NETCON 200

The future of distribution network automation

All-in-one, compact feeder RTU for
the evolving electrical grid

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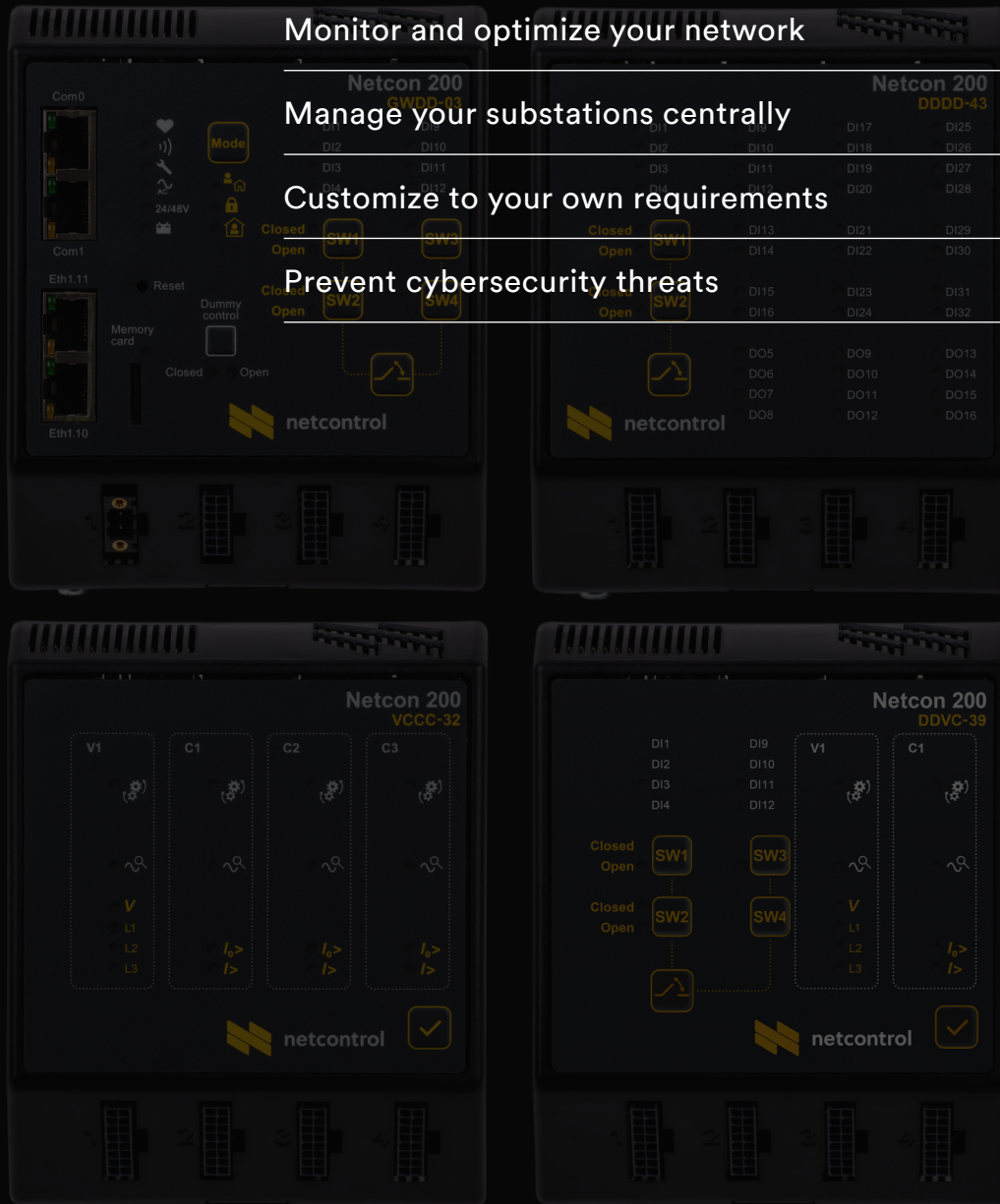
FEATURES

Improve network availability

Monitor and optimize your network
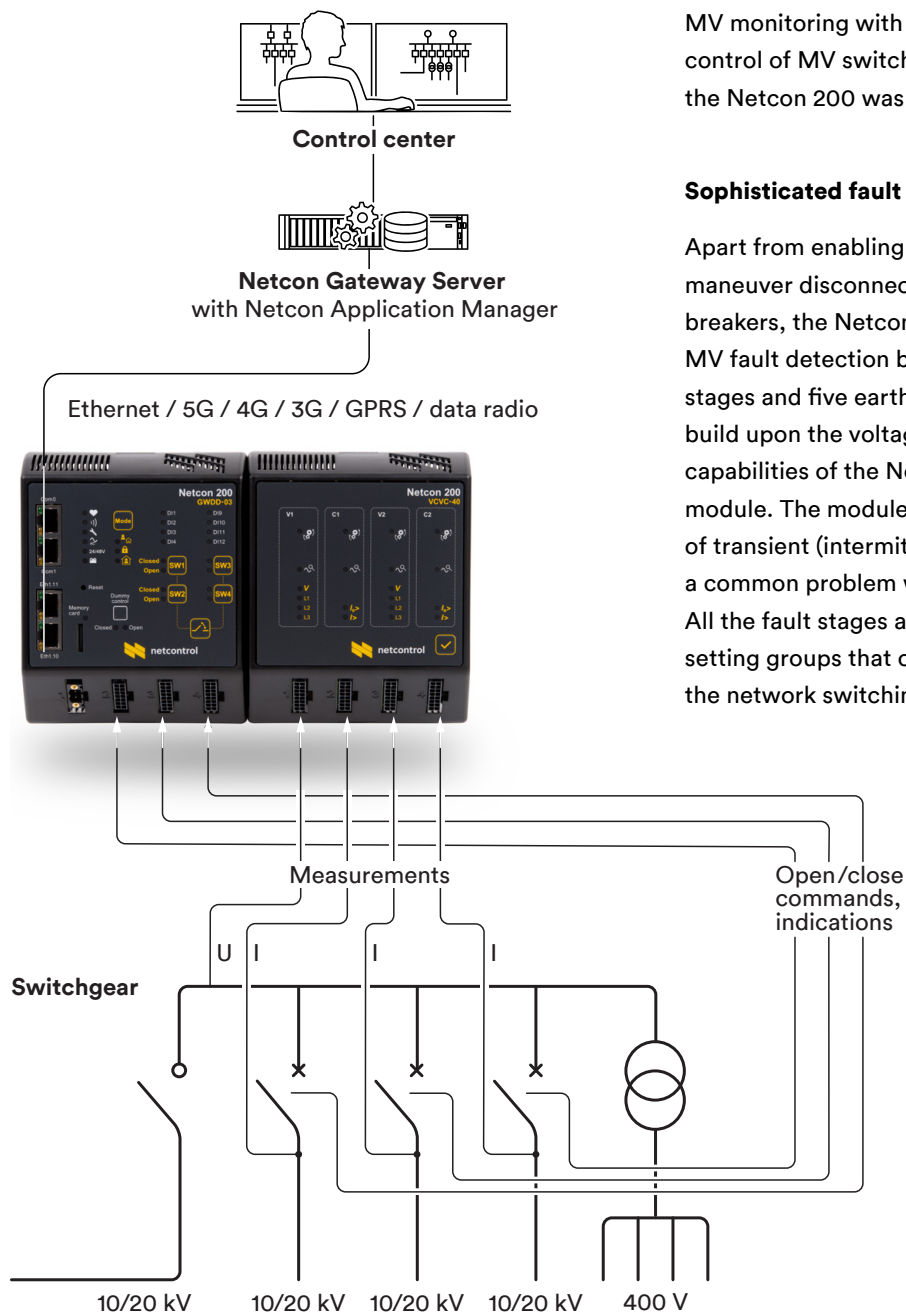
Manage your substations centrally

Customize to your own requirements

Prevent cybersecurity threats

The future of distribution network automation

The Netcon 200 is a smart RTU for monitoring medium-voltage feeders along with the remote control of switching devices on them. Standard protocols and interfaces make its connection to other systems straightforward. Compact yet modular in structure, the Netcon 200 is easily and economically customized for and integrated into each substation.

Control center

Netcon Gateway Server
with Netcon Application Manager

Ethernet / 5G / 4G / 3G / GPRS / data radio

Measurements

Open/close commands, indications

Switchgear

U I I I

10/20 kV   10/20 kV   10/20 kV   10/20 kV   400 V

IMPROVED MV NETWORK AVAILABILITY AND MANAGEMENT

Every distribution network operator today is aware of the tight availability requirements that societies are setting for the benefit of end customers. Since most network outages are caused by faults on the medium-voltage (MV) side, the obvious solution is MV monitoring with fault detection and the remote control of MV switching equipment. This is what the Netcon 200 was designed to provide.

Sophisticated fault detection

Apart from enabling network operators to maneuver disconnectors, load switches and circuit breakers, the Netcon 200 features bidirectional MV fault detection based on four overcurrent stages and five earth fault stages per feeder. These build upon the voltage and current measurement capabilities of the Netcon 200 VCCC or VCVC module. The modules also support the detection of transient (intermittent) earth faults, which are a common problem with aging underground cables. All the fault stages are included in feeder-specific setting groups that can be remotely swapped when the network switching state, for example, changes.

Integrated feeder protection

The Netcon 200 can also offer a separately licensed, integrated feeder protection functionality that trips the circuit breaker on a feeder when triggered by the relevant fault stages. It can thus replace the separate protection relays traditionally deployed at secondary substations. For example, three feeders can be protected by a single Netcon 200 consisting of a GWDD-03 module and a VCCC-32 module.

Function	ANSI number
Non-directional overcurrent protection	50/51
Directional overcurrent protection	67
Non-directional earth fault protection	50N/51N
Directional earth fault protection	67Ns
Intermittent earth fault protection	67INT
Auto-reclose	79

Thoroughly tested, the protection includes an optional auto-reclose functionality with three shots. This means that transient faults can often be cleared with no human intervention. But the protection can still be easily controlled, according to the circumstances, through the remotely swappable setting groups.

Enhanced load management

The real-time measurements provided by the Netcon 200 mean that the network switching state and therefore transformer loads can be better managed by the distribution management system (ADMS) and/or the SCADA system. This is especially useful in exceptional situations such as during maintenance or faults. The load data and development trends also enable you to avoid over-cautious and premature renewal investments made just "to be on the safe side".

Extensive quality measurement

Constant measurement of electricity quality and data available from the fault and disturbance recordings help utility companies forecast and reduce service-level disturbances in the network. Complaints from customers are reduced and customer satisfaction improves.

The Netcon 200 has the following power quality measurements for voltage and current:

- RMS
- Symmetrical components
- Waveforms
- Phase angle & sequence
- Harmonic components (up to 50th)
- Total harmonic distortions

Measurements of apparent, active and reactive power and energy are also available.

Accurate time synchronization

Effective fault detection presupposes the precise time stamping of events. The Netcon 200 can obtain time synchronization, for example, from an NTP (Network Time Protocol) server or from the control center via the communication protocol.
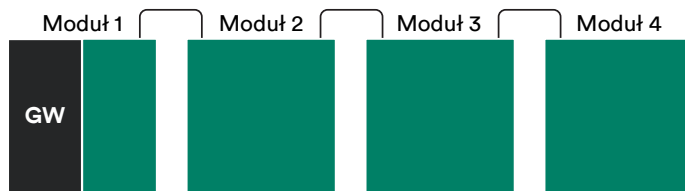
Intelligent alarms

Through Netcontrol's advanced sum alarm logic, the data supplied by individual alarm signals can be refined into comprehensive alarm information.

Netcon 200 cabinet (right) next to an RMU.

Modularity
in hardware and software

Moduł 1   Moduł 2   Moduł 3   Moduł 4

GW

Hardware

The Netcon 200 modules are quite compact. Four modules can be combined in various ways according to the size of the secondary substation or disconnector station and the desired functionality. (Six modules are possible with an auxiliary power supply.) The configuration is through a user-friendly web interface with the help of ready-made templates.

The Netcon 200 setup must always include a GWDD module because this provides essential central processing, gateway and power supply functions for the entire Netcon 200. Other modules are optional, and up to three can be included. To the right, you can see the front panels and HMIs of some of the available or projected types.

Software

A new Netcon 200 software version and/or an expanded software license may bring about completely new applications. These include feeder protection provided that the Netcon 200 and the substation already have the required modules and sensors or that these be added as a retrofit installation.
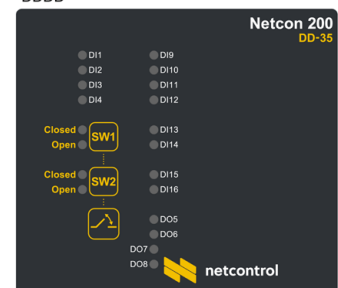
Programmable logic functions

A REST-compliant application programming interface (API) supporting multiple programming languages allows users to write their own apps for the Netcon 200. These may retrieve data from the Netcon 200, monitor changes in it, send commands to it and check logs.
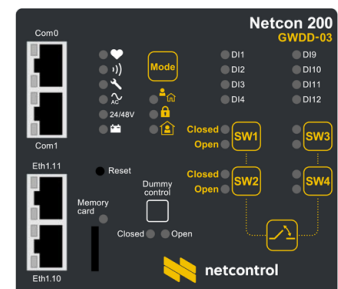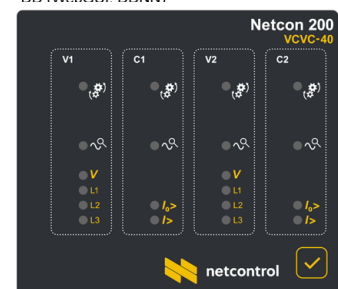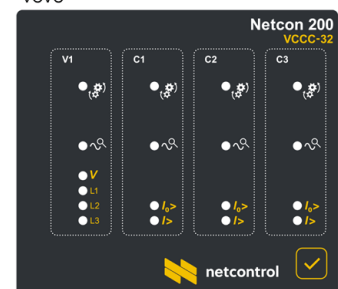

GWDD
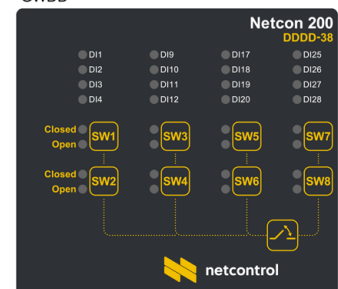
DDDD

DD (WebGUI: DDNN)

VCVC

VCCC

Modules in detail

The GWDD module is the heart of the Netcon 200. The other modules are optional, providing measurement & fault indication for MV feeders or additional digital inputs and outputs for the control and supervision of switching devices.

NETCON GWDD

Power   *Process*

Main processor and gateway

As the base module, the GWDD contains the system-control functions; the data communication services; and the measurement-data recording and sum alarm functions.

- Runs the Netcon NFE communication software, which supports over 50 protocols
- 1 memory card slot
- Web user interface for configuration and diagnostics (see p. 9)
- Console / data communication serial port, V.24 (RS-232/RS-485)
- Data communication serial port, V.24 (RS-232/RS-485)
- Ethernet data communication port, 10/100 BaseT
- Ethernet control port, 10/100 BaseT
- Dummy breaker control

- Control mode (remote/none/local) selection
  - The module has a soft L/N/R switch that is operated via its built-in HMI.
  - An external L/N/R switch can also be fitted which then overrides the soft switch.
- 1 Pt100/Pt1000 input for temperature

Power supply

The GWDD also handles the power supply.

- Input voltage range 20...60 V DC
- Monitoring of battery charging and health
  - Alarms for charger failure and a low battery are displayed on the HMI and sent to the SCADA.
  - Deep-discharge protection turns off the Netcon 200 when voltage drops to a preset limit (with the PSU interface adapter, it also disconnects other loads from the battery).

Digital inputs and outputs

Finally, the GWDD module offers digital inputs and digital outputs (i.e., remote-control outputs) that can be used to control and monitor 4 switching devices (disconnectors, circuit breakers, etc.).

- 16 digital inputs (DIs)
- 8 contactor outputs (DOs), potential-free
- These DIs and DOs can be used either in a general-purpose I/O mode or in a mode where they are constrained by a built-in control logic.
- 2 additional general-purpose DIs are available unless used with an external local/none/remote switch.
- 1 further general-purpose DI is available unless the PSU interface adapter is used.

NETCON DDDD, DD

The DDDD module can control and monitor 8 switching devices:

- 32 DIs
- 16 DOs

The DD module is simply one half of the DDDD, with 16 DIs and 8 DOs, for 4 switching devices.

The DIs and DOs of these modules have the same features as the 16 DIs and 8 DOs of the GWDD.

NETCON VCCC

Process

MV measurement & fault detection

The VCCC module provides MV fault detection, disturbance recording and power quality data for 3 MV feeders in a single switchgear.

- 3-channel voltage measurement (V)
- 4-channel current measurement (C)
- 16-bit resolution
- 0.1% precision

Voltage is best measured with IEC 61869-11 –compatible sensors of the voltage divider type, but several other options are also available. The **VMA246** signal adapter can be used to match the output of an instrument voltage transformer

(VT) in the switchgear to the Netcon 200 voltage inputs. One VMA246 is required per switchgear.

For **current**, the three phases and the residual (i.e., sum) can all be measured per feeder. It is also possible to measure three currents and calculate the fourth from them.

In compensated networks, with weak earth fault currents, the most accurate results are obtained when Rogowski-coil sensors are used to measure not just the phases (or two of them) but the residual, or sum, current directly.

Alternatively, the output of an instrument current transformer (CT) on the switchgear feeder can be fed to the **CMA160** or **CMA167** adapter to convert it to a voltage suitable for the Netcon 200 current inputs. One CMA160 or CMA167 is needed per feeder. The CMA160 attenuates the signal more, yielding a wider measurement range but a coarser resolution. The CMA167 is therefore more suited for networks with weak earth fault currents.

Distance to fault

The Netcon 200 also calculates the fault impedance. Combined with cable information in the ADMS, the impedance information makes it possible to determine the distance to a fault.

Cable fault prediction

The VCCC analog measurements have a high enough sampling frequency to detect the intermittent, transient faults that typically occur when a cable begins to fail. Alarm limit can be configured for sending alarms of such faults to the SCADA.

NETCON VCVC

The VCVC handles measurements and fault indication for 2 feeders that are on different switchgears. It is otherwise the same as the VCCC.

Versatile & cybersecure communication

The Netcon 200 has comprehensive features for cybersecure data communication. Both link(s) with the control center(s) and connections with intelligent electronic devices (IEDs) at the substation can be either serial or IP-based.

KEY PROTOCOLS

For both SCADA and IED communication, the Netcon 200 supports the key communication protocols of today.
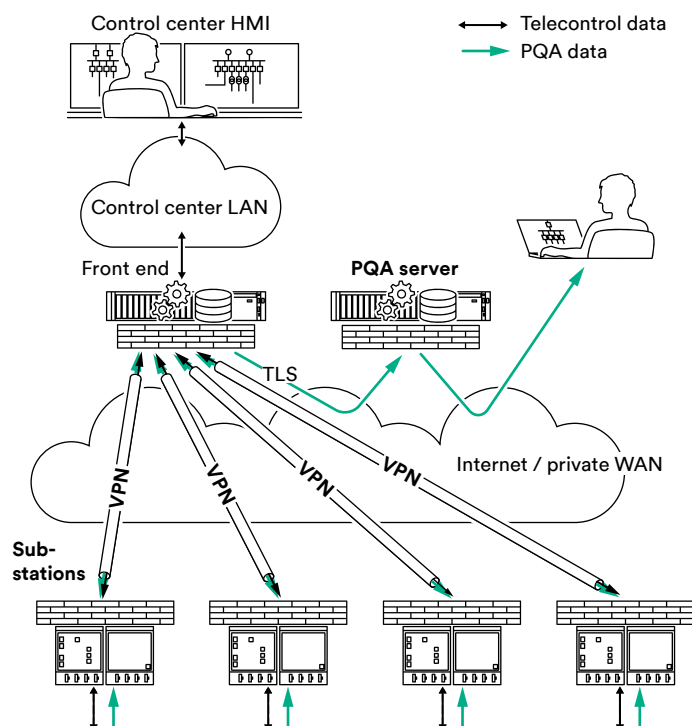
SCADA (slave)

- IEC 60870-5-104 (with redundancy groups)
- IEC 60870-5-101
- DNP3
- Modbus RTU/TCP
- RP570
- NetMan

IED (master)

- IEC 60870-5-104
- IEC 60870-5-101
- IEC 60870-5-103
- IEC 61850 client
- Modbus RTU/TCP
- SPACOM

CYBERSECURITY

- Secure Boot
- Safe file transfer with SFTP, SCP and rsync (over SSH)
- Firewall and port hardening
- OpenVPN, IPSec
- DDoS protection
- Secure IEC-104 transfer according to IEC 62351-3
- Role-based local and remote access control via a RADIUS server
- Secure maintenance connection using SSH
- Secure configuration using HTTPS and SSH
- PAM password management
- Digitally signed OS patches
- AIDE intrusion detection

Control center HMI

→ Telecontrol data
→ PQA data

Control center LAN

Front end

PQA server

TLS

Internet / private WAN

VPN

Sub-stations

The IP communication is tightly controlled according to the Netcon Secure IP architecture. A firewall built into the Netcon 200 passes only carefully selected traffic, such as remote-use and administrative connections. Connections with the Control center are protected by VPN tunnels.

For uploading fault records and power quality data, the Netcon 200 uses the standard Comtrade file format and secure FTP transmission. The measurements are first collected in one central location, usually the front end server (e.g., Netcon Gateway Server), over secure VPN connections. As shown in the figure, this data transfer is kept logically distinct from the telecontrol traffic to and from the control center. From the front end, the data can then be forwarded to the PQA service cloud by means of secure file transfer. Authorized users can access the data and analyses through their web browsers.

Central and local management

The Netcon 200 offers three user interfaces for configuration and management. The local front-panel HMIs and the local/remote web browser interface provide access to a single Netcon 200 unit whereas the Netcon Application Manager web server enables the central management of a large number of Netcon 200 devices.

BUILT-IN HMIs
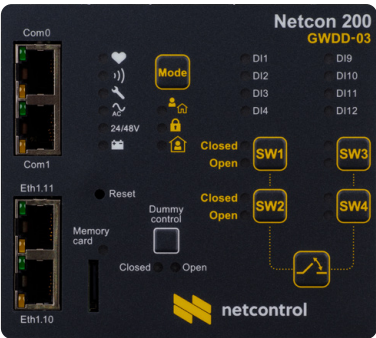
The GWDD HMI has LEDs for disconnector or circuit breaker positions and buttons for their control, as well as a control mode button with associated LEDs (remote/none/local). There are also LEDs for system functions such as battery and communication status.
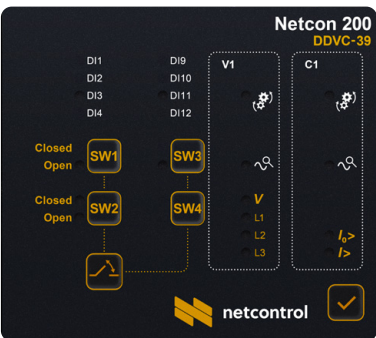

The VCCC/VCVC HMI has LEDs for data acquisition, for power quality issues, for the presence of voltage in the three phases and for overcurrent and residual current. Some of the indications are alarms and can be acknowledged with a button at the bottom right.

WEBGUI

WebGUI is a comprehensive browser-based interface for configuring a Netcon 200 unit and viewing its IO and system signals (with some options for control as well). It runs on the GWDD module and the user connects to it over IP, either locally or through a secure remote connection.

The configuration is organized into a straight-forward process guided by a wizard. However, individual settings can be changed whenever necessary.

WebGUI is arranged into pages and tabs. It has three permission levels. **User** can, for example, browse the IO signals and view logs; **Operator** can also operate switches for testing purposes. Only **Administrator**, however, can change the Netcon 200 configuration.
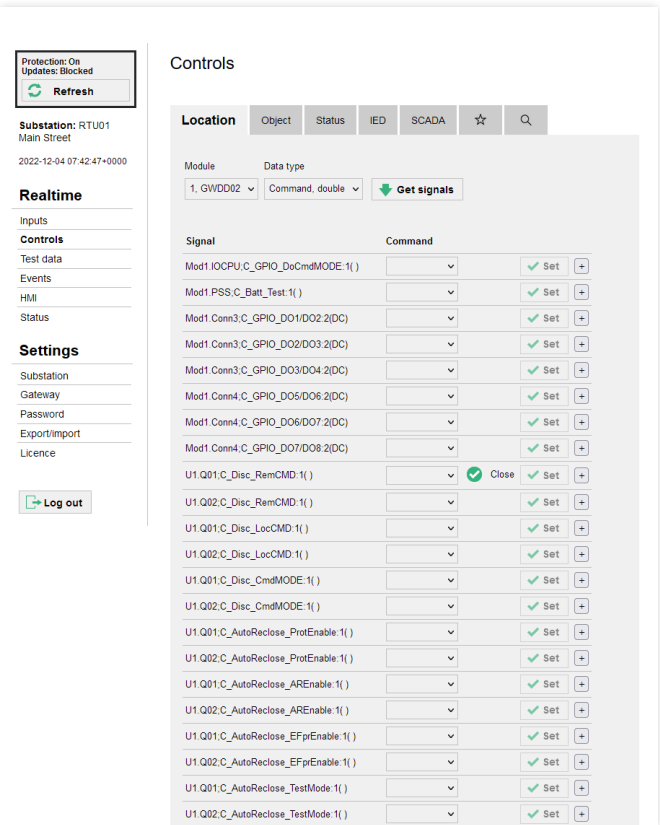
NETCONTROL'S OWN
HANDS-ON TRAINING COURSES

While designed to be easy to use, the Netcon 200 is a sophisticated product. Your personnel will be best introduced to it during Netcontrol's own three-day training course.

Guided by our professional instructors, the participants will be introduced to

- the Netcon 200 modules,
- the HMI panels,
- the web browser interface,
- the product documentation.

Through hands-on exercises, the participants will learn to

- configure the modules, including the collection of history data, the fault detection and line protection functions as well as disturbance recorders;
- set up the Netcon 200 interfaces with the communication network and with the control-center and power quality analysis systems;
- configure the Sum Alarm and Signal Mirror functions;
- test the configuration using the functions built into WebGUI;
- restart the Netcon 200 substation; and
- make a backup of the configuration and recover from it.

Our courses are arranged by agreement and only include a maximum of 4 participants plus the instructor(s). No one will remain just a spectator. The training course is a smart investment into your personnel and your smart Netcon 200 substations.

NETCON APPLICATION MANAGER

The Netcon Application Manager is a SW tool for the centralized management & maintenance of a large number of Netcon 200 RTUs. It is also used with the Netcon 100 and the Netcon 500.

Distributed as a virtual machine and running on a web server, the program reduces the overall cost of the system through savings in time and resources.
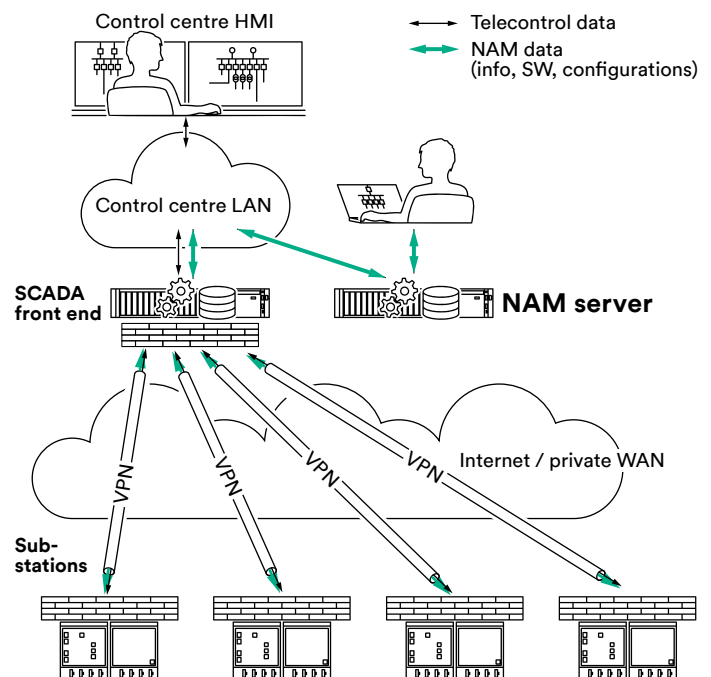
Application Manager enables the user to

- dynamically assign RTUs to groups, on which all operations can then be performed;
- monitor the HW setups of RTUs remotely;
- efficiently roll out new RTUs thanks to automatic download of configuration after installation & basic setup;
- monitor remotely that all the RTUs have the correct software versions and configuration files;
- back up and restore RTUs configurations remotely;
- plan, execute and verify remote software updates and configuration changes for single RTUs or specified groups; and
- ensure that communication with all the RTUs is working.

Technical specifications

MECHANICAL & ENVIRONMENTAL

Enclosure dimensions (W × H × D)	115 × 140 × 75 mm
Enclosure protection class	IP30
Operating temperature	−40...+70°C*
Transport temperature	−40...+70 °C
Relative humidity	< 96%

*Continuous operation beyond +55°C may lead to degradation in MTBF.

EMC STANDARDS

IEC 61000-6-4	RF Emission (CISPR 22)
IEC 61000-6-2	Immunity for industrial environments
IEC 61000-6-5	Immunity for power station and substation environments
IEC 60255-25	Electromagnetic emission tests for measuring relays and protection equipment
IEC 60255-26	Electromagnetic compatibility requirements for measuring relays and protection equipment
EN 55022	Emission, conducted and radiated
IEC 61000-4-2	Electrostatic discharge immunity
IEC 61000-4-3	RF Electromagnetic field immunity
IEC 61000-4-4	Electrical fast transient/burst immunity
IEC 61000-4-5	Surge immunity
IEC 61000-4-6	RF Conducted immunity
IEC 61000-4-8	Power frequency magnetic field immunity
IEC 61000-4-16	Mains frequency voltage immunity
IEC 61000-4-17	Immunity to ripple on DC supply
IEC 61000-4-18	Damped oscillatory wave immunity
IEC 61000-4-29	Immunity to dips and interruptions on DC power input port

PROCESS INTERFACES

DI & DO interfaces	
Connector type	Molex Micro-Fit 3.0, 16-way
Digital inputs	
Operation voltage, current	24 or 48 V DC, 5...10 mA
Isolation from electronics	2.5 kVAC
Isolation from chassis	500 VAC
Contact outputs	
Interface type	Closing contacts
Maximum continuous current	2 A, 60 V DC
Maximum switching capacity	2 A, 60 W, 125 VA
Minimum electrical life	10^6 operations, resistive
Coil power consumption	0.14 W
Coil-contact dielectric strength	1.5 kVAC
Isolation from chassis	500 VAC
Measurement interfaces	
Connector type	Molex Micro-Fit 3.0, 16-way
Isolation from electronics	1 kV
Isolation from chassis	500 V RMS
Voltage	
Input burden	1 MΩ in parallel with 200 pF
Measurement range	0...13.5 V RMS
Measurement resolution	0.3 mV
Current	
Input burden	102 kΩ in parallel with 1.2 nF
Measurement range	0...2.7 V RMS
Measurement resolution	0.008 mV
Measurement range in engineering units	0.1...31000 A**

** With ACF 3000_60/16 or _66/16 sensors optimized for the Netcon 200.

The future of distribution network automation

REAP THE NETCON 200 BENEFITS

Improve network availability

- Remote and local control of feeder switching devices
- Bidirectional fault detection
- Detection of transient cable faults
- Automatic fault-triggered tripping for feeder protection
- Alternatively, automatic network reconfiguration in response to MV faults

Monitor and optimize your network

- Accurate MV and LV power quality measurements
- Transformer monitoring for optimization of renewal investments
- Automatic disturbance recordings for fault analysis, revealing weak spots

Manage your substations centrally

- Remote configuration
- Continuous remote management with software updates

Customize to your own requirements

- Single platform for reliability and ease of installation
- Compact, cost-effective design with battery management
- Modular build to suit the requirements of each substation
- REST-compliant API for user-created automation routines

Prevent cybersecurity threats

- Port hardening, internal firewall and multiple VPN tunnels
- Secured SCADA communications in compliance with IEC 62351