# Station and HMI Servers

## About

The **UC 500** server family, part of the **CLP 500** portfolio, provides an all-in-one flexible communication gateway, automation platform and HMI solution for utility and industry applications. The multiple hardware options and its modular and scalable software architecture support the full spectrum of applications from integrated cost-effective station servers to high performing distributed applications, such as large substations or power plants.

## Product overview

The multi-protocol multi-channel gateway provides seamless connectivity options for either station IED data aggregation, connectivity to multiple local or remote control and management systems, RTU/telecontrol gateways or SCADA front-end processors.

The built-in logic engine, fully programmable in IEC 61131-3 languages, allows further application flexibility, either as an application-layer gateway and data processor or as a full automation SoftPLC controller.

The optional **HMI 500** server supports alarms and events, data historian as well as multi-client web-based user interface, featuring advanced 2D vector graphics, topological colouring, tagging and pinning and trending. The **UC 500** therefore also provides users with a full featured SCADA platform for any utility or industrial application.

Notwithstanding the complete feature set, the **UC 500** products, available either with pre-installed or as easy to install software, are configured or managed through the Efacec Automation Studio integrated engineering environment, hence providing application flexibility without compromising engineering efficiency.



### Product Overview

**UC 500** — Station Server
SCADA/HMI server, station controller or gateway/data concentrator. Software product for application to third-party PC-based hardware platforms.

**UC 500E** — Embedded Station Server
**UC 500** station server featuring industrial-grade fanless hardware platform, suitable for harsh environments and targeting minimal maintenance.

### Key features

- Single platform for station servers and HMI
- Multiple communication options
- IEC 61850 Ed. 2.1 compliance
- Hosts SCADA/HMI server
- Full web interface
- IEC 61131-3 PLC programming
- Multiple redundancy options
- Security features built-in

### Benefits

- Unified engineering across all product components
- Modular and scalable hardware and software
- Open and user-friendly
- Feature-rich state-of-the-art HMI
- Easily integrated into IT infrastructures
- Highly adaptable to users' requirements
- Object and template-based database and HMI configuration
- Long experience in substation and Conventional or Renewable Power Plant automation systems

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# Server Components

## Enhanced communications

The available communication software modules support over 50 different serial or IP communication protocols, including all well-established communication standards. Supporting up to 8 control/management centre independent channels and up to 256 IED/RTU connections per unit (unit cascading options available), the **UC 500** can be setup in different configurations according to application scale and expansion requirements. Up to 8 different protocols may be active in each unit, hence allowing the integration of a diverse range of remote stations, SCADA software, RTUs, meters, protection relays, controllers or recorders of multiple manufacturers.

The **UC 500** also provides transparent redundant communication channel/ port operation for selected protocols such as DNP or IEC protocols (in either serial or IP links). Available for both IED/RTU or master station links and in both standalone and redundant unit configurations, redundant communication links further increase system availability.

The availability of OPC connectivity allows simplified integration with industrial automation systems.

## Distributed control system integration

For substation and power plant applications the **UC 500** station servers fully support IEC 61850 and can be applied as true IEC 61850 gateways, providing open system design and full compatibility with other compliant devices, engineering tools and systems.

From a system engineering perspective, the user not only profits from simplified IEC 61850 engineering, but also from the flexibility of defining the logical node classes and logical device allocation in each configuration. This provides unmatched logical configuration capabilities that, allow the deployment of versatile automation and supervision applications within an open systems perspective.

Together with IEC 61850 operation, the **UC 500** also supports SNMP/ ICMP monitoring, hence allowing full supervision of all active assets in the communication system.

Integrating Efacec devices allows further benefits, not only by the use of the common engineering toolset and HMI metaphors, but also by using specific device templates that enable the reduction of errors in system configuration and of engineering times.
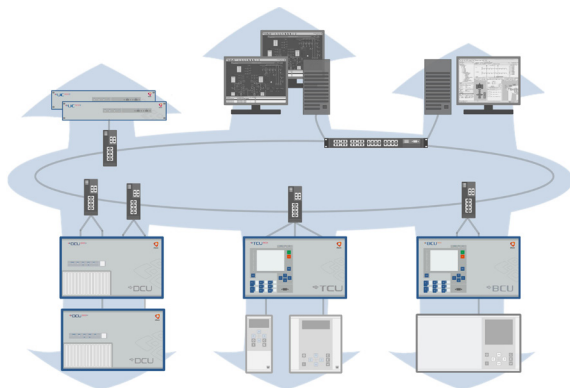


**Fully-integrated IEC 61850 Automation Systems**

| Communication Options | |
|---|---|
| **For distributed Automation** | |
| IEC 61850-8-1 MMS Client (TCP/IP) | o |
| IEC 61850-8-1 MMS Server (TCP/IP) | o |
| Others (Please Contact) | o |
| **Masters/Clients** | |
| IEC 60870-5-101 (Serial) | o |
| IEC 60870-5-101 (UDP/IP) | o |
| IEC 60870-5-103 (Serial) | o |
| IEC 60870-5-104 (TCP/IP) | o |
| IEC 61850-8-1 MMS Client (TCP/IP) | o |
| DNP 3.0 (Serial) | o |
| DNP 3.0 (UDP/TCP/IP) | o |
| Modbus (Serial) | o |
| Modbus (TCP/IP) | o |
| JBus (Serial) | o |
| SpaBus (Serial) | o |
| SNMP / ICMP (UDP/IP) | o |
| OPC UA Client (TCP/IP) | o |
| Procome (Serial) | o |
| Courier (Serial) | o |
| 4F (Serial) | o |
| 4F (UDP/IP) | o |
| PUR (Serial) | o |
| PUR (UDP/IP) | o |
| MLINK (Serial) | o |
| SEL FM (Serial) | o |
| INSUM (Serial) | o |
| SILCOM (Serial) | o |
| Others (Please Contact) | o |
| **Slaves/Servers** | |
| IEC 60870-5-104 (TCP/IP) | o |
| IEC 60870-5-101 (UDP/IP) | o |
| IEC 60870-5-101 (Serial) | o |
| DNP 3.0 (Serial) | o |
| DNP 3.0 (UDP/TCP/IP) | o |
| Modbus (Serial) | o |
| Modbus (TCP/IP) | o |
| OPC AE (TCP/IP) | o |
| OPC UA (TCP/IP) | o |
| 4F (Serial) | o |
| 4F (UDP/IP) | o |
| PUR (Serial) | o |
| PUR (UDP/IP) | o |
| CETT (Serial) | o |
| TG809 (Serial) | o |
| Ferranti (Serial) | o |
| Others (Please Contact) | o |

o Optional feature

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# Server Components

## Clock synchronisation

Real-time clock synchronisation can be performed via SNTP, IRIG-B, PTP or by communication protocol. Multiple clock configurations are possible as well as management of time-stamping offsets either for operation with multiple time zones or multiple remote clocks.

## SoftPLC processor

The **UC 500** products include an optimised logic processor engine with large memory capacity for application of extensive user-defined algorithms programmed in IEC 61131-3. Boolean, integer and floating point logic and arithmetic is available together with the full range of standard function blocks including flip-flops, counters or timers and user-defined reusable function block libraries.

The optimised logic engine supports prioritised cyclic and multi-event scheduling to meet diverse functional needs. Since all data points can be fed to and from the logic engine, the user has the ability to adapt the device to any specific automation or data processing requirement.

Applications ranging from generation of simple alarm/event grouping, through switching interlocks or switching sequences to sophisticated discrete control logic are possible. Power plant control, substation load shedding or distribution fault isolation and restoration are typical examples of **UC 500** SoftPLC applications.



IEC 61131-3 Programming

## IED record extraction and handling

To simplify incident analysis, fault, disturbance, SOE or other data records may be extracted automatically from protection relays or other IEDs via IEC 61850 or other protocols. Locally stored records can then be accessed from the station server and analysed with the Automation Studio COMTRADE and record viewers as well as other third-party tools.

## Reports

A reports infrastructure is available, which, combined with the data historian, provides a powerful and highly flexible way to create reports with advanced data visualisation, including tables and charts, including data processing features which can deal with large datasets. Reports are fully user-designed and include parameterisation capabilities enabling the HMI user to specify report output according to simple input parameters such as values, dates or identifiers. Several output formats are available including HTML, Excel or PDF.



IEC 61131-3 Programming

## Notifications

A flexible notification mechanism is available, which allows sending template-based messages to configured users, through SMS and/or email. Notification triggering may be time-based or even/alarm triggered to cover both emergency situations and periodic reporting. Together with the reports feature, full-blown pre-configured reports may also be sent as email attachment.

## Data historian

A database centred history recording function which includes event data and periodic/statistical data logging is provided. Data records are provided with 1ms resolution time stamping (source and local). Stored data can be extracted for analysis in external tools as well as fed to the SCADA HMI screens for trend displays or data lists.



HMI 500 Trends

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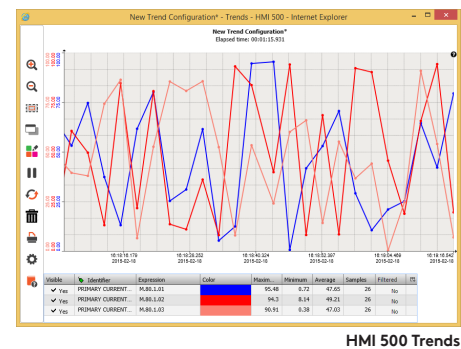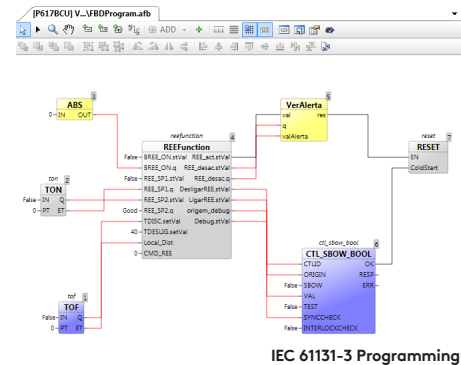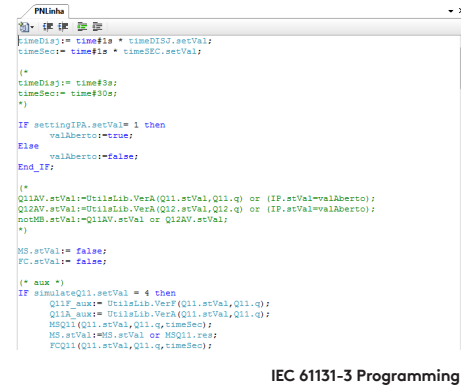
# Server Components

## Data and control processing, alarms and events

Core data processing such as unit and linear conversions, measurement filtering, thresholds and alarms levels and hierarchical correlation are available for each data point without requiring any additional IEC 61131-3 programming. Processing of alarms and of alarm acceptance and notification is also included.

Direct or select-operate methods are available together with execution model mapping for multiple protocols as well as control blocking, final state checking and execution signaling in either SCADA, automation or gateway applications. Final state equations and blocking rules can be defined per control point, considering control origin and execution state.

## Network Topology Processor

A network topology processor automatically determines the connectivity state of elements (live, not live, earthed, loop and combinations) and colors them accordingly. Colouring /styling is fully configurable and the topology processor output is also available for automation purposes (IEC 61131-3 logic).

## Engineering and troubleshooting

Engineering is fully integrated in the **Automation Studio** toolset whether a device oriented or a distributed control system approach is required. While being highly adaptable products, configuration and maintenance efforts are reduced with features like template-based engineering, libraries, copy-paste and drag-and-drop, etc.

**Automation Studio** is a unique easy to use environment providing a range of features from advanced 2D vector graphics editors to simulation as well as data extraction and configuration management. These features are complemented with unified project system integration, comparison and productivity wizards or import/export including IEC 61850 SCL that make enhanced system functions simple to setup, visualise and manage.

Troubleshooting and administrating **UC 500** servers is also simplified with extensive logging, built-in communication protocol tracing, self-monitoring, system report collector including remote retrieval using **Automation Studio** and remote desktop access.

## Access control and system security

In accordance with security standards the UC 500 software supports encryption for selected protocols such as HTTPS, system hardening, built-in firewall and anti-virus solutions, port mapping for all communication protocols as well as role-based operating-system managed authentication and access control to all features.

## Self-diagnostics

All software modules provide extensive diagnostic data points and management controls, therefore integrating self-monitoring with application data. Independent software and hardware watchdog keep track of process and thread states as well as operating system status.

| Application Options | UC 500 | UC 500E |
|---|---|---|
| Data/control points | > 64k | up to 64k |
| Alarms management | ● | ● |
| Data historian | ● | ● |
| IED record extraction and handling* | ○ | ○ |
| IEC 61131-3 programming | ○ | ○ |
| HMI 500 server/web server | ○ | ○ |
| HMI 500 client interface | ○ | |
| Number of simultaneous HMI 500 clients | up to 64 | up to 16 |

● Base feature | ○ Optional feature
✱ Requires IEC 61850 MMS client option



**System Log**



**Network Topology Processor**



**Graphics Editor**

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# Device Platforms

## Platform overview

The UC 500 software runs on standard PC-based platforms running Windows operating system, benefiting from low hardware and software costs, flexibility and usability as well as readily available support. Running on a standard operating system also allows easy integration with corporate systems or third party applications. The UC 500 is delivered as software or in standard or industrial PC configurations.

Based on industrial fanless hardware UC 500E provides performance and stability together with maintenance free solutions. The solution is ideal for harsh utility or industrial environments. Moreover the product variants are based on a tailor made componentised Windows 10 IoT LTSB/LTSC operating system that optimises system performance and reduces cyber security vulnerabilities. Write protection on core disk also ensures that, upon restart, original firmware is reset. Packages including software and operating system updates are made available according to product support options.

| Platform Options | UC 500 | UC 500E |
|---|:---:|:---:|
| **Chassis** | | |
| 19" Rack-mounted (2U) | * | ● |
| **Processor** | | |
| CPU (Core i5-6300U @ 2.4 GHz) | | ● |
| RAM (GB) | | ● (8 or 16 GB) |
| Core flash disk | * | ● (64 GB) |
| Expansion disks (up to 500 GB) | | ○ |
| Hardware watchdog | | ● |
| **Interfaces** | | |
| IRIG-B input | | ○ |
| USB ports | | 2+2 |
| 10/100/1000BASE-TX | | ● (14x) |
| Serial ports (RS232/RS422/RS485) | * (up to 64 serial ports) | ● (2x) |
| Expansion serial ports (RS232/RS422/RS485) | | ○ (8,16 or 24) |
| PRP/HSR hardware-based redundancy modules | | ○ (2x) |
| Watchdog output | | ● |
| General purpose status I/O** | | ○ |
| **Operating System** | | |
| Windows 10 64 bit | | ● |

● Base feature | ○ Optional feature
* Multiple hardware options available depending on selected hardware configuration.
Please contact Efacec for standard solutions.
** Required for redundancy control in specific hot-standby configurations.
*** Operating system not included.



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# Device Platforms

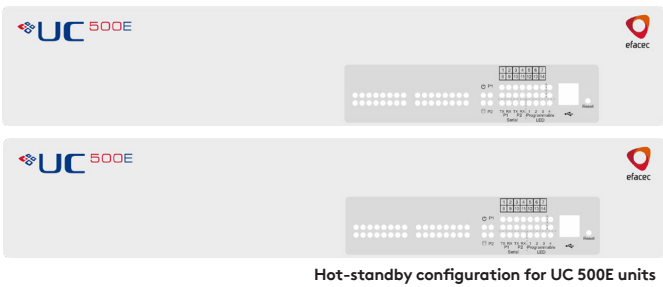## High-availability and redundancy options

Both **UC 500** and **UC 500E** can be deployed in standalone or in hot-standby configurations. All products support software and hardware watchdog for failure detection and recovery.

Hot-standby configurations allow high availability with continuous data point and database synchronisation from active to stand-by unit. Failure detection and failover management can be handled by software or by an external control panel. This control panel also performs serial port switching and manual redundancy control.

The **UC 500E** variant provides built-in redundant power supply as well an active redundancy management ensuring that no control steps are lost during failover. This high-availability variant features duplicated power supplies for unmatched availability.



**Hot-standby configuration for UC 500E units**

| Platform Options | ◈UC 500 | ◈UC 500E |
|---|---|---|
| **Availability Configurations Options** | | |
| Hardware watchdog and auto-reset (detection of hardware and OS failures) | ●* | ● |
| Hot-standby configuration (2 units with HW watchdog and I/O, Changeover panel and serial port switches) | ●* | ○ |
| High-availability configuration (Hot-pluggable power supply and dual-CPU) | | ● |
| Second Power Supply | | ● |
| Software failure detection and recovery (self-healing of software module failures) | ● | ● |
| **Power Supply** | | |
| 24/48/60/110 V d.c. (24 V to 110 V) | | |
| 110/125/220 V d.c. (110 V to 240 V) 110/115/120/200/230 V a.c.(110 V to 240 V) | ** | ○ |

● Base feature | ○ Optional feature
✶ Hardware not included.
✶✶ Power Supply depends on selected hardware configuration.
Please contact Efacec for standard solutions.



**UC 500E Rear Panel**

# User Interface

Equipped with the **HMI 500** state-of-the-art SCADA/HMI solution, the **UC 500** servers provide a concise process view for operational purposes, operations management as well as for data analysis.

Mimic displays can be setup with full blown 2D vector graphics including gradients and transparencies and high-performance animations ranging from multi-states, style changes or 2D transforms that allow the designer to meet the most demanding interactivity requirements.

Client-side deployment is seamless by the use of secure web-based technologies both for communication and visualisation. Supporting multiple local or distribute operating stations supported by different computing platforms such as smart phones, tablets, desktop or laptop computers, panel PCs, etc.
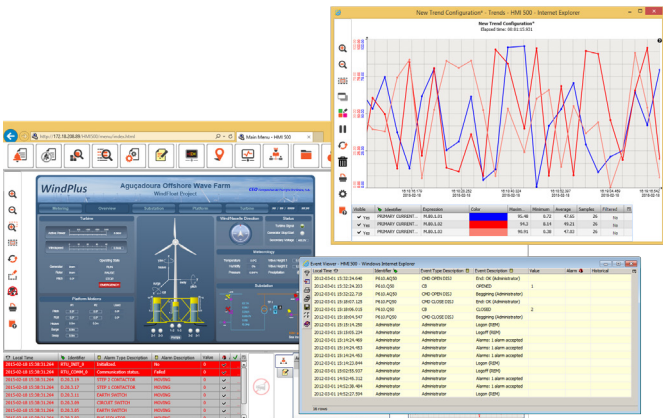


**HMI 500 Multi-window View**



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# Product Architecture

The **UC 500** features a modular architecture in which software components may be enabled or disabled according to requirements. Customer specific applications can also be developed or integrated on request.
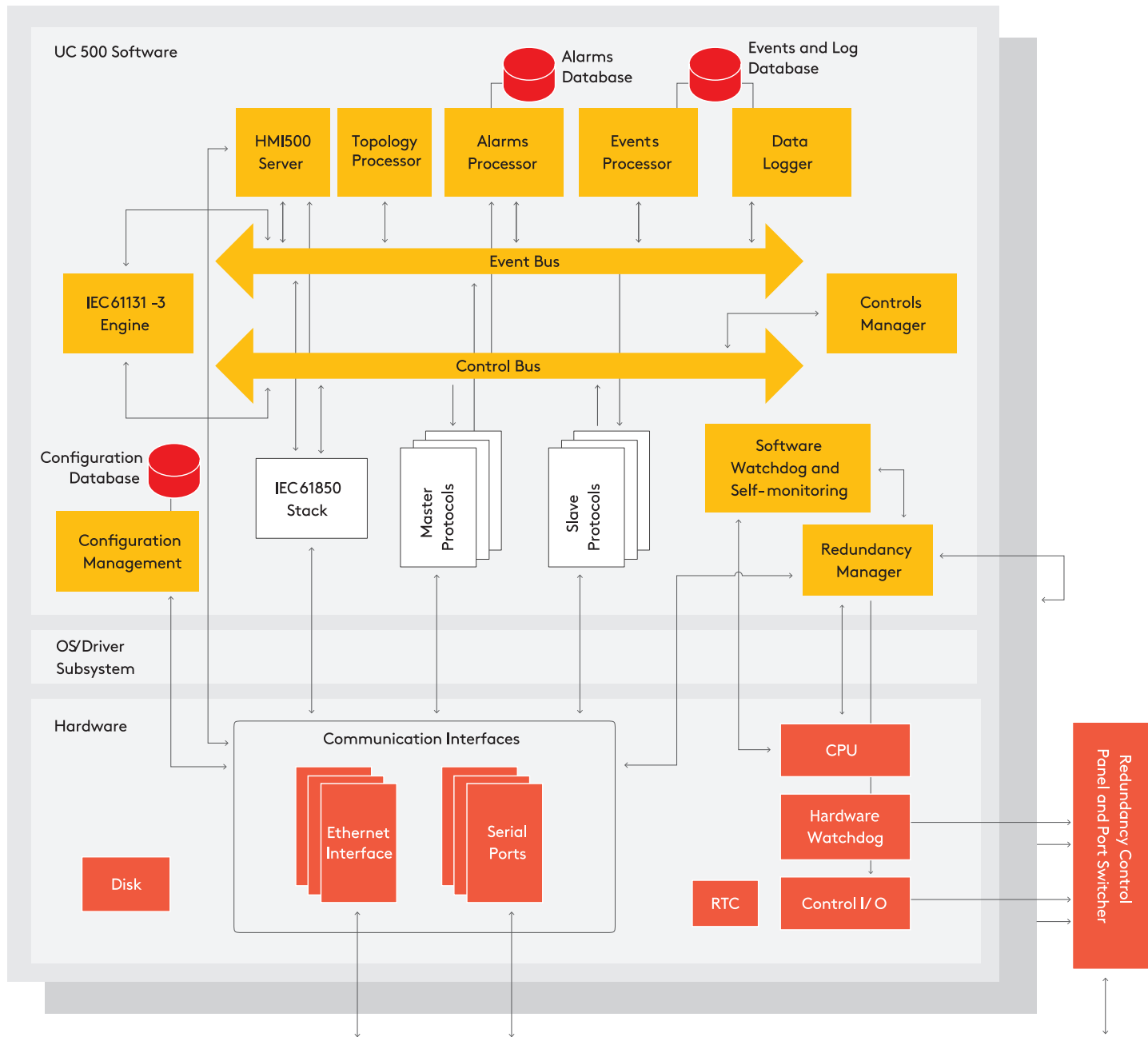


Legend:

- 🟧 System Modules
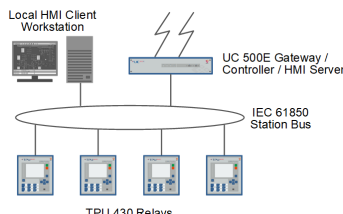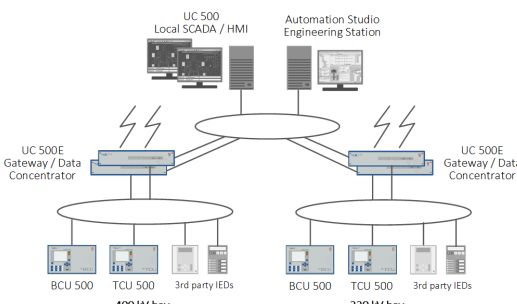- ⬜ Communication Modules
- 🟥 Hardware Modules

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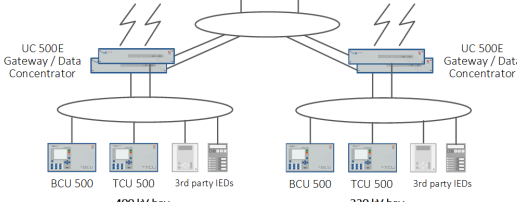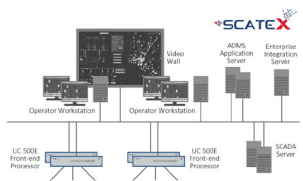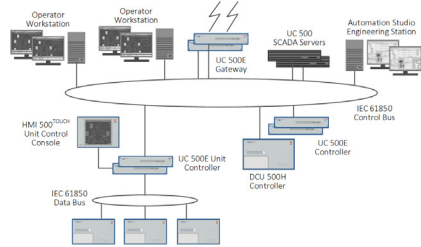
# Example Applications

## Application overview

The UC 500 server products are flexible and scalable, hence allowing best balance between cost and performance in accordance with user requirements. The open nature of the product, the modular architecture, software feature set and hardware options enable multiple applications from simple integrated station HMI/gateway solutions to high-end DCS and small-scale SCADA applications.

## Product enhancements and life-cycle support

The field-proven, flexible and open platform ensures that your system is equipped with future-proof technology and that stepwise investment strategies are not hindered. Efacec also provides a full range of services from training and product support, through development of sp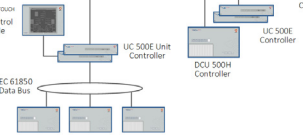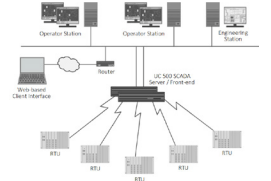ecific software components, to engineering and maintenance that ensures you have the best fitting solution for your requirements considering the full system life-cycle.

| Product | Example Application Description | |
|---|---|---|
| **UC 500E** | **Integrated distribution substation gateway and HMI server:**<br><br>• IEC 61850 Station Bus<br>• Integrated local SCADA server and historian<br>• IEC 61131-3 programming for station-level functions<br>• Redundant connections to remote control center |  |
| **UC 500** | **Transmission substation local SCADA:**<br><br>• Independent communication architecture per voltage-level |  |
| **UC 500E** | **Transmission substation redundant gateway and data concentrator:**<br><br>• Multiple remote national control centerconnections<br>• IEC 61850 multi-vendor integration | |
| **UC 500E** | **SCADA/DMS/EMS front-end processor:**<br><br>• Multi-protocol multi-channel redundant processors<br>• Multiple front-ends per SCADA system |  |
| **UC 500** | **DCS SCADA solution for renewable or conventional power plant:**<br><br>• Multiple HMI operator stations<br>• Redundant SCADA server<br>• Integrated system configuration workstation with Automation Studio |  |
| **UC 500E** | **Hydro power plant DCS system group controller:**<br><br>• Open IEC 61850 data and control bus featuring client server and GOOSE messaging<br>• Specific power plant control IEC 61131-3 library functions<br>• High-availability configuration | |
| **UC 500** | **Small-scale wide-area SCADA:**<br><br>• Integrated front-end and SCADA server<br>• Multiple out-stations and RTUs<br>• Free-choice of communication protocol<br>• Operator workstations and remote web-based access |  |

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