

NTX-200 Substation Controller



The NTX-200 Substation Controller, smallest of our NTX-200 Series modular substation system designs, incorporates complete substation management functionality. It also adds the ability to interface to a large amount of data from IEDs and to a small to medium amount of locally wired data acquisition and control devices in the substation. The NTX-200 utilizes a client/server design. Throughout the NTX-200, servers (such as NTX Gateways to IEDs) produce data, and clients (such as the NTX gateway supplying the virtual databases to the master) receive data. It can also transmit many selected subsets of this data to one or more master stations in the master's native protocol. Local I/O can also be configured in the three motherboard slots available.

To take maximum advantage of the client/server model, the NTX-200 uses a distributed processing architecture. Multiple high-performance ARM9E (Advanced RISC Machine) 32-bit microprocessors, each programmed to support specific functions, are linked together using a peer-to-peer type network. The ARM9E microprocessor-controlled high-capacity serial/Ethernet gateways make the NTX-200 an ideal, low-cost substation solution for data concentrator and protocol converter applications in small to medium sized substations.



NTX-200 controller (front view)



NTX-200 controller (rear view)

NTX-200 Substation Controller

Design features

- Distributed processing architecture featuring multiple high-performance, ARM9E 32-bit microprocessors with DSP extension in a client/server, peer-to-peer type LAN
- Embedded Linux operating system (not accessible by the user, for secure operating conditions)
- Legacy protocols from previous Connex NTU models will be supported based on demand
- Extended temperature range: -10° to 70°C (14° to 158°F)
- Multiple Virtual RTU™ database mapping
- Field programmable; remotely programmable via an Ethernet WAN/LAN
- Built-in IRIG-B (unmodulated) Time Code Reader and GPS time reference (NMEA 0183) interface (optional external antenna required) or NTP time synchronization supported via the Ethernet Network
- Optional IEC 61131- and 61499-compliant NTX Logic PLC that executes user-defined control and/or calculation algorithms
- Sequence-of-events reporting with 1ms resolution
- Two USB channels: one for mini-USB to USB connections to the maintenance channel; one to support a thumb drive to update flash firmware
- Multiple 10/100 BaseT Ethernet with DNP, IEC 60870-5-104 or Modbus RTU protocol over TCP/IP or UDP client, server, or multiples of both, with a high quantity of IP connections available per network port
- EURO Card format (3U x 42hp; 9.5" w x 6" H x 12" D); mid-plane motherboard where the front modules contain the majority of the Logic (Network CPU Node), and the rear modules contain the corresponding terminations
- Multiple master/IED isolated communication serial interfaces (configurable per port for RS-232C, with or without flow-control, to external modems or fiber optics, or RS-485 for copper)
- Achieve NERC CIP compliance with the use of built-in solutions
- Deploy secure communications with DNP 3.0 SA v5

Application and expansion

The NTX-200 can be used in a traditional centralized equipment rack- or wall-mounted cabinet. The three-slot I/O motherboard supports:

- Up to three 16-point DC Analog Input Modules
- Or up to three 32-point Digital Input Modules
- Or up to three Bell 202 FSK Modems

or any combination of these modules in the three slots.

The I/O is not expandable beyond the base three-slot I/O Motherboard. An NTX System Controller with termination provides a combination of router and dual-serial ports with an Ethernet Port, a 4 x 6 control relay driver matrix and DC Analog Output Channel functionality as the base communications, and an NTX internal network controller. Up to 24 external control relays can be equipped with both momentary (varying contact voltage/current ratings supported) and latch relays and 16 external DC Analog Output channels. The unit power supply and up to three additional NTX Quad-Serial with Ethernet port gateways can be incorporated in the card file mid-plane system motherboard—for a total of 14 isolated EIA561 RS-232/RS-485 RJ45 serial ports and 4 high-capacity 10/100 BaseT Ethernet ports. NTX™ Explorer software makes it easy to configure or expand the type and number of ports and protocols communicating with the master stations or IEDs, defining local I/O points, and/or other components. The NTX-200 can also serve as a remote Data Acquisition and Control node in a distributed substation system.

Technical specifications

Card file

Card file dimensions	Complies with IEEE 1101/11 & IEEE 1011.10 standards 42 HP wide and 3U high (9" W x 5.25" H x 12" D with 10.75" centers for panel-mounting) for single Euro-card format modules, bottom wall- or panel-mounted
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Configuration	The half-size card file contains: <ul style="list-style-type: none">- the power supply- a 4-slot node system mid-plane motherboard- a 3-slot I/O mid-plane motherboard
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Gateway nodes

NTX System Controller	<p>One DNP3, IEC 60870-5-104 or Modbus RTU over 10/100 BaseT TCP/IP or UDP Ethernet (RJ45), configurable as a server, a client, or multiples of both</p> <p>Includes 2 isolated RJ45 serial ports, each configurable as a primary protocol device, a secondary (DNP3, Level 2 certified) protocol device, or as a pass-through port from the WAN</p> <p>Maximum IP connections: 16</p> <p>One mini-USB maintenance channel port; one USB for thumb drive firmware updates</p>	
Time clock	<p>On-board UTC time/date clock, non-volatile; internal time code reader for satellite clock unmodulated IRIG-B (with P1344 extensions) time synchronization or with optional antenna, GPS clock time synchronization (NMEA 0183 protocol), or NTP via the Ethernet network</p>	
I/O controller	<p>Mounts piggyback on the NTX System Controller and provides the interfaces to the card file-mounted analog and digital inputs, analog outputs and relay outputs</p> <p>Not installed where no local I/O is required</p>	
NTX quad-serial/ Ethernet gateway	<p>One DNP3, IEC 60870-5-104, IEC 61850 or Modbus RTU over 10/100 BaseT TCP/IP or UDP Ethernet (RJ45), configurable as a server, a client, or multiples of both.</p> <p>Includes four isolated EIA561 serial ports with RJ45 connectors per quad serial/Ethernet gateway node, with expansion for up to three quad-serial/Ethernet gateway nodes</p> <p>Maximum IP Connections: 64 each</p> <p>Multiple legacy and modern protocols supported</p>	
Database capacity	14,000 data values per system controller and NTX gateway	
Serial port connections	EIA561 RJ45 connectors	
Ethernet connection	RJ45, with multiple clients, servers and multiples of both; IP configurable	
Serial communication ports	<p>Isolated digital EIA561 RS-232C DTE (with or without handshaking) or RS-485 serial interfaces, configurable per RJ45 port</p> <p>Optional external fiber optic transceiver</p>	
Serial analog operation channel	<p>Two- or four-wire (9600 baud with optional external modem; 1200 baud with optional internal Bell 202 modem (Includes radio keying with isolated PTT output)</p>	
Serial baud rate	300 to 115,200 bits per second, selectable per port	
Alternate application	<p>NTX Logic is a Programmable Logic Controller (PLC) application that runs on a NTX System Controller platform with firmware fitted with the Run-Time License. The NTX Logic supports all the standard IEC 61131 & 61499 control program languages, as well as Flow Chart.</p>	
IEC 61131/61499 languages supported	<p>SFC: Sequential Function Chart FBD: Function Block Diagram LD: Ladder Diagram ST: Structured Text IL: Instruction List FC: Flow Chart</p>	

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Local binary inputs¹

Capacity	96 points, in groups of 32 inputs (limited to three I/O module slots) Configurable per point as binary with time (SOE ²), binary without time (Status), or Form A or two consecutive as Form C counters	
Scan period	1 millisecond	
Resolution	1 millisecond	
Change buffer	256 events	
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	
Contact wetting	Standard isolated ± 28 VDC supplied by NTX-200 power supply; 32 inputs per module; optional external 48 or 130 VDC	
Input current limits	8 mA closed contact; < 4 mA open contact	
Input isolation	Optically isolated	
Contact input connections	10 mm compression terminal blocks, accepting up to #12 AWG (2.5mm ²) wire	
AS545033 module dimensions	100 mm x 126 mm x ~90 mm (3.9" x 4.96" x ~3.54") with 34-pin header to 32-pole terminal block for each 16 digital inputs. Contact condition LED indicators.	
Mounting	35 mm DIN-rail mounted	

Local counter inputs¹

Capacity	48 Form C or 96 Form A points, in groups of one counter 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

Local DC analog inputs

Capacity	48 points, in groups of 16 inputs (limited to 3 I/O module slots)	
Analog inputs	Standard: 0 ± 1 mA Optional: 4-20 mA, 0 ± 1.5 mA, 0 ± 2 mA, 0 ± 10 mA, 0 ± 5 VDC, etc.	
A/D resolution	16-bit	
A/D conversion time	10 milliseconds per point, in groups of 16 points	
A/D conversion voltage	± 5 VDC; configurable for ± 1 VDC, ± 2 VDC, ± 10 VDC	
Analog accuracy	0.1%; -10° to 70°C (14° to 158°F)	
Multiplexing hardware	Differential—all solid-state (CMOS FET)	

Common mode rejection	85 dB @ 0 to 60 Hz
Normal mode rejection	> 70 dB @ 60 Hz
Isolation between inputs	10 m Ω
Analog input connections	10 mm compression terminal blocks, accepting up to #12 AWG (2.5mm ²) wire
AS545032 module dimensions	100 mm x 126 mm x ~90 mm (3.9" x 4.96" x ~3.54") with DB25F to 24-pole terminal block for each 8 analog inputs
Mounting	35 mm DIN-rail mounted



External local DC analog outputs

Capacity	16 analog outputs, in groups of 1 and/or 4 channels
D/A resolution	16-bit
Analog outputs	Isolated 4–20 mA
Output impedance	25 m Ω
Isolation	Galvanic
Analog accuracy	0.1%; -10° to 70°C (14° to 158°F)
Analog output connections	10 mm compression terminal blocks, accepting up to #12 (2.5mm ²) wire
Mounting	35 mm DIN-rail mounted



External control outputs

Capacity	Optically isolated drivers for up to 24 relays (in groups of 4 or 8 relays)
Relay coil	24 VDC
Control sequence	Internal select-before-operate
Local/remote switch	Card file external switch
Contact interface connections	10 mm removable compression terminal blocks, accepting up to #12 AWG (2.5mm 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 mounted
Momentary contact ratings	5 A or 10 A @ 277 VAC (or 32 VDC); optional: 10 A @150 VDC
Latch relay contact ratings	10 A @ 277 VAC (or 32 VDC)
Contact closure times ²	Selectable: 0.001 second increments



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

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

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Power requirements

Power supply mounting	Internal card file module; combines the various input voltage pre-regulator and 5 VDC logic supply into a single package
Input voltage	24 VDC, 48 VDC, 125 VDC, 250 VDC, 120 VAC, 230 VAC Tolerance range: $\pm 15\%$ minimum Single or Redundant Power Supplies
Power Supply Redundancy	Using the full size 19" wide card file, the NTX-200 can support redundant power supplies using the same input voltage, or any two AC or DC power supplies may be used. The customer can determine which power supply source is primary and which is considered secondary.
Power consumption	20 watts, typical
Power supply certifications	Internal noise < 1.5% of input voltage (certified to IEEE Standard C37.1-1994) Input voltage range > $\pm 15\%$ nominal (certified to CFE U0000-11)
Optional battery charger	Sealed lead-acid; 6 hours backup, typical
Backup with AC	Automatic no-break failover

Enclosures

Enclosure ratings	Various sizes NEMA 12 (indoor) or NEMA 4 (outdoor) cabinets
Rack mounting	Bottom card file (with module removal clearance), flush/semi-flush through panel or 19" rack/wall cabinet mounting DIN-rail mounted analog and digital input terminal blocks, control output modules, and analog output modules
Access	Front/rear card file access

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/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 and 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

NTX series I/O expansion/interface alternatives

Other external terminal block options

Bell 202 or 9600 baud 4-wire multi-drop telephone modem

External GPS satellite clock and antenna

35 mm DIN-rail, in 2-meter lengths

RJ45 RS-232 to 9-pin or 25-pin interface cables

RJ45 RS-485 to 8 terminal block assembly interface cables

Protocols

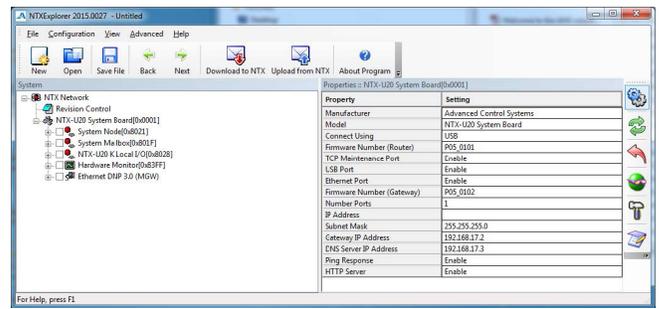
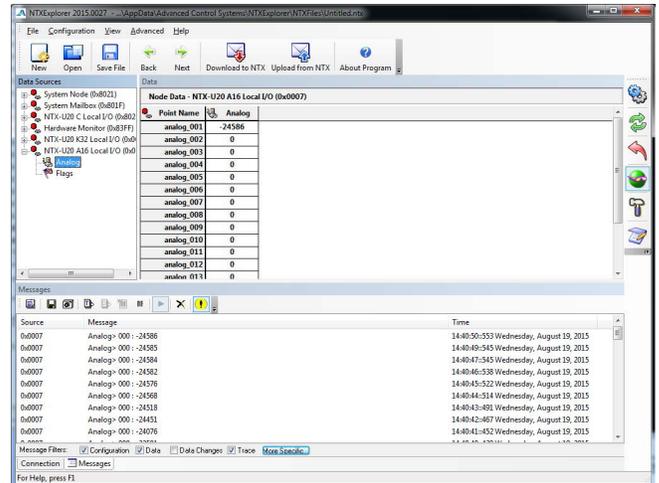
Master and IED protocol compatibility expand constantly.
Visit our web site for a complete and up-to-date list.

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-200 provides an easy way to remotely download or upload a configuration to or from the NTX-200 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-200 when it is convenient. Configuration in an NTX-200 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

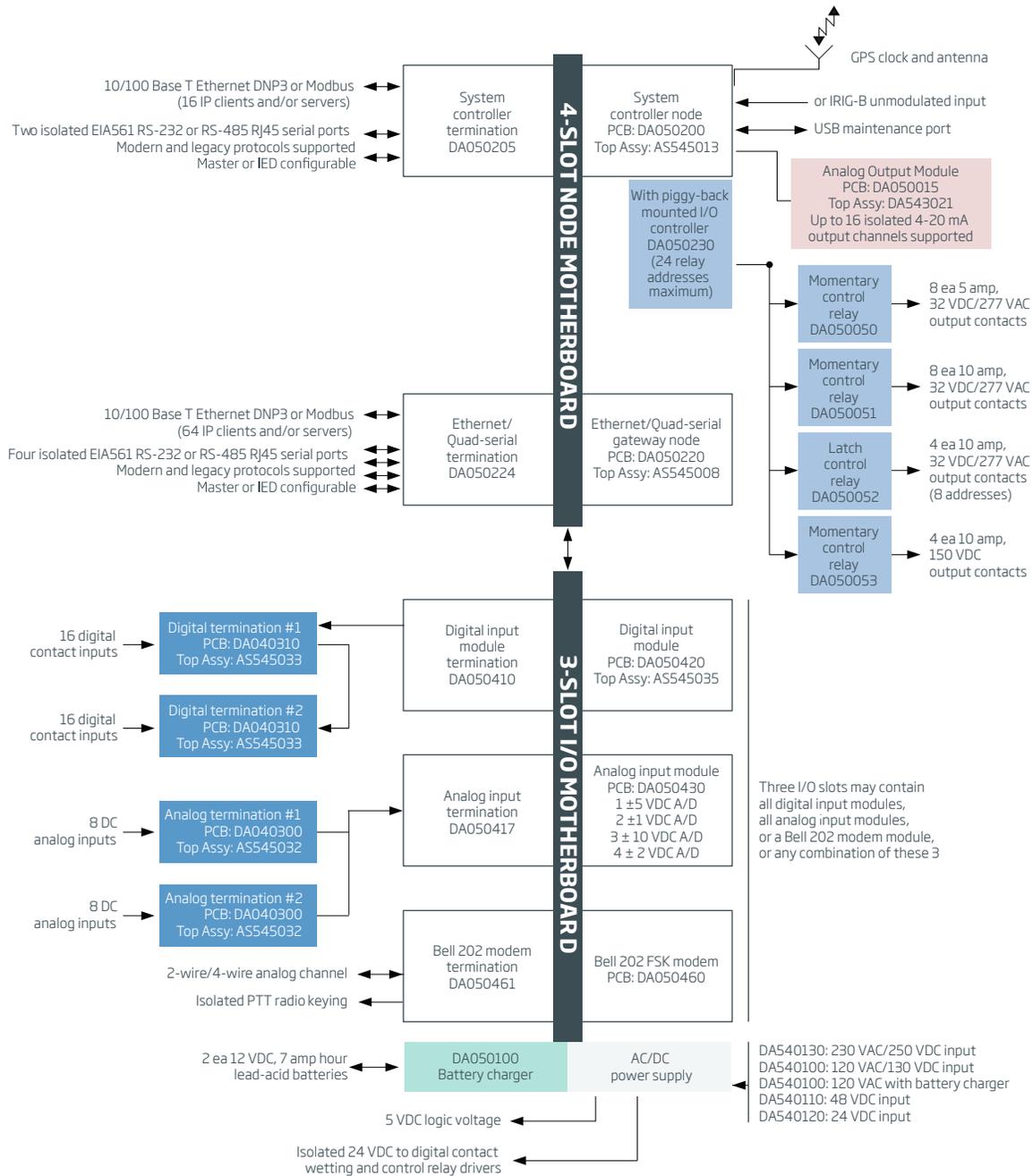


technician for testing or database verification purposes. Monitored data has two quality flags associated with each data value in the database:

- 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-200, NTX Explorer can connect with permissions via a WAN for remote configuration.

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