which – once connected to a Fidu-Face – adjust the burner valve to the high or low position. This option includes an additional sensor input for measuring the burner valve position.

Two-speed modulating control

This modulating control includes an additional control output for adjusting the burner to high output. The boiler output at which the burner switches from low to high speed is set by the dealer when the system is commissioned.

Heat buffers

Conventional heat buffer

Buffers are used to store the excess heat generated by the heat sources. A buffer can only be filled during the pre-set buffer time and additional buffer time. Filling normally starts when the start condition 'minimum boiler temperature for buffer storage' is met, or following a start command by the CHP (Combined Heat and Power) system. Whether heat is actually stored in the buffer depends on the available buffer space.

The conventional buffer control includes open and close outputs for the boiler shut-off valve (or discharge valve), the mixing valve for filling the buffer (or load mixing valve) and the mixing valve for emptying the buffer (or discharge mixing valve), as well as two outputs for switching the buffer filling pump (or load pump) on/off or to high/low. This control includes sensor inputs for measuring the return boiler water temperature, heat exchanger temperature, buffer inlet temperature, buffer return temperature and six buffer segment temperatures.

Heat buffer control for open buffers

This control calculates the volume of heat stored in the buffer based on the average segment temperature, the pre-set maximum temperature and the capacity of the buffer tank. This calculated value is then relayed to the Energy Control module. Eight sensor inputs are included for connecting the same number of segment temperature sensors.

Source pumps

To prevent the computer from simultaneously activating more than one source pump or frequently switching between the pumps, you can set activation delays and minimum operating times for these devices. You can also program the pumps to keep running at low speed, so the pipes won't freeze during prolonged periods of frost.

A heat pump can be controlled based on the:

- buffer load
- cold/warm manifold temperature
- buffer load + cold/warm manifold temperature.

The heat pump can only be activated if the condenser and evaporator valves are both open and the condenser and evaporator pumps are both running.

Energy Control

The Energy Control module is used to manage heat and CO₂ sources based on the current and the desired heat stock in a buffer tank. When the 24-hour heat consumption threatens to exceed the maximum limit, the module adjusts the heating setpoints of the pre-selected blocks. The Energy Control module is only suitable for heat sources and heat buffers that have been installed according to the open buffer principle. This means that each heat source needs to be fitted with its own control mechanism to achieve an outlet water temperature of approx. 95°C.

The Energy Control module includes an 'energy control unit', which consists of all the heat sources, heat buffers and pipe heating circuits that are interconnected by a system of water pipes. The Energy Control module calculates the heat output required of each heat source based on the available and desired buffer storage capacities. The results of these calculations are then used to adjust the setpoints of the various heat sources. The CO₂ sources are controlled in much the same way, except that the module's calculations are not based on the amount of CO₂ produced, but the amount of heat released during the production process.

Alarms

Gas measurement

The gas meter measures the actual gas consumption. This data is registered in various ways, such as the highest gas consumption, the average gas consumption and the cumulative gas consumption. The 24-hour consumption measured by the gas meter is used to calculate the maximum heat output.

You can include additional gas measurements to register the amount of gas consumed by a CHP system, for instance. The values registered include the current gas consumption, gas consumption over the last 15 minutes, gas consumption today, gas consumption yesterday, cumulative gas consumption since reset time, highest hourly consumption and time of highest hourly consumption.

Electricity consumption measurement

This sensor input registers a number of values, including the current electricity consumption, electricity consumption over the last hour, electricity consumption today, electricity consumption yesterday, cumulative electricity consumption since reset time, highest hourly electricity consumption and time of highest hourly electricity consumption. If applicable, the registered electricity consumption is divided into peak and non—peak times.

Cyclic lighting

Cyclic lighting is controlled based on three adjustable periods per day, enabling you to set a pre-, mid- and post-night period, for instance. During the pre-set periods, an adjustable cycle time of up to 60 minutes is enabled. While the cycle time is in effect, the computer activates the pre-selected lighting groups in turn.

The HortiMaX CX500 continuously monitors the mains voltage, sensor inputs and responses to control actions. The alarm circuit board generates an immediate warning should the mains voltage fail. The software reports any incorrect measurements or failures to respond to control actions in time to the alarm board. The software is also capable of distinguishing between climate and irrigation alarms and external alarms.

External alarms

The HortiMaX CX500 can be used as the main reporting and registration system for all alarms generated by the greenhouse equipment. The alarm connections can be assigned user-definable texts, such as Osmosis, Cooling Cell or Block Control Cabinet. Alarms are registered in a logbook and relayed or not relayed to the alarm board depending on how the alarms are set up. You can also program whether an alarm is to be triggered immediately or following a pre-set delay.

Selective alarm reporting

In addition to the standard methods of alarm reporting, alarms can also be sent by text message. The various types of alarm message for the climate and irrigation modules are divided into groups. You can program whether a group of alarms should be sent by text message and, if so, the phone numbers that the alarms should be sent to. The latter option enables you to send particular alarms to different people. Other options allow you to set the number of send attempts, the delay time between attempts and the delay time before the alarm message is eventually sent to the alarm board. This last setting is used if no response is received to the text messages within the time required.

Please note that selective alarm reporting is an add-on application and requires a modem and text messaging service in order to operate. It is also necessary to connect the alarm board to an external alarm reporting device (with an emergency power supply).

Customised with the HortiMaX CX Assistant

The HortiMaX CX Assistant software makes configuring a growing solution easy and fun. This process focuses on a grower's crop and control needs, rather than 'hard' technology. Depending on the type of crop grown, the local conditions, the user's knowledge level and other requirements (for instance, the number of measurements, sensors, pumps, valves and valve groups needed), a grower discusses which controls to add to the system together with one of our dealers. The HortiMaX CX500 is customised to the grower's exact requirements by simply dragging and dropping the desired controls in CX Assistant. The illustration on the next page shows how this process works.

Is a grower planning to expand or has a grower's needs changed? No problem - the CX500 is easy to upgrade or modify. Does a grower want to start using hot air heaters in addition to the pipe heating system? All our dealers are able to configure, test and activate any extra controls a grower needs. A dealer simply connects their computer on-site, downloads the configuration file (or 'site file') and makes the necessary changes.

Although CX assistant was specially designed for dealers, growers might be interested to know what its main features are. CX Assistant allows dealers to:

- configure and customise a HortiMaX CX500
- check a process computer or configuration
- automatically generate a wiring list
- determine which I/O modules and other components are needed
- request a software licence
- install and activate a configuration in the HortiMaX CX500
- download and modify an existing configuration
- analyse the costs of a grower's configuration.

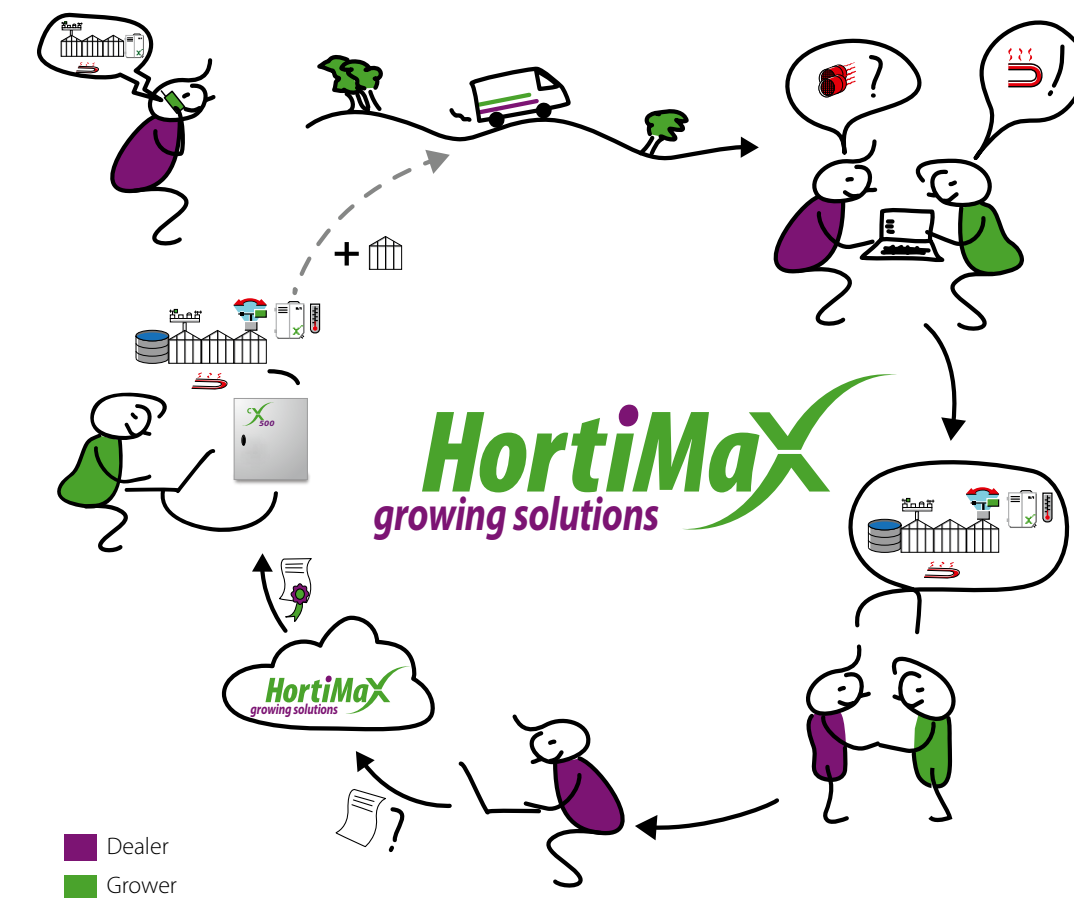
CX Assistant translates the entire configuration into the sales price of the grower's HortiMaX CX500. This price is calculated based on the controls that were added to the configuration. The software minimises both the 'time to configure' and 'time to install'.

The specific benefits for growers:

- The focus is on a grower's crop and control needs.
- The configuration and quotation process is transparent.
- CX Assistant greatly reduces the delivery time.



Customising the HortiMaX CX500



A breeze to operate with Synopta Lite

After installation, the HortiMaX CX500 is immediately ready for use. A PC is all that is needed to connect the HortiMaX CX500. The system is operated with Synopta Lite, our user interface software. A key benefit of Synopta is its stable and tried-and-tested performance. In addition, the software has led the industry in simplicity and ease of use for many years.



Components	Synopta Lite	Synopta Professional
Separate server	No, on IPC	Separate server
Max. number of windows	1	Unlimited
Max. number of systems	Unlimited	Licentie
Define shortcuts	Yes	Yes
Syngraph	Up to 10 lines	Unlimited
Historical storage	Up 4 weeks	Unlimited
Statistical summaries	Up to 10 graphs	Unlimited
Summaries	A number of fixed summaries	Custom summaries
Language support	Native language	Native language
Remote Access	Standard	Standard
Users	One user at a time	Multi User
User rights	X	✓
Syntab	X	✓
Export function	X	✓
Syncustom	X	✓
Synview	X	✓

Comes standard with every HortiMaX CX500, included in price!

Synopta Professional includes more options. Available at extra cost.

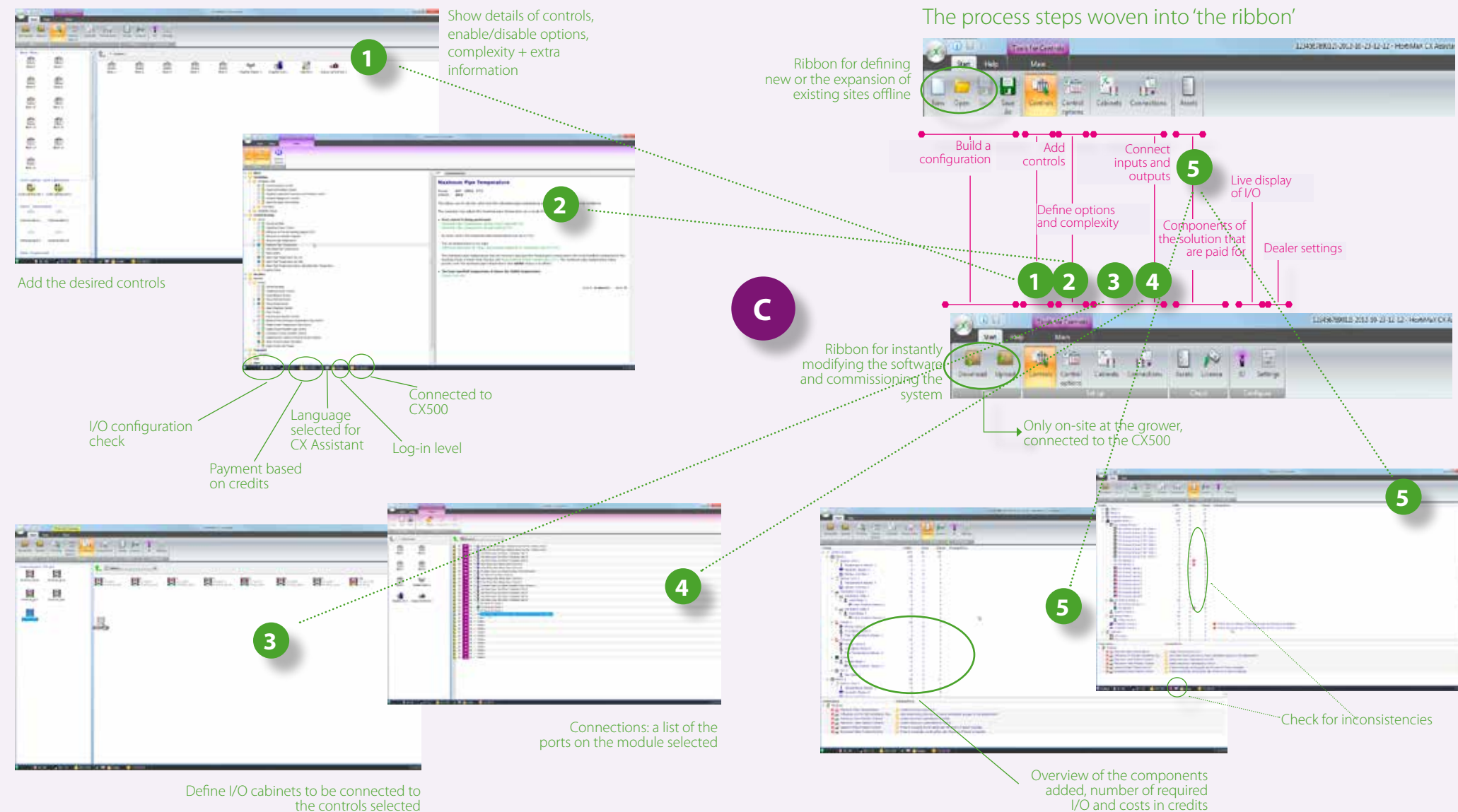
Upgrade

We redesigned Synopta specifically for the HortiMaX CX500. After all, a process computer that is expandable, versatile and adaptable requires intelligent software that offers the same benefits. This led to the development of Synopta Lite, which includes a number of changes to make the software even easier and faster to use. Should the functionality of Synopta Lite not meet a grower's needs, it is easy to upgrade to Synopta Professional. The table on the left lists the differences between both versions.

More detailed information on our Synopta software can be found in this document: 110157 Synopta 3 product description

- The specific benefits of Synopta Lite for growers:
- Intuitive and transparent system
 - Fast learning curve for new users
 - Includes all functionality for basic control
 - Ready for use right away (plug & play)
 - Easy to upgrade







A Global Growing Solutions Company

www.ridder.com