NETCON 500

The cyber secure RTU and gateway

Designed for energy generation, transmission and distribution and for the energy intensive industry
NETCON 500
The cyber secure RTU and gateway

FEATURES

- Single platform with all-in-one functionality
- Remote terminal unit (RTU)
- Communication concentrator
- Cyber security built in
- Protocol converter supporting over 50 protocols
- Station automation functions
- Operator panel
- Low total cost of ownership (TCO)
- Investment protection through full retrofit capability
- Full support for remote control and unit maintenance

GPS time

SCADA systems
- IEC 60870-5-103, JBUS and SPA relays
- IEC 61850 relays, IEDs
- Netcon 500 OP
- Legacy Modbus RTU and DNP3 relays

Switchgear
- Ethernet switch

GW502

WAN
The cyber secure RTU and gateway

The Netcon 500 is a versatile, standards-based remote terminal unit and control station. Hardware modularity and a rich set of software features make the Netcon 500 a very flexible solution.

**PROCESS CONTROL AT REDUCED COST**

With the Netcon 500 outstation, distributed processes can be controlled and monitored over a wide geographical area, while automation tasks at the site are also carried out – all at a reduced cost. The Netcon 500 is suited to:

- Power generation substations
- Electric utility substations
- Industrial plant electricity distribution
- Rail electricity distribution
- District heating power plants and pumping stations
- Tasks related to oil and gas pipelines.

**Multiple functions combined in one unit**

The Netcon 500 outstation combines modern gateway features with classic terminal unit functionality:

- Remote terminal unit
- Communication concentrator
- Protocol converter
- Operator panel
- Station automation
- Programmable Logic Controller (PLC).

Power automation functions can be configured, ranging from simple alarm generation to automatic start/stop functions e.g. for generators.

**Investment protection**

The total cost of ownership of a Netcon 500 system is low. The Netcon 500 is compatible with a wide range of established and emerging technologies. Such versatility makes it an intelligent choice, one that protects your past investments into hardware and software.
The Netcon 500 is an efficient solution thanks to its compliance to standards and its system scalability. Modifications and upgrades are easily made to an existing installation.

The Netcon 500 hardware is designed for trouble-free operation over a long lifetime. Modularity makes maintenance easy and cost-effective.

**High adaptability**

The Netcon 500 is highly adaptable to changes in the communication infrastructure. When the connection type and speed change, the Netcon 500 is easily reconfigured to operate according to the changed specifications.

**ACCURACY, RUGGEDNESS, SECURITY**

The availability of reliable and timely process information is gaining ever more importance. Legislation sets new requirements on the monitoring and reporting of electric quality, on interruptions of supply to customers and related economic compensation. Reliable and highly available connections are needed.

**Accurate time synchronisation**

The accuracy and resolution of the time stamps of process events are crucial for disturbance analysis. The time resolution of the Netcon 500 RTU I/O is 1 millisecond, as is the accuracy when GPS is used for synchronisation.

**Designed for harsh environments**

The Netcon 500 is designed for substation environments with high levels of electric and magnetic interference. It has been thoroughly tested and complies with the latest EMC directives and the IEC 61850-3 standard for substations.

**Cyber secure**

As IP-technology-based computer LAN and WAN networks gain dominance in the utility ICT infrastructure, the Netcon Gateway platform is a cyber-secure preference, featuring:

- Firewall
- VPN
- Encryption
- Authentication.
MAIN PARTS OF THE NETCON 500

The Netcon 500 outstation has three main parts: the Netcon Gateway, the Netcon 500 RTU and the (optional) Netcon 500 Operator Station.

1. Netcon 500 gateway

The GW502 is the main processing unit of the Netcon 500. It handles the cyber security and communications, including protocol conversion. It runs the reliable, resilient and secure Linux OS (a distribution maintained by Netcontrol) and the Netcon NFE communication software with a wide selection of protocols (see page <OV>).

Normally the GW502 also supplies power to the rack modules, though the SIO508 module can power additional racks not including a GW502.

The power supply to these two cards is redundant, and the communication can also have redundant paths from two GW502 cards (see page 5).

2. Netcon 500 RTU

The RTU part consists of the traditional process interfaces for wired I/O along with the associated communication services.

3. Netcon 500 OP

The Netcon 500 OP (operator panel) is an advanced HMI that connects to the Netcon 500 over the local network. While the other modules still interface the process and connect to the control centre, the Netcon 500 OP performs the process monitoring, control and visualisation.

Based on a low-power, fanless, industrial 15" touchscreen panel PC, the Netcon 500 OP gives the user a clear overview of:

- the alarms and event history
- the current switching state of the substation
- measurements and trends.

The user interface is highly configurable, as in modern SCADA systems.
Netcon 500 modules

NETCON GW502 MAIN PROCESSOR

The Netcon GW502 main processor unit handles cyber security, communication and protocol conversion. It has options for redundant communication and processing. The GW502 also powers the rack and the modules.

- Voltage range: 24...48 V
- Power consumption: < 12 W
- Dual 10/100Base-TX Ethernet
- Ethernet switch: 4 x 10/100Base-TX + 1 x 100Base-FX
- Three V.24 serial ports
- V.24 console port
- Rack bus interface
- V.11 GPS receiver interface

- One V.24 console port, RJ45 interface
- Four-channel plastic optical fibre (POF) module attached to rear connector
- GPS PPS synchronisation pulse input

Netcon POF4

The Netcon POF4 is a V.24-to-plastic-optical-fibre adapter. It is powered from an SIO508 module. The Netcon POF4 is typically used for serially connected protection relays. The response and bandwidth can be significantly increased by splitting the communication to physically separate loops with a minimum of one device in each.

NETCON PROCESS IO

The Netcon 500 process IO modules are powered and synchronised by and communicate with the rack-internal IO bus. Each of the modules operates as an independent RTU. An accurate PPS timing pulse from a GPS can be connected over the rack bus to each IO module.

Analog in – AI16

- 16 differential inputs channels
- Accuracy: 14 bits
- Input range: −22...+22 mA
- Common mode voltage: ±60 VDC

COMMUNICATION ACCESSORIES

Serial port server – SIO508

The Netcon SIO508 Ethernet-to-serial-port server provides eight V.24 (RS-232) serial ports. Like the GW502, it can power the rack and the other modules.

- One 10 baseT Ethernet port
- Eight V.24 serial ports with handshake at the rear connector/cable interface
Digital in – DI64

- 64 DI/PI (8 floating groups of 8 DI/group)
- Positive or negative common
- 24 VDC, 48 VDC or 110 VDC

Digital out – DO32

- 32 outputs (4 floating groups of 8 outputs/group)
- Load: 24...110 VDC; 0.2 A switching/1 A continuous/3 A peak
- Electronic short circuit protection
- Impedance measurement

Combined IO – IO64

The IO64 combines analogue inputs, digital inputs and digital outputs in one module. It is the most cost effective option in smaller stations, with only a few I/Os of each type, because it minimises the number of separate cards.

- 40 DI/PI, 16 DO, 8 AI
- 24 VDC, 48 VDC or 110 VDC

NETCON 500 RACKS

Three different sizes of rack are available for the Netcon 500, named after the number of slots (each slot being roughly 30 mm wide):

- S3, S3-B
- S7
- S14.

The S14 comes with detachable angles for installation into a standard 19” rack or swing frame. The S7 and S3-B are designed for attachment to a cabinet wall at the back (with extra long sides to create space for the cables); the S3, to a door or 19” rack from the side.
One Netcon GW502 card may simultaneously be connected to as many as four different SCADA systems, typically through Gateway Servers. Each SCADA can use a different protocol and acquire a separate set of data. However, the several SCADAs can also share data, thus giving rise to redundant communications.

With the IEC 60870-5-104 protocol, four redundancy groups are supported. Thus the number of connected SCADAs (Gateway Servers) rises to 16.

A single Netcon 500 system may contain two GW502 cards, each with its own NFE instance. The Linux UCARP function is then used to determine which instance is run and assigns the virtual IP(s) connecting the RTU to the SCADA system(s) to that instance.

Faults in one GW502 or the process-side hardware can therefore be bypassed with a switch to the other GW502.
3. Two GW502 devices forming a redundant slave

In a fully redundant slave, two GW502 cards with their NFE instances are constantly running and connected to the SCADA(s) on the one hand and to the process on the other. The NFE databases on the two devices are synchronised, sharing the same data. This guards against failures anywhere along the path of information.
EXTENSIVE CONNECTIVITY

Through the NFE communication software the Netcon 500 has extensive connectivity ranging from classic low-speed telecontrol to modern IP-based protocols.

The Netcon 500 supports for example the following standards for master station communication:

- IEC 60870-5-101
- IEC 60870-5-104 (KEMA certified)
- DNP 3.0

The Netcon 500 outstation supports multiple concurrent master station connections on different media and using different protocols. The Netcon 500 can also function as an intermediate concentrator station for numerous small outstations and IEDs.

For station level communication the Netcon 500 supports for example the following standards:

- IEC 61850-8-1
- IEC 60870-5-103
- DNP 3.0

Legacy IEDs of various ages and protocols are connected to the Netcon 500 over serial interfaces in a multi-drop or in a point-to-point star configuration.

IEC 61850-8-1 support

The Netcon 500 has full support for the emerging IEC 61850-8-1 standard. The implementation is open, with proven multi-vendor interoperability. Since the Netcon 500 is capable of acting as a communications gateway and a protocol converter, an IEC 61850 substation equipped with it can be connected to the control centre with any standard protocol, such as IEC 60870-5-104.

Reap the benefits of IEC 61850-8-1

- Simpler substation structure: IEC 61850 offers a single, uniform method of integrating IEDs
- Enhanced engineering, implementation, operation and service: savings of time and cost on configuration, commissioning and maintenance
- Reduction of wiring costs: IEC 61850 replaces wires between feeders, control switches and signalling devices
- Increased reliability: standard Ethernet serves as a uniform real time communication channel for all data.
# Netcon 500 protocol support

<table>
<thead>
<tr>
<th>PROTOCOL</th>
<th>SERIAL</th>
<th>IP</th>
<th>MASTER</th>
<th>SLAVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC 61850-8-1 client, editions 1 &amp; 2</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>IEC 60870-5-104</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>IEC 60870-5-104 with NUC extensions</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>NFE-link</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Modbus serial/TCP</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>DNP 3.0</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>IEC 60870-5-101</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>IEC 60870-5-103</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>ADLP80</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>RP570 &amp; ADLP180</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>RP570 &amp; ADLP180 modem pool</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>ANSI X3.28 (Allen Bradley)</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>COMLI</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Alstom Courier</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Ferranti MKIII</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>IEC 62056-21</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Mobitex</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Mobitex radio simulation</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Netcon 8830/8080</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>NettLink</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>System NM</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Nortroll</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>P&amp;B</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Procol</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Sinaut ST1</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Spacom</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Telegyr 065, 102</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Telegyr 800</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>
Netcon 500 tools

Netcontrol provides a set of user-friendly tools to make the configuration and management of Netcon 500 systems easy and flexible.

NCU CONFIGURATION TOOL

The Netcon 500 can be remotely configured through the NCU (Netcon Configuration Utility) tool. Running on the Windows platform, this software has a graphical user interface that presents the parameters in an intuitive tree hierarchy.

NCU CONFIGURATION TOOL

A basic Netcon 500 setup includes the following, configurable through NCU:

- Communication ports
- Master protocols
- Slave protocols
- Process IO units of the Netcon 500
- Cross-references between masters and slaves
- Mirrored data
- Redundancy.
WEBGUI

The Netcon 500 WebGUI is a browser-based interface for monitoring, commissioning and testing the Netcon 500. Through WebGUI a user can locally or remotely see all real-time IO, alarm, event and version information of the Netcon 500 RTU. Alarms can be acknowledged through WebGUI, and the user can also give control commands, for example when commissioning or testing the RTU. WebGUI includes a user-friendly interface for fetching disturbance records pertaining to a certain date from the RTU.

User permissions are divided into three levels: user, operator and administrator. An administrator can restart the NFE software or reboot the entire RTU and make backups of configurations. The Netcon 500 WebGUI also has a license management interface where new licenses can be applied.
Netcon 500 tools

NETCON SERIAL ANALYZER

The Netcon Serial Analyzer is a tool for troubleshooting serial communications.

NSA records serial data and telecontrol protocols. It can be used for locating protocol problems and verifying the correct implementation of different protocols on various devices.
PLC APPLICATION WORKBENCH

The Netcon 500 has an embedded PLC functionality, Application Workbench, for local applications such as the control of hydro power generation. The integrated PLC eliminates the need for separate stand-alone devices, thus reducing the site complexity.

Application Workbench is a complete programming environment used to develop highly portable applications. It supports six different automation languages: the five IEC 1131-3 languages plus flow chart.
NETCON 500 INVESTMENT PROTECTION

Utilities may conduct their retrofit programs by upgrading parts of their outstations:

- Change of communication protocol for the existing outstation, with corresponding enhancements in functionality
- Replacement of hardware with the same protocol continuing to be used
- New hardware modules interfacing an existing rack
- Use of adapter modules to connect existing wiring from the process to new RTU technology.

The advantages of these approaches to the utility lie in the ease and swiftness of the solution.

BENEFITS OF THE NETCON 500

- Total cost effectiveness
- Easy customisation
- Retrofitting a substation in one day or even less
- Ability to integrate new features and products with legacy systems and protocols
- Easy addition of new protocols and connectivity options with the new range of IEDs