

NTX-20 Intelligent Controller

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, IED 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 61131-1-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.



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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 inputs¹

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

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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 (2.5mm ²) 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 ¹

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 ²	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 m Ω
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 (2.5mm ²) 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

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



Optional external control output

Capacity	Optically isolated drivers for up to 24 relays (in groups of 4 or 8 relays)
Relay coil voltage	24 VDC
Control sequence	Internal select-before-operate
Momentary contact ratings	5 A or 10 A @ 277 VAC (or 32 VDC), 10 A @ 150 VAC
VDC Latch relay contact ratings	10 A @ 277 VAC (or 32 VDC)
Contact closure times ²	Selectable: 0.001 second increments
Local/remote switch	Standard: pin jumpers; optional: external switch
Contact interface connections	10 mm removable compression terminal blocks, accepting up to #12 AWG (2.5m ²) wire
Module dimensions	100 mm x 126 mm x 90 mm (3.9" x 4.96" x 3.54")
Mounting	35 mm DIN-rail mount
Contact closure time	Selectable: 0.001 second increments (protocol dependent)



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

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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, or WAN
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.

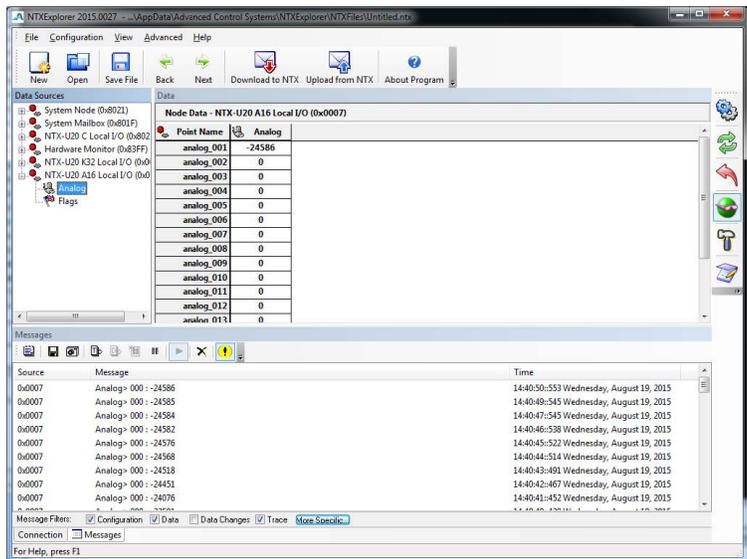
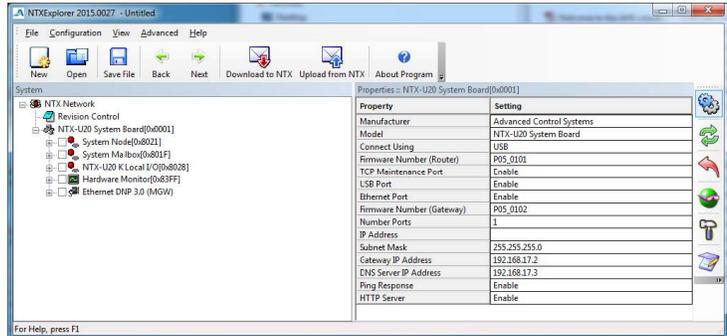
All configuration changes can be made independently, stored in a file on the PC, and downloaded to the NTX-20 when it is convenient. Configuration in an NTX-20 can also be uploaded to a PC.

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:

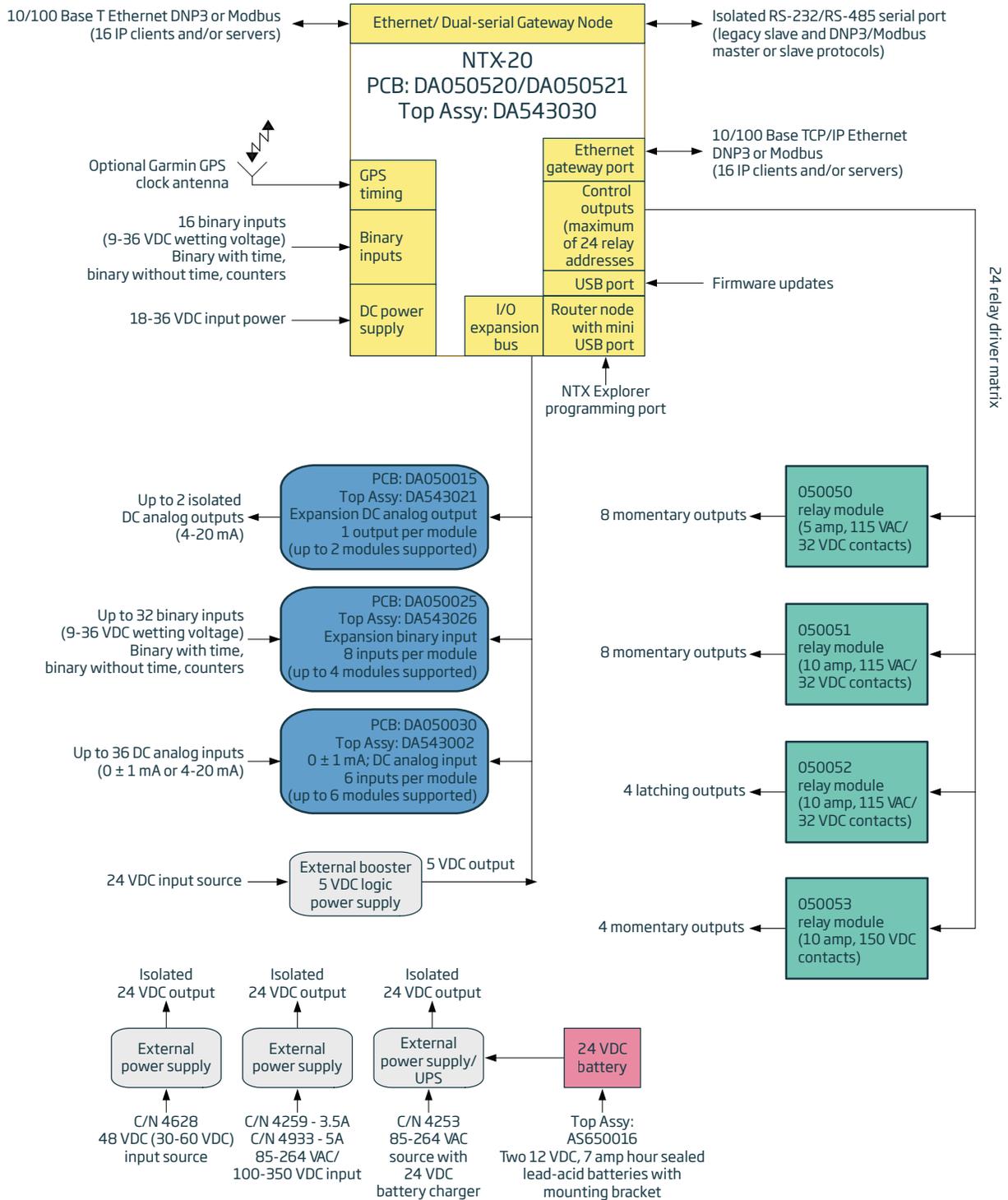
- Data that is not updating from the external source (off-line IED, etc.) is displayed with a gray background
- Manually modified data is displayed with a red background

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



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NTX-20 block diagram



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