

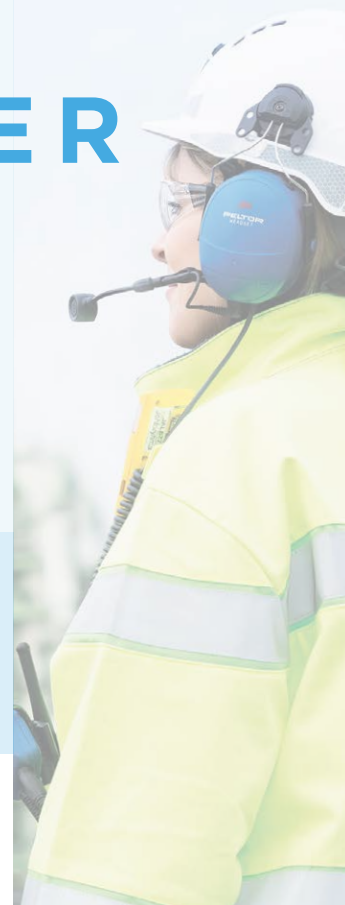


NAPCON CONTROLLER

NAPCON Controller maximizes both production rate and quality by providing tight control over the process despite difficult dynamics or disturbances. Fast implementation process and the reliable operation of NAPCON Controller guarantee early return on investment.

NAPCON IMPROVE

- **NAPCON CONTROLLER**
- **NAPCON OPTIMIZER**





NAPCON CONTROLLER MAIN BENEFITS

- NAPCON Controller enables continuous operation near the true plant limits, also during changes, thus facilitating production rate maximization.
- Short pay-back time; typically considerable production increase has been achieved with no investment on processing equipment and with no process down-time.
- Early start; NAPCON Controller starts to earn its economic benefits already during the commissioning of the application, as NAPCON Controller works well even if only a part of the control matrix is on.
- NAPCON Controller elegantly handles complex process behavior and difficult process dynamics, which enables tight control subject to process-specific targets and constraints.
- Robust solution architecture ensures low susceptibility to process disturbances and low maintenance needs.

NAPCON CONTROLLER KEY FEATURES

- NAPCON Controller is platform independent. State-of-the-art certified OPC UA communication allows interfacing with all common process control systems (DCS or PLC).
- NAPCON Controller is scalable. Its flexible structure facilitates implementation of small or large control applications from just a few controlled and manipulated variables up to several hundred. Its modular design allows easy expansion from a single unit to multi-unit control to support investment and expansion programs.
- NAPCON Controller is applicable to both linear and non-linear processes and also supports cascade control structure.
- NAPCON Controller has an efficient optimization algorithm that allows fast control cycles of only a few seconds.



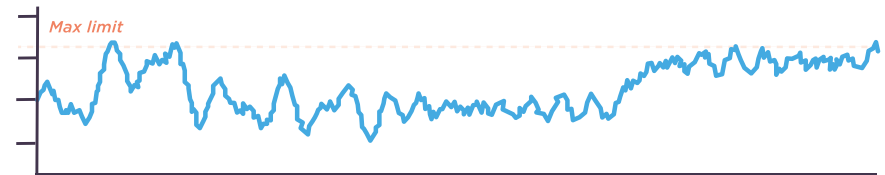
PRODUCTION OPTIMIZATION CASE EXAMPLE

In the core of the NAPCON Controller is a configurable optimization problem that is formed and solved at each control cycle. Production optimization and other plant objectives are conveniently integrated to NAPCON Controller's optimization problem utilizing versatile variable types and tuning parameters that are easily accessible through NAPCON's user friendly tools. Depending on the process and the control strategy, most weight can be put e.g. on production maximization, maximization of certain yields, minimization of energy and other costs, reducing emissions or maximization of process run length.

Efficient handling of process constraints and other limitations is essential for production optimization. NAPCON Controller supports several different constraint types, thus enabling solution design that best fits the process in question. In NAPCON Controller, all constraints are constantly monitored, but only the currently most limiting ones affect the solution at each control cycle. The constraining values can be adjusted as required based on process state and operative

*"First we tried to keep the specs by **manually** adjusting temperature and flow rate set points on our product."*

*"Then we installed **NAPCON Controller**. Product variations reduced dramatically and we could move closer to the specs! This paid off by improved energy efficiency, better yields and higher throughputs."*



**PLC OR DCS
OPERATOR CONTROL**

**NAPCON CONTROLLER
VARIATIONS MINIMIZED**

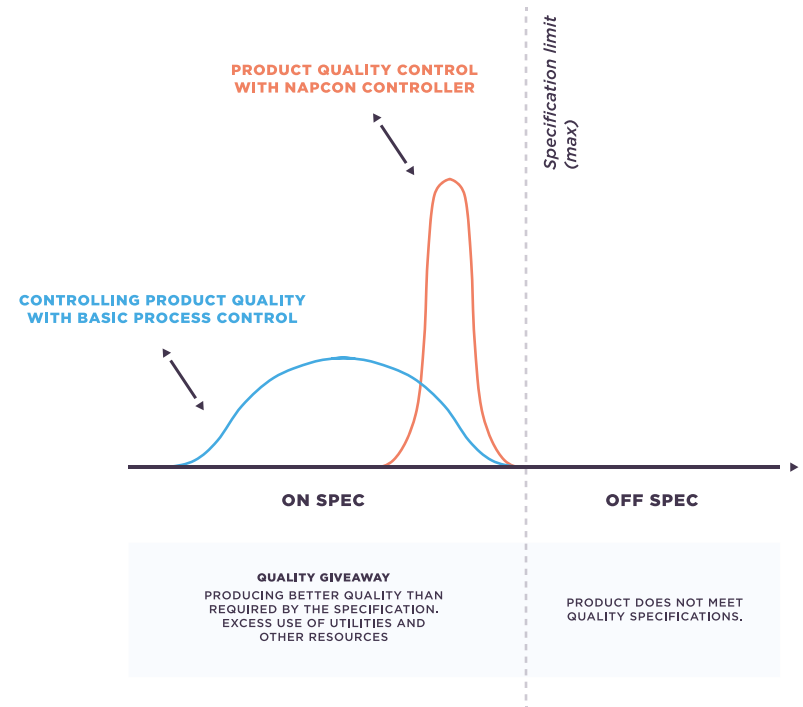
**NAPCON CONTROLLER
PROCESS ON A MAXIMUM LIMIT,
10-15 % MORE PROFIT**

NAPCON Controller decreases variations in the process and facilitates production maximization, maximization of certain yields and minimization of energy consumption.

QUALITY CONTROL CASE EXAMPLE

NAPCON Controller is particularly suitable for controlling the product quality of a process industry plant, where off-spec production would mean significant losses and producing over-quality would not be optimal use of resources. Where on-line process analyzers are available, NAPCON Controller can easily be tuned to utilize them. NAPCON Controller is built to master asynchronous and irregular analyzer measurements and also to monitor for possible faulty analyzer values. When analyzer values are not available NAPCON Controller can either run based on its own process models or use online process calculations instead.

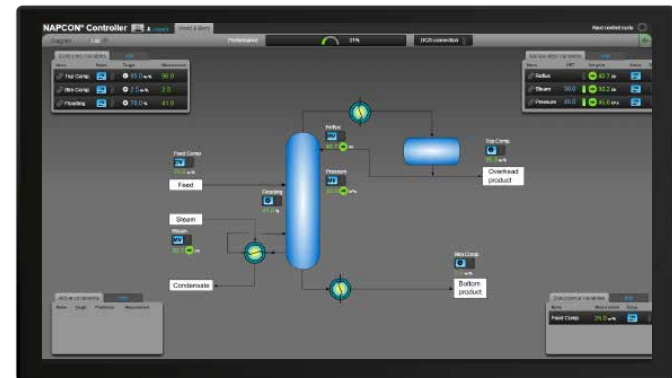
NAPCON Controller comes together with NAPCON Analytics, a powerful calculation platform that can be used for creating on demand on-line process calculations that can be used either independently or in conjunction with on-line analyzer values or laboratory data.



The optimal process operation is to run as close as possible to the process limits. NAPCON Controller decreases variance in main quality variables and keeps the process safely and economically near, but on the right side of the constraints.

NAPCON CONTROLLER USABILITY AND CONFIGURATION

The usability of NAPCON Controller has been designed with panel operator's work flow in mind. The most convenient way to operate NAPCON Controller is through web displays. Web technology allows integration of NAPCON Controller user interface with the operating environment of process control system (SCADA or DCS). As multivariable control applications are complex by nature, the user interface facilitates focusing on the most important topics that need operator attention. Its objective is also to provide an overview of the application and to allow drill-down.



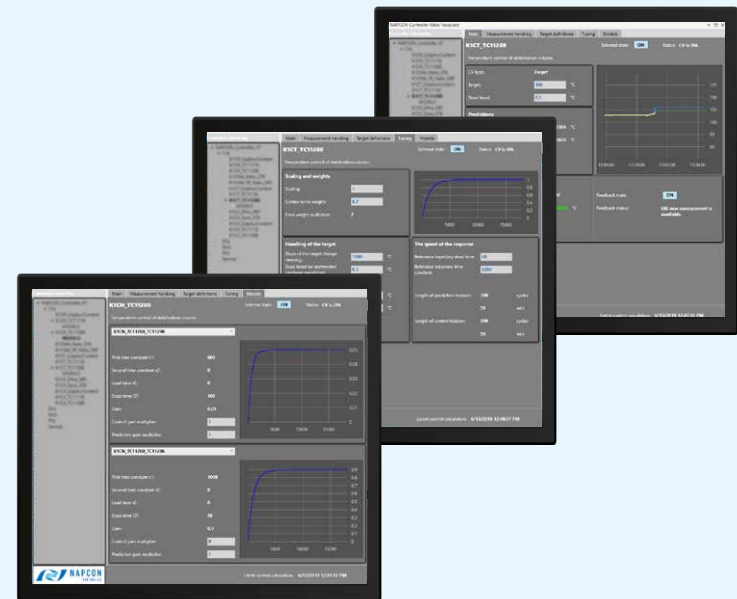
NAPCON Controller operator user interface is based on the latest web technology. It can be seamlessly integrated to all modern DCS or SCADA operating environments and facilitates fluent workflow for panel operators.

NAPCON CONTROLLER USABILITY AND CONFIGURATION

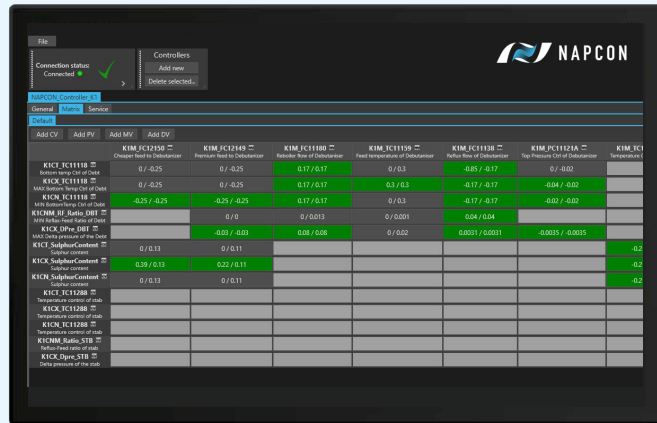
There is a separate user interface for configuration, tuning and troubleshooting the NAPCON Controller applications.

- NAPCON Controller faceplates overview of the application for tuning, providing access to full spectrum of control parameters.
- Control models used by NAPCON Controller are identified with NAPCON's modeling tool with just a few clicks. For maximum robustness of control models, NAPCON Modeller features regularization, variable bounds and partial model identification. If needed, NAPCON Modeller provides tools to remove outliers and other undesired data features.
- NAPCON Configurator offers easy configuration process which is facilitated by an intuitive user interface.
- NAPCON Improve Dashboards provide extensive reporting and visualization capabilities for control performance reporting and monitoring. Flexible dashboard architecture allows for a straightforward addition of user defined KPIs to meet any demands for the detail level of controller performance report. Dashboard is based on the latest web technology and offers full customization of the UI elements for great usability.

- Full integration with NAPCON Analytics, a powerful calculation and reporting platform with features that allow to:
 - create on demand calculations and data visualization with a web application to be used for analytics, monitoring, big data etc.
 - support for 3rd party data analysis libraries

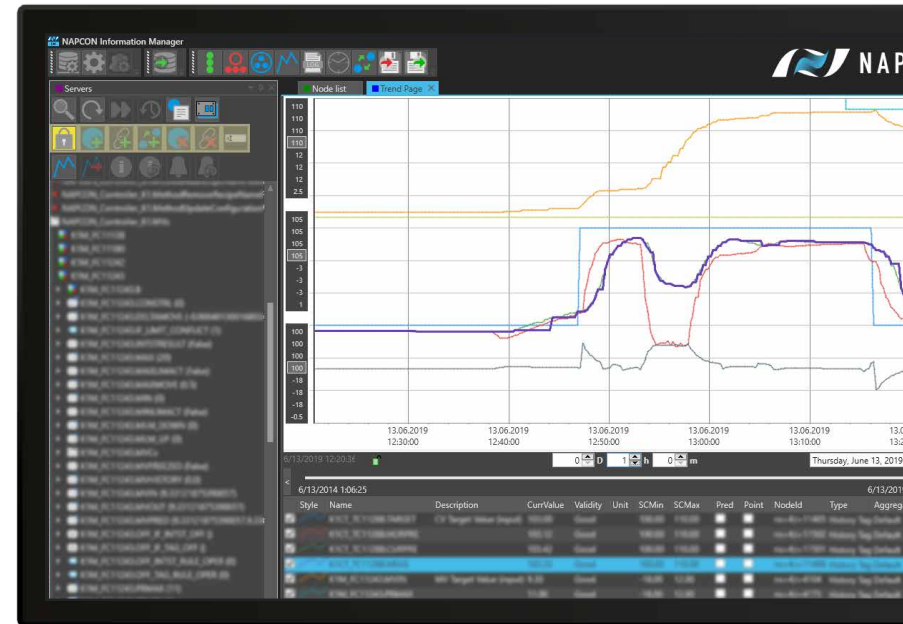


NAPCON Controller faceplates provide access to full spectrum of control parameters to allow the best control performance by controller tuning.



NAPCON Configurator offers easy configuration process of NAPCON Controller. The configuration tool is integrated with NAPCON Modeller and NAPCON Informer to support seamless workflow for controller configuration.

NAPCON APC Dashboards offer extensive reporting and visualization capabilities for control performance monitoring. Default KPIs facilitate easy insight on control results. Flexible web-based dashboard architecture also enables user-defined KPIs to monitor behavior of NAPCON Controller applications.



Trend views offer a convenient way to monitor control performance. Versatile trending options are available for control performance and controller parameters.

WIDE APPLICATION AREA

NAPCON Controller has been successfully used in several fields of the process industry, including e.g. oil refining, petrochemicals industry, food & beverage, and forest products industry. Key success factors of the wide applicability include the flexibility of NAPCON Controller algorithm and the extensive number of optional tuning parameters to adapt the application to the selected control strategy. Also the NAPCON Controller has the ability to handle asynchronous on-line analyzer measurements, as well as to combine them with on-line process calculations and flexible handling of varying raw material and product grades.

One of the most typical control strategies for NAPCON Controller is the maximization of economic performance. Configuration for that has been made especially easy and versatile:

- Several controlled variable (CV) types: maximization and minimization, target, asymmetric, dead band, asynchronous analyzer with fault checking as well as maximum and minimum constraints
- Feedforward disturbance variables (DV) to compensate for measured and estimated disturbances
- Online model adaptation
- Online MV optimization if extra degrees of freedom are available to achieve maximum potential.



OPERATIONAL SAFETY AND RELIABILITY

- NAPCON Controller undergoes rigorous automatic testing before deployment at the client site.
- NAPCON Controller interfaces to the underlying process control system (DCS or PLC) through safety loops to ensure maximum safety and reliability of the control solution.
- NAPCON Informer goes above and beyond to ensure reliable operation of NAPCON Controller and provides:
 - Excellent scalability with high data throughput
 - Wide support for security features: encrypted OPC UA communication, antivirus software, whitelisting, user identification, encrypted data transport, certificates.

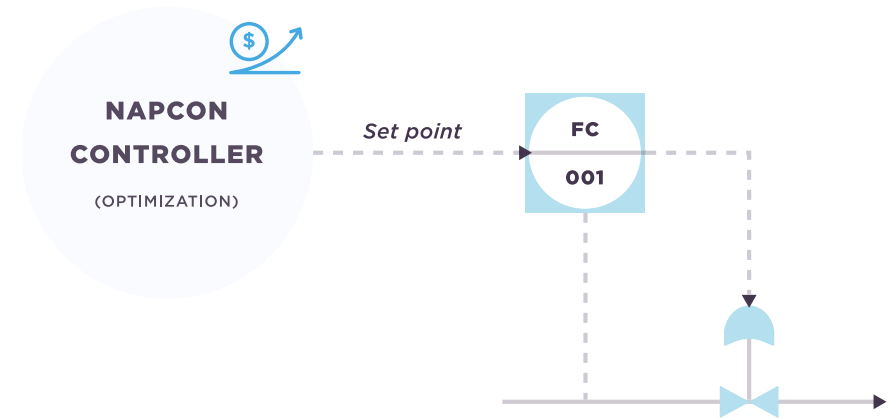


ADVANCED PROCESS CONTROL ALGORITHM

NAPCON Controller calculates optimal set point values for basic process controllers. The calculation of optimal control moves is based on dynamic process models. Optimality is defined as:

- Meeting the user-specified advanced process control targets (such as product specifications)
- Maximization or minimization of certain variables (such as maximization of throughput or yield or minimization of energy consumption)
- Respecting the constraint values defined for process variables, valve positions and controller outputs
- Obeying the limits for rate of change for the set point values as well as the minimum and maximum limits for the set point values.

Optimal set point values are calculated on every control cycle that can vary from a few seconds to several minutes.



NAPCON Controller calculates new optimal set point values for basic controllers on each control cycle. The objective is to push the process to the best operating point as defined by advanced process control targets and constraints. The cycle length is adjustable from a few seconds to several minutes.

PLATFORM - NAPCON INFORMER

NAPCON Informer is the process information management system that forms the platform for NAPCON Controller. NAPCON Informer has several key tasks for enabling NAPCON Controller application to run:

- It coordinates the execution of various NAPCON Controller applications, required on-line calculation applications and other supporting applications.
- It takes care of communication with other systems. OPC UA protocol is used for the communication. The most important is the communication with the process control system (DCS or PLC).
- Process measurements, NAPCON calculation results and its tuning and other parameter values are stored in NAPCON Informer database.
- NAPCON Information Manager offers an engineering user-interface for NAPCON Controller.

NAPCON Informer consists internally of two components, which are:

1. NAPCON UA Server

- Standard OPC UA Server
- OPC UA compliant information modelling
- Information models for various variable types needed by NAPCON Controller (eg. APC configuration, tuning, models, etc.)
- Storage of current values of OPC UA nodes (measurements, configuration parameters, meta data etc.)
- Dynamic modification of the OPC UA address space
- Built on Microsoft .NET technology

2. NAPCON History Database

- Store historical data for process data, alarms and events for further use, e.g. trending, reporting, data analysis and troubleshooting
- PostgreSQL database technology. Object-relational database optimized for time-series storage
- Several schemes for data compression
- Buffered input to even out momentary high loads of data transmissions.



NAPCON CONTROLLER TECHNOLOGY

NAPCON Informer has many excellent features that improve the usability, reliability and security on NAPCON Controller applications

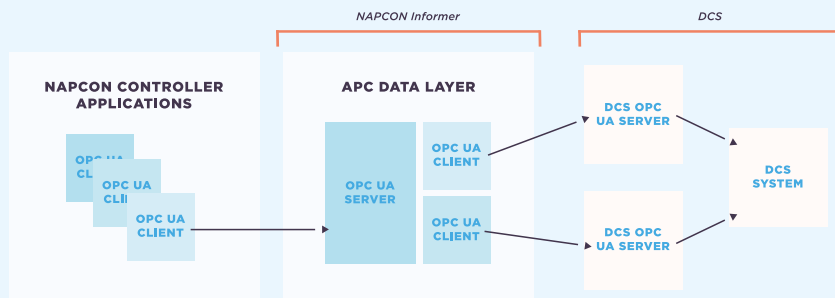
- Excellent scalability with high data throughput capability
- Security features that are built into OPC UA: message encryption and signing, user and application identification
- Application monitoring & logging for efficient maintenance
- Automated scheduled backup on remote PCs.
- Independent user operations via Windows Service based components
- Windows 64 bit platforms

WEB-BASED OPERATOR USER-INTERFACE

NAPCON Improve Operator Interface is implemented with modern browser-based web technologies. This makes the user-interface platform-independent, and allows its installation on the operating stations of all modern process control systems (SCADA or DCS).

Supported browsers are Chrome, Firefox (version 35 and up) and Edge. The user interface does not require an Internet connection. NAPCON Improve Operator In-

terface is directly linked with NAPCON Informer database. There is also an easy-to-use tool for designing and configuring NAPCON Controller user-interfaces, called NAPCON Improve Operator Interface Designer. This tool links directly with NAPCON Informer database, too.



ON-LINE PROCESS CALCULATIONS

On-line process calculations form a vital part of most advanced process control applications. They can range from simple mathematical operations (such as calculation of the difference between two temperature measurements) to computation of virtual analyzers or inferentials to estimate important product properties in real-time (such as composition, distillation end point or humidity of a powder product).

NAPCON suite includes three different types of on-line calculations:

- Simple mathematical calculations can be directly implemented to the database in NAPCON Information Manager.
- NAPCON Calculation Framework enables definition of most complex calculation using C# programming language.
- NAPCON has rigorous on-line calculation packages for typical process industry units, TISLA package for distillation column calculations and NAPCON PPP for reactors

REQUIREMENTS

NAPCON Controller and supporting software components are installed on a server in a DMZ area in the plant automation network.

Hardware requirements (typical APC application with 10 manipulated variables):

- CPU with 6 core or more
- Memory at least 16 GB RAM
- Hard disk requirements depend on desired extent and length of stored process history.
- Part of our delivery scope is to define hardware that is best matched for user needs.

Operating systems:

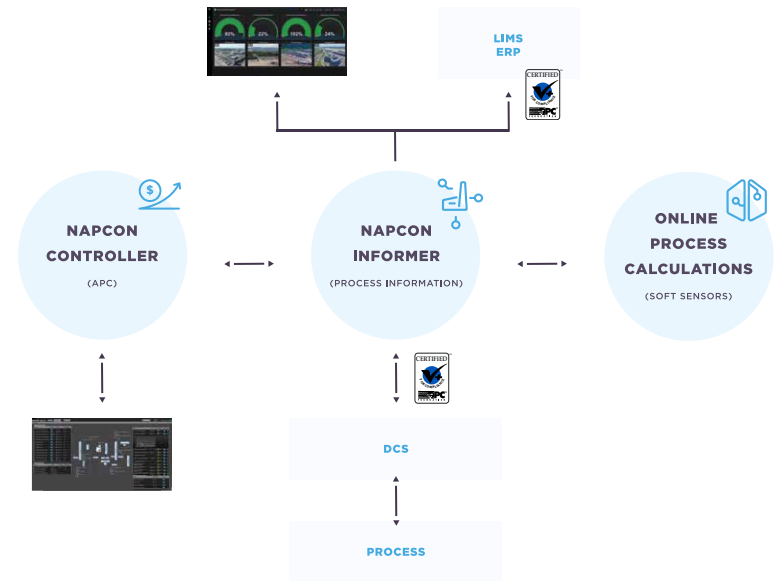
- Windows Server 2016
- Windows Server 2019
- Windows 10

NAPCON recommends virtualization, but can naturally be directly installed on a physical server. E.g. VMware and Hyper-V are supported virtualization platforms.

NAPCON can be connected to a process control system (DCS or PLC) that supports OPC UA communication either native or with OPC UA gateway.

COMMUNICATION

- NAPCON Controller operates on ISA95 levels 2 and 3 on top of a process control system (DCS) ensuring that all operation occurs at maximum level of cyber security.
- The communication between NAPCON Controller and DCS is run through NAPCON Informer which is OPC UA certified database, providing the following features:
 - OPC UA Certified, certified profiles: Standard Server / Data Access Server / Method Server• OPC UA Gateway functionality (e.g. connectivity to DCS systems)
 - OPC UA standard compatible data aggregation for improved history services
 - OPC UA standard diagnostics
 - Intuitive and flexible reporting
 - Integration of accurate and up-to-date data for users from different sources and levels of production
 - Advanced data manipulation and export in multiple formats (e.g. csv, xls, xlsx)
 - Common interface for accessing data stored in separate existing databases
- Several controllers can be linked together also from other vendors through secure OPC UA interface featured by NAPCON Informer.
- Full integration with NAPCON Analytics provides custom online process calculation and soft-sensing capabilities.



OPC UA communication is used between NAPCON applications. That offers seamless integration between NAPCON Controller APC algorithm and online process calculations providing data for advanced process control.



UNDERSTAND

NAPCON Understand solutions will turn the data provided by your plant into relevant information that helps to optimize your company's production.

NAPCON Informer
NAPCON Analytics



IMPROVE

NAPCON Improve solutions will bring out the maximum potential of your operations and helps you to ensure that your investments meet your strategic goals.

NAPCON Controller
NAPCON Optimizer



TRAIN

NAPCON Train solutions will bring the real life plant into the virtual world, making training operators and testing the limits of your plant safe and exciting.

NAPCON Simulator
NAPCON Games

WWW.NAPCONSUIITE.COM

NAPCON@NESTE.COM

+358(0)10 458 1200