The NTX-20 controller is an economical solution for feeder automation where Ethernet and/or serial communications connectivity is desired. Combining both Ethernet and serial connectivity, master gateway, LED gateway, router, internal GPS precision time reference interface, binary inputs, and power supply functions in a single-package module, the NTX-20 controller interfaces with distribution line switches, capacitor banks, transformers, distributed substation breaker bays, water pumps, valve control devices, etc., to provide low-cost automation with the highest reliability possible.

Deployed on a per-device basis, the NTX-20 with optional control output modules adds control and data acquisition to a power distribution system for one or more feeder line switches, auto-regulator transformers, and capacitor banks.

Using this switch controller, your distribution automation system can plot alternate distribution paths around faulty circuits to restore service automatically, using our fault detection, isolation and restoration (FDIR) application from a centralized master, or with the Centrix™ Advanced Feeder Automation platform (our substation island-based feeder platform). Trouble-spot displays at the control center to give operators precise location information aid in manually dispatching service personnel. The result is shorter service interruptions, affecting smaller areas.

The NTX-20 provides a low-cost data acquisition and control solution for both power distribution and water and gas applications. Local closed-loop control or calculations can be easily accomplished with the optional NTX Logic IEC 61131–compliant Programmable Logic Controller (PLC) program. The NTX-20 and all optional expansion modules are 35 mm DIN-rail compatible, for convenient mounting in cabinets or remote device enclosures.
Design features

- High-performance 32-bit RISC processor with DSP extension
- Linux® operating system
- Extended temperature range: -10° to 70°C
- Multiple Virtual RTU™ database mapping
- Field programmable; remotely programmable via WAN/LAN
- On-line configuration, monitoring, and diagnostic facilities
- 10/100 BaseT with DNP3 and Modbus RTU over TCP/IP or UDP
- Two isolated serial ports, configurable for RS-232 or RS-485 interfaces
- SOE for up to 48 binary inputs
- GPS time reference interface (optional external Garmin GPS clock/antenna)
- Optional IEC 61131-compliant NTX Logic PLC that executes user-defined control and/or calculation algorithms
- Two USB channels to support maintenance and firmware updates
- Broad 18 to 36 VDC power input range
- 35 mm DIN-rail compatible design
- Seismic tested to acceptance standards
- High reliability under the harshest environmental and electrical conditions

Applications

- Feeder automation
- SCADA for single/multiple circuit devices
- Water, wastewater, gas, and pipeline monitoring and control

Modular configuration options

- Control relay outputs
- Expanded binary with or without time or counter inputs
- DC analog inputs
- DC analog outputs

The NTX-20 is a 35 mm DIN-rail mounted dual-PCB module. It uses an ARM 9 E 32-bit RISC processor. The peripheral set includes USB Full Speed Host and Device interfaces and a 10/100 Base T Ethernet MAC. The NTX-20 operating system is Linux with flash memory. The internal GPS Garmin Satellite Receiver synchronizes the system clock with UTC time or optionally with other time zones. An optional external antenna is required to receive the NMEA-0183 protocol satellite time messages.

The internal power supply accepts a 18–36 VDC input, with a maximum consumption of 10 watts. The NTX-20 has a 4x6 optically isolated control relay driver matrix, with a capacity of 24 control relay output drivers. External control relay modules can be supplied as momentary or latching relays with a variety of contact ratings. Relay coils are for a standard nominal 24 VDC external power source.

An optional I/O expansion bus adds these modules:

- Up to two 1-channel analog output modules (isolated 4–20 mA output), Up to 16 Analog Output Channels with added external booster logic power supply.
- Up to four 8-point binary input expansion modules (binary with or without time, Form A or two consecutive points for Form C counters).
- Up to six 6-point DC analog input modules (0 ± 1 mA or 4–20 mA input).

The NTX-20 network interface supports a DNP/IP and Modbus RTU/IP client, a DNP/IP and Modbus RTU/IP server, or multiples (16 IP ports) of both. Two isolated serial channels are individually configurable for master slave (secondary) or IED master (primary) Modbus RTU and DNP3 Level 3 protocol emulations with configurable baud rates of 300 to 115.2 Kbps.

Legacy primary (master) protocols, such as Cooper 2179, are supported. Legacy secondary (slave) protocols, such as ACS7000, Harris 6000, L&G 8979, SC1801 and SComD are also supported (others may be added based on customer demand). The NTX-20 includes 16 optically isolated binary inputs that are configurable for binary with time (SOE), binary without time (simple status), Form A counter, or two consecutive points as a Form C (KYZ) counter. The binary inputs are scanned by a separate microprocessor at a 1-millisecond rate for a 1-millisecond event resolution. An adjustable sliding software de-bounce filter requires a changed contact to be in the same state for 0 to 25 consecutive millisecond scans before accepting a change of contact state. The binary input buffer can store up to 256 event changes between master scans. Binary input wiring connections are made to a 3.81 mm removable compression terminal block that can accept up to #12 AWG (2.5mm²) wire.

The NTX-20 includes a non-volatile, on-board UTC Time/Date clock, which can be synchronized via protocol or the on-board GPS satellite clock interface for precise 1ms resolution accuracy (using the optional external GPS clock/antenna).
Technical specifications

Base module

Dimensions 200 mm x 108 mm x 70 mm (8” W x 4.25” H x 2.75” D)
Mounting 35 mm DIN rail

Gateway nodes

Gateway Ethernet network port One RJ45 10/100 Base T DNP3 and Modbus RTU over TCP/IP or UDP
Maximum IP connections 16 (client and/or server ports)
Gateway serial ports Two isolated 9-pin serial ports; DNP3 and Modbus RTU master or slave, or selected secondary protocols, configurable per port
One mini-USB maintenance channel port
Serial communications Isolated digital RS-232C (DTE with or without handshaking) or RS-485 configurable serial interfaces
Serial baud rate 300 to 115,200 bits per second, selectable per port
Serial pass-through ports Either or both isolated serial ports may be configured for transparent serial pass-through from the Ethernet connection to the WAN
Real-time clock UTC time/date (optional local time) non-volatile clock with GPS satellite time synchronization (optional Garmin GPS clock/antenna)
Module dimensions 200 mm x 108 mm x 70 mm (8” x 4.25” x 2.75”)
Firmware updates USB thumb drive port to flash memory or via NTX Explorer software
Additional application NTX Logic is a Programmable Logic Controller (PLC) application that runs on a NTX Gateway platform, fitted with the Run-Time License and external programming accessibility.

The NTX Logic supports all the standard IEC 61131 & IEC 61499 control program languages, as well as Flow Chart. Requires a software license from IsaGraf.

IEC 61131/61499 languages supported SFC: Sequential Function Chart ST: Structured Text
FBD: Function Block Diagram IL: Instruction List
LD: Ladder Diagram FC: Flow Chart

Local binary inputs 1

Base capacity 16 contact inputs
Optional external inputs 32 contact inputs (in groups of 8 inputs)
Binary point configurations Binary with time, binary without time; Form A counter;
2 consecutive inputs Form C counter
Scan period 1 millisecond
Resolution 1 millisecond
Change buffer 256 events

1 Binary inputs include binary with time (SOE), binary without time (Status/Alarm), and counter input points; 2 Protocol-dependent
Local binary inputs (continued)

Debounce filter
Adjustable bounce filter; changed contact must be in the same state for configurable (0-25) consecutive millisecond scans on a per point basis

Chatter filter
If enabled, provides a chatter period of 0 to 65535 milliseconds and a chatter filter change limit of 1 to 32 changes; both configurable on a per point basis

Contact input sense mode
Non-invert or invert on a per point basis

Binary contact input wetting voltage
9 VDC to 36 VDC

Input current limits
8 mA closed contact; <4 mA open contact

Input isolation
Optically isolated

Contact input connections
10 mm removable compression terminal blocks, accepting up to #12 AWG (2.5mm²) wire

Module dimensions
108 mm x 22.5 mm x 114.5 mm (4.25” x .88” x 4.5”)

Mounting
35 mm DIN-rail

Local counter inputs

Capacity
24 Form C or 48 Form A points, in groups of one input

Contact input
Configurable for count per contact transition or count per contact full cycle

Freeze command
From master station based on protocol or locally frozen by the real-time clock
May be frozen (report on a freeze command) or running counts (report on a count change)

Counter register size
Minimum of 16 bits

Optional analog input module

Capacity
36 inputs (in groups of 6)

Analog input
Standard: 0 ± 1 mA; optional: 4-20 mA

Input impedance
500 ohms; optional: 25 ohms

A/D resolution
16 bits

A/D conversion voltage
0 ± 500 mVDC

Common mode rejection
85 dB @ 0 to 60 Hz

Normal mode rejection
> 70 dB @ 60 Hz

Isolation between inputs
10 mΩ

Analog accuracy
0.1% at 25°C

Multiplexing hardware
Differential—all solid-state (CMOS FET)

Interface connections
10 mm removable compression terminal blocks; accepting up to #12 AWG (2.5mm²) wire

Module dimensions
108 mm x 22.5 mm x 114.5 mm (4.25” x .88” x 4.5”)

Mounting
35 mm DIN-rail mount

1 Binary inputs include binary with time (SOE), binary without time (Status/Alarm), and counter input points; 2 Protocol-dependent
### Optional analog output module

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>2 analog output channels (1 channel increments)</td>
</tr>
<tr>
<td>D/A resolution</td>
<td>16 bit</td>
</tr>
<tr>
<td>Analog output</td>
<td>Isolated 4-20 mA</td>
</tr>
<tr>
<td>Output impedance</td>
<td>25 MΩ</td>
</tr>
<tr>
<td>Isolation</td>
<td>Galvanic</td>
</tr>
<tr>
<td>Analog accuracy</td>
<td>0.15% at 25°C</td>
</tr>
<tr>
<td>Interface connections</td>
<td>10 mm removable compression terminal blocks;</td>
</tr>
<tr>
<td></td>
<td>accepting up to #12 AWG (2.5mm²) wire</td>
</tr>
<tr>
<td>Module dimensions</td>
<td>109 mm x 22.5 mm x 114.5 mm (4.25” x .88” x 4.5”)</td>
</tr>
<tr>
<td>Mounting</td>
<td>35 mm DIN-rail mount</td>
</tr>
<tr>
<td>Power supply</td>
<td>Requires a booster 5 VDC I/O logic power module for the third and each consecutive analog output module to 16 channels maximum</td>
</tr>
</tbody>
</table>

### Optional external control output

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>Optically isolated drivers for up to 24 relays</td>
</tr>
<tr>
<td></td>
<td>(in groups of 4 or 8 relays)</td>
</tr>
<tr>
<td>Relay coil voltage</td>
<td>24 VDC</td>
</tr>
<tr>
<td>Control sequence</td>
<td>Internal select-before-operate</td>
</tr>
<tr>
<td>Momentary contact ratings</td>
<td>5 A or 10 A @ 277 VAC (or 32 VDC), 10 A @ 150 VAC</td>
</tr>
<tr>
<td>VDAC Latch relay contact ratings</td>
<td>10 A @ 277 VAC (or 32 VDC)</td>
</tr>
<tr>
<td>Contact closure times²</td>
<td>Selectable: 0.001 second increments</td>
</tr>
<tr>
<td>Local/remote switch</td>
<td>Standard: pin jumpers; optional: external switch</td>
</tr>
<tr>
<td>Contact interface connections</td>
<td>10 mm removable compression terminal blocks,</td>
</tr>
<tr>
<td></td>
<td>accepting up to #12 AWG (2.5mm²) wire</td>
</tr>
<tr>
<td>Module dimensions</td>
<td>100 mm x 126 mm x 90 mm (3.9” x 4.96” x 3.54”)</td>
</tr>
<tr>
<td>Mounting</td>
<td>35 mm DIN-rail mount</td>
</tr>
<tr>
<td>Contact closure time</td>
<td>Selectable: 0.001 second increments (protocol dependent)</td>
</tr>
</tbody>
</table>

### Available control modules

- 8 momentary relays with 5 A, 115 VAC/32 VDC; 1 Form C contact per relay
- 8 momentary relays with 10 A, 115 VAC/32 VDC; 1 Form C contact per relay
- 4 latching relays (8 address pairs) with 10 A, 115 VAC/32 VDC; 2 Form C contacts per relay
- 4 momentary relays with 10 A, 150 VDC; 1 Form X contact per relay

### I/O protection certifications

- Inputs and outputs: IEEE SWC protected (certified to ANSI/IEEE C37.90.1/2002)
- Impulse voltage protected (certified to IEC 255-5 Standards)
- NERC CIP compliance: Fully complies with the NERC CIP Version 5.2 requirements; contact Minsait ACS for a complete table of NERC CIP Compliance Statements
- Seismic Tested Qualifications: 2012 ICC-ES AC 156 Standard Acceptance Criteria for Seismic Test
NTX-20 Intelligent Controller

Power requirements

Input voltage
- Internal 18-36 VDC (24 VDC nominal) @ 10 watts
- Optional: external 220 VAC/230 VDC, 115 VAC/125 VDC, 48 VDC to 24 VDC

Optional battery charger
Sealed lead-acid; 12 hours backup, typical

Additional I/O power source
5 VDC logic power booster to I/O module assemblies.
Contact Minsait ACS to determine if this is required.

Optional enclosures

Enclosure ratings
Various sizes NEMA 12 (indoor) or NEMA 4 (outdoor) cabinets

Rack mounting
35 mm DIN rail

Operating range

Operating temperature
-10° to 70°C (14° to 158°F)

With heater option
For operation down to -30°C (-22°F)

Humidity
10% to 95% non-condensing

NTX Explorer Configuration and Monitor software

User interface
Keyboard- and mouse-driven menus/views emulate Microsoft® Windows® Explorer

Platform
Portable PC, IBM-compatible

Operating system
Windows XP/WIN7/WIN8/WIN 10

Accessibility
File transfer from the PC to the NTX or from the NTX to the PC via a micro-USB serial connection to the NTX USB maintenance port

PC serial interface
Mini-USB to USB interface port cable

Monitor parameters
Input and output state/values; control relay or IED tests, selective tracing of internal network traffic
Manually modify analog, counter, or binary data values for on-line simulation testing of all inputs
On-line IED communication statistics
Enabled for either local or remote WAN access; can be disabled by the customer

Miscellaneous options

Custom enclosures, with or without optional heater
External terminal blocks
Bell 202 or 9600 baud 4-wire multi-drop telephone modem
External Garmin satellite clock and antenna
35 mm DIN-rail, in 2-meter lengths
RS-232 9-pin or 25-pin interface cables
RS-485 9-pin to 8 terminal block assembly interface cables
External digital contact wetting terminal blocks
External local/remote switch
Protocols

Master and IED protocol compatibility expand constantly. Visit our web site for a complete and up-to-date list.

NTX Explorer Configuration and Monitor software

The NTX Explorer and Monitor programs work on a personal computer using the Microsoft® Windows® (XP, WIN7, WIN8, and WIN 10) operating system. It emulates the standard PC Windows Explorer file management system to minimize special training requirements. Drag-and-drop techniques are employed for database-mapping. NTX Explorer is used for configuration of the unit, in the field or the convenience of your office. Using Ethernet links to the NTX-20 provides an easy way to remotely download or upload a configuration to or from the NTX-20 via the WAN. Configuration parameters include baud rate, Virtual RTU addresses, modem type, local I/O configurations, etc.

All configuration changes can be made independently, stored in a file on the PC, and downloaded to the NTX-20 when it is convenient. Configuration in an NTX-20 can also be uploaded to a PC.

NTX Monitor is used for field diagnostics. It is used to display real-time data and functions such as binary and counter inputs, SOE data, analog points, IED inputs and outputs, state and activity of the binary output system, and internal LAN traffic. Local and IED control points can be tested directly in NTX Monitor. It is helpful in troubleshooting IED communications (through the monitor of communications statistics for each connected device) and application problems.

Monitored local input data can be modified manually by a technician for testing or database verification purposes. Monitored data has two quality flags associated with each data value in the database:

- Data that is not updating from the external source (off-line IED, etc.) is displayed with a gray background
- Manually modified data is displayed with a red background

With a 10/100 BaseT Ethernet interface to the NTX-20, NTX Explorer can connect with permissions via a WAN for remote configuration.