



Advanced Control Systems

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November 2, 2015

Columbus Division Of Electricity
910 Dublin Rd
COLUMBUS, OH 43215-1169
Jason G. Peterson
(614) 645-7832
JGPeterson@columbus.gov

Subject: Offer No.: 15AQ000109, R4
Description: NTX 220 Substation Controller for MPR-3010 & NTU-7510 Upgrades

Dear Jason:

Advanced Control Systems, Inc. is pleased to present this offer in response to Columbus Division of Electricity request for an NTX-220 Substation Controller for upgrading 5 MPR-3010 & 3 NTU-7510 obsolete ACS RTUs. The systems will be manufactured and tested at our Norcross, Georgia USA factory. This revision 4 clarifies on-site engineering installation assistance is included and reduces the not-to-exceed travel & living expenses closely coupled with the City's latest consultant reimbursement policies.

The specific Customer Benefits provided by the NTX-220 can be identified as follows:

- Highly reliable, technically advanced client/server, peer-to-peer distributed multiple 32-bit microprocessor technology
- Fully secured and stable platform for all distributed microprocessor nodes
- Very intuitive NTX Explorer Configuration and Monitor tools
- Configurable with high-speed serial communication ports and 10/100 Base T DNP3 over TCP/IP or UDP Ethernet ports
- Support most popular legacy protocols - Vendor-transparency for integration of IEDs
- Full 10 years parts and labor factory warranty

Advanced Control Systems (ACS) is a leading provider of smart grid solutions to the global electric power industry. Our automation product lines include a wide range of flexible and cost-effective substation, distribution and feeder automation solutions. The ACS product line also includes the most sophisticated remote terminal units (RTU) in the industry—our NTX series of intelligent automation controllers, available in pole-top and substation models.

Please review the attached offer and let me know if you have any questions, concerns or need further clarification. We appreciate your business!

Sincerely,

Janie Schmidt
Regional Sales Director
Tel: 404-861-7380
Janie.Schmidt@acspower.com

Columbus Division of Electricity

NTX 220 SUBSTATION CONTROLLER for MPR-3010 & NTU-7510 Upgrades

Firm Offer

Offer No.: 15AQ000109

Rev.: 04

Date: November 2, 2015



This document contains proprietary information

Originated by: M. Clint Cowan, Substation Systems Manager, Sales & Marketing

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1 INTRODUCTION

When Columbus Division of Electricity partners with Advanced Control Systems, you are harnessing the talents and focused energies of business people who are pioneers in substation automation, and leading providers of smart grid solutions. Decades of outstanding smart grid solutions and service to the global electric power industry provide the technical matrix in which fiscally prudent and market-driven business decisions are made every day.

With NTX-220 Upgrades of obsolete MPR-3010 & NTU-7510 RTUs, this solution lets you:

- greatly reduce wiring and test labor, and engineering costs associated with RTU replacements
- eliminate substation wiring drawing revisions
- eliminate master station database and display revisions
- eliminate the most failure-prone or unsupported electronics with extremely reliable and fully-supported NTX-220 hardware and software
- reduce the time required to modernize existing installations from weeks to hours
- obtain many more years of useful life from existing equipment and installations
- take advantage of the latest RTU technology, such as modern open protocols; high-capacity, high-speed master and slave gateways (serial and/or TCP/IP); modern Windows® PC-based configuration and diagnostic tools
- take advantage of modern communications digital interface mediums
- segregate vast amounts of data into separate Virtual RTU addresses; supply this data and control capabilities to multiple master stations at no additional cost
- integrate IEDs inside and outside the existing substations

We very much appreciate that you and other staff members have invested your time and effort in reviewing our submittal. From the vantage of our knowledge and experience base, we certainly see the challenges—and the genuine mutual successes—that are possible under the realization of this solution.

ACS offers an NTX series product for every application. Additional information about these solutions, along with a comparison of the products, can be found in Attachment A - Substation Automation Solutions – NTX Series of this document.

2 SOLUTION OVERVIEW

Advanced Control Systems, Inc. (ACS) is pleased to present this solution in response to Columbus Division of Electricity request for a NTX-220 Substation Controller.

The NTX-220 Substation Controller, the mid-size version of the ACS NTX series substation systems, provides complete substation management functionality. It also adds the ability to interface to a very large amount of data from integrated IEDs, and to a medium to large amount of data from hardwired local I/O devices in the substation. Multiple user-defined subsets of this data can be transmitted to one or more master stations in the master's native protocol.

Multiple high-performance ARM9E 32-bit RISC microprocessors, each programmed to support specific functions, are linked together using a peer-to-peer type network. The ARM9E microprocessor-controlled, high capacity NTX quad serial/Ethernet gateways make it an ideal, low-cost substation solution for data concentrator and protocol converter for small- to medium-sized transmission or distribution substation installation. A full-width 19" card file supports up to 18 serial and 5 Ethernet ports, with up to 259 virtual IP ports.



Figure 1 NTX-220 Substation Controller

The NTX-220 can be used in a traditional centralized equipment rack- or floor-mounted cabinet. The base NTX-220 has a six-slot I/O motherboard, which supports any combination of these modules in the slots:

- up to six 16-point DC analog input modules
- up to six 32-point digital input modules
- up to six Bell 202 FSK modems
- up to 16 isolated 4-20ma Analog Output Channels

The I/O is expandable beyond the base 6-slot I/O motherboard using a separate analog and/or digital input expansion card file(s) with 12 additional input module slots each with the same card file dimensions.

Additional information about the ACS NTX-220 Substation Controller can be found in Attachment B - Substation Controller – NTX 220 of this offer.

3 SCOPE OF SUPPLY WITH PRICING

ACS will supply to Columbus Division of Electricity the NTX-220 Substation Controller as follows:

Item	Qty	Description	Unit Price	Total
		NTX-220 Substation Controller for Upgrading NTU-7510 & MPR-3010 RTUs that includes all components and interface cables for a complete upgrade kit for each substation site.		
1	2	<p>NTX-220 Substation Controller for NTU-7510 Upgrade Kits at West (J6671) & HAP Cremeen (J7684) Substation as follows:</p> <p>NTX-220 Electronics Card Cage, P/N CF545051, 19" W x 5.25" H x 12" D, 19" rack mounted, with Power Supply, 5-slot System Node Mid-Plane and a 6 Slot Input Module mid-plane Motherboard.</p> <p>NTX System Controller Node with Termination, P/N AS545011/DA050205, Router/Gateway functionality with One 10/100baseT DNP3 and/or Modbus RTU over TCP/IP or UDP Ethernet Port, configurable for up to 8 IP clients, servers, or multiples of both. Includes two configurable isolated EIA 561 RS-232 DTE/485 RJ45 serial ports, with DNP 3.0, and Modbus RTU primary/secondary protocols, Cooper 2179 primary IED protocol and ACS7000, Harris 6000, L&G8979, SC-1801, & SCOMD secondary protocols for master communications. 32-bit ARM9E CPU running under an embedded version of the Linux operating system. Mini USB Maintenance port and USB for a thumb drive to update firmware and archive configuration files. IRIG-B Time Code Reader for unmodulated signaling and GPS Satellite Clock interface Mini-DIN connector using NMEA 0183 protocol included with optional clock antenna available for NTX-240 time synchronization only. Supports NTP Synchronization via an Ethernet Connection.</p> <p>Includes NTX Logic Controller- Programmable Logic Controller application for the NTX-series that includes:</p> <p>NTU Logic Run-Time License included for ACS or customer developed algorithms to be run on the System Controller in any NTX series so equipped, C/N 5080.</p>	\$15,260	\$30,520

	<p>One NTX Ethernet/Quad-Serial Gateway Node with Termination Module, P/N AS545008/DA050224 x 1, F/W P05-0105, with One 10/100baseT DNP3 and/or Modbus RTU over TCP/IP or UDP Ethernet Port, configurable for up to 64 IP clients, servers, or multiples of both. Includes Four configurable isolated EIA 561 RS-232 DTE/485 RJ45 serial ports, with DNP 3.0, and Modbus RTU primary/secondary protocols, Cooper 2179 primary IED protocol and ACS7000, Harris 6000, L&G8979, SC-1801, & SCOMD secondary protocols for master communications. 32-bit ARM9E CPU running under an embedded version of the Linux operating system.</p> <p>Four NTX-200 Series Serial Port Communications Interface Cable - RJ-45 to RJ-8A Weidmuller for RS-485, AA401509 x 4</p> <p>NTX Smart I/O Controller, P/N AS545084/050217 for up to 512 card file mounted digital inputs, 256 analog inputs and 2 Analog Output Channels. 2nd source upgrades I/O will be supported as originally defined for the specific model.</p> <p>NTX Binary Output Controller, P/N AS545016/050243 using an isolated 16 x 16 Binary Output relay driver Interface - for up to 256 External DIN Rail mounted control relay Interfaces.</p> <p>1 Spare NTX Gateway Node Slot\ available</p> <p>Bell 202 Modem, FSK, AS545045 / DA050461 x 1</p> <p>ACCS card file mounted Bell 202 Modem using one Analog or Digital Input Module Slot. Includes isolated Radio Keying PTT output and serial port interface cable.</p> <p>Five Spare NTX I/O Slots available</p> <p>Four Analog Input Modules to Replace Existing 7510 Analog Multiplexer Modules P/N DA075300 / DA045440 X 4. Will use the same analog input signaling as scaled in the NTU-7510 Card File rear Termination Resistor.</p> <p>Analog interface Cable AA4650086</p> <p>Analog Logic Power Cable, AA401371</p> <p>Digital Adaptor to Existing 7510 DIM's, DA075302 x 1</p> <p>Digital Interface cable for 7510 DIMs, AA401253</p> <p>Rear Panel AS545063 with Wetting Voltage connector and Cable for NTU-7510 +V to rear 7510 motherboard connector J8, AA650101</p> <p>Adaptor Cable to Existing Control Cards, AA401386</p>		
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		<p>NTX Power Supply, P/N 540100, 125Vdc/115Vac input with 24Vdc output for contact wetting and control output relay drivers and 5Vdc logic power. Card Cage Mounted with Power Panel AS545043 for 130Vdc.</p> <p>For installation in existing NTU-7510 Cabinet</p> <p>Includes complete assembly and system level testing of complete unit, and custom NTX-220 drawings.</p> <p>NTX Explorer Configuration & Diagnostic USB Serial Cable - 10', USB 2.0 Cable, Type A-5 pin (mini-B). C/N 4194</p> <p>NTU/NTX Jump Drive with all instruction manuals and literature on substation systems products.</p>		
2	1	<p>NTX-220 Substation Controller for NTU-7510 Upgrade Kit at Italian Substation (J9302) as follows:</p> <p>NTX-220 Electronics Card Cage, P/N CF545051, 19" W x 5.25" H x 12" D, 19" rack mounted, with Power Supply, 5-slot System Node Mid-Plane and a 6 Slot Input Module mid-plane Motherboard.</p> <p>NTX System Controller Node with Termination, P/N AS545011/DA050205, Router/Gateway functionality with One 10/100baseT DNP3 and/or Modbus RTU over TCP/IP or UDP Ethernet Port, configurable for up to 8 IP clients, servers, or multiples of both. Includes two configurable isolated EIA 561 RS-232 DTE/485 RJ45 serial ports, with DNP 3.0, and Modbus RTU primary/secondary protocols, Cooper 2179 primary IED protocol and ACS7000, Harris 6000, L&G8979, SC-1801, & SCOMD secondary protocols for master communications. 32-bit ARM9E CPU running under an embedded version of the Linux operating system. Mini USB Maintenance port and USB for a thumb drive to update firmware and archive configuration files. IRIG-B Time Code Reader for unmodulated signaling and GPS Satellite Clock interface Mini-DIN connector using NMEA 0183 protocol included with optional clock antenna available for NTX-240 time synchronization only. Supports NTP Synchronization via an Ethernet Connection.</p> <p>Includes NTX Logic Controller- Programmable Logic Controller application for the NTX-series that includes:</p> <p>NTU Logic Run-Time License included for ACS or customer developed algorithms to be run on the System Controller in any NTX series so equipped, C/N 5080.</p>	\$20,075	\$20,075

		<p>One NTX Ethernet/Quad-Serial Gateway Node with Termination Module, P/N AS545008/DA050224 x 1, F/W P05-0105, with One 10/100baseT DNP3 and/or Modbus RTU over TCP/IP or UDP Ethernet Port, configurable for up to 64 IP clients, servers, or multiples of both. Includes Four configurable isolated EIA 561 RS-232 DTE/485 RJ45 serial ports, with DNP 3.0, and Modbus RTU primary/secondary protocols, Cooper 2179 primary IED protocol and ACS7000, Harris 6000, L&G8979, SC-1801, & SCOMD secondary protocols for master communications. 32-bit ARM9E CPU running under an embedded version of the Linux operating system.</p> <p>Five NTX-200 Series Serial Port Communications Interface Cable - RJ-45 to RJ-8A Weidmuller for RS-485, AA401509 x 5</p> <p>NTX Smart I/O Controller, P/N AS545084/050217 for up to 512 card file mounted digital inputs, 256 analog inputs and 2 Analog Output Channels. 2nd source upgrades I/O will be supported as originally defined for the specific model.</p> <p>NTX Binary Output Controller, P/N AS545016/050243 using an isolated 16 x 16 Binary Output relay driver Interface - for up to 256 External DIN Rail mounted control relay Interfaces.</p> <p>1 Spare NTX Gateway Node Slot\ available</p> <p>Bell 202 Modem, FSK, AS545045 / DA050461 x 1</p> <p>ACS card file mounted Bell 202 Modem using one Analog or Digital Input Module Slot. Includes isolated Radio Keying PTT output and serial port interface cable.</p> <p>Five Spare NTX I/O Slots available</p> <p>Eight Analog Input Modules to Replace Existing 7510 Analog Multiplexer Modules P/N DA075300 / DA045440 X 8. Will use the same analog input signaling as scaled in the NTU-7510 Card File rear Termination Resistor.</p> <p>Analog interface Cable AA4650086</p> <p>Analog Logic Power Cable, AA401371</p> <p>Digital Adaptor to Existing 7510 DIM's, DA075302 x 1</p> <p>Digital Interface cable for 7510 DIMs, AA401253</p> <p>Rear Panel AS545063 with Wetting Voltage connector and Cable for NTU-7510 +V to rear 7510 motherboard connector J8, AA650101</p> <p>Adaptor Cable to Existing Control Cards, AA401386</p>		
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		<p>NTX Power Supply, P/N 540100, 125Vdc/115Vac input with 24Vdc output for contact wetting and control output relay drivers and 5Vdc logic power. Card Cage Mounted with Power Panel AS545043 for 130Vdc.</p> <p>For installation in existing NTU-7510 Cabinet</p> <p>Includes complete assembly and system level testing of complete unit, and custom NTX-220 drawings.</p> <p>NTX Explorer Configuration & Diagnostic USB Serial Cable - 10', USB 2.0 Cable, Type A-5 pin (mini-B). C/N 4194</p> <p>NTU/NTX Jump Drive with all instruction manuals and literature on substation systems products.</p>		
3	3	<p>NTX-220 Substation Controller for MPR-3010 Upgrade Kits at North, Hydro and Power Plant Substation (J2780) as follows:</p> <p>NTX-220 Electronics Card Cage, P/N CF545051, 19" W x 5.25" H x 12" D, 19" rack mounted, with Power Supply, 5-slot System Node Mid-Plane and a 6 Slot Input Module mid-plane Motherboard.</p> <p>NTX System Controller Node with Termination, P/N AS545011/DA050205, Router/Gateway functionality with One 10/100baseT DNP3 and/or Modbus RTU over TCP/IP or UDP Ethernet Port, configurable for up to 8 IP clients, servers, or multiples of both. Includes two configurable isolated EIA 561 RS-232 DTE/485 RJ45 serial ports, with DNP 3.0, and Modbus RTU primary/secondary protocols, Cooper 2179 primary IED protocol and ACS7000, Harris 6000, L&G8979, SC-1801, & SCOMD secondary protocols for master communications. 32-bit ARM9E CPU running under an embedded version of the Linux operating system. Mini USB Maintenance port and USB for a thumb drive to update firmware and archive configuration files. IRIG-B Time Code Reader for unmodulated signaling and GPS Satellite Clock interface Mini-DIN connector using NMEA 0183 protocol included with optional clock antenna available for NTX-240 time synchronization only. Supports NTP Synchronization via an Ethernet Connection.</p> <p>Includes NTX Logic Controller- Programmable Logic Controller application for the NTX-series that includes:</p> <p>NTU Logic Run-Time License included for ACS or customer developed algorithms to be run on the System Controller in any NTX series so equipped, C/N 5080.</p>	\$13,185	\$39,555

	<p>One NTX Ethernet/Quad-Serial Gateway Node with Termination Module, P/N AS545008/DA050224 x 1, F/W P05-0105, with One 10/100baseT DNP3 and/or Modbus RTU over TCP/IP or UDP Ethernet Port, configurable for up to 64 IP clients, servers, or multiples of both. Includes Four configurable isolated EIA 561 RS-232 DTE/485 RJ45 serial ports, with DNP 3.0, and Modbus RTU primary/secondary protocols, Cooper 2179 primary IED protocol and ACS7000, Harris 6000, L&G8979, SC-1801, & SCOMD secondary protocols for master communications. 32-bit ARM9E CPU running under an embedded version of the Linux operating system.</p> <p>NTX Smart I/O Controller, P/N AS545084/050217 for up to 512 card file mounted digital inputs, 256 analog inputs and 2 Analog Output Channels. 2nd source upgrades I/O will be supported as originally defined for the specific model.</p> <p>NTX Binary Output Controller, P/N AS545016/050243 using an isolated 16 x 16 Binary Output relay driver Interface - for up to 256 External DIN Rail mounted control relay Interfaces.</p> <p>1 Spare NTX Gateway Node Slot\ available</p> <p>Bell 202 Modem, FSK, AS545045 / DA050461 x 1</p> <p>ACS card file mounted Bell 202 Modem using one Analog or Digital Input Module Slot. Includes isolated Radio Keying PTT output and serial port interface cable.</p> <p>Five Spare NTX I/O Slots available</p> <p>Three Analog Input Modules to Replace Existing 3010 Analog Multiplexer Modules P/N DA075301 / DA045440 X 3. Will use the same analog input signaling as scaled in the MPR-3010 Card File rear Termination Resistor.</p> <p>Analog interface Cable AA4650086</p> <p>Rear Panel AS545063 with Wetting Voltage connector and Cable for <u>V</u> and 5Vdc logic power to rear 3010 card file connector and Analog 5Vdc Logic Power, AA401402 or equal.</p> <p>Digital Adapter 075302 for Digital Inputs (Status / Accum) installed in the MPM module slot for existing 480028-1 Optical Input Buffer modules. Accumulator and Status input external terminal blocks untouched in the upgrade.</p> <p>Digital Interface cable for 3010 DIMs, AA401204 Cable AA401386 x 1 for connection to existing 24Vdc coil relay modules</p>		
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		<p>NTX Power Supply, P/N 540100, 125Vdc/115Vac input with 24Vdc output for contact wetting and control output relay drivers and 5Vdc logic power. Card Cage Mounted with Power Panel AS545043 for 130Vdc.</p> <p>For installation in existing NTU-7510 Cabinet</p> <p>Includes complete assembly and system level testing of complete unit, and custom NTX-220 drawings.</p> <p>NTX Explorer Configuration & Diagnostic USB Serial Cable - 10', USB 2.0 Cable, Type A-5 pin (mini-B). C/N 4194</p>		
4	2	<p>NTX-220 Substation Controller for MPR-3010 Upgrade Kits at Furnace and Southerly Substations (J2780) as follows:</p> <p>NTX-220 Electronics Card Cage, P/N CF545051, 19" W x 5.25" H x 12" D, 19" rack mounted, with Power Supply, 5-slot System Node Mid-Plane and a 6 Slot Input Module mid-plane Motherboard.</p> <p>NTX System Controller Node with Termination, P/N AS545011/DA050205, Router/Gateway functionality with One 10/100baseT DNP3 and/or Modbus RTU over TCP/IP or UDP Ethernet Port, configurable for up to 8 IP clients, servers, or multiples of both. Includes two configurable isolated EIA 561 RS-232 DTE/485 RJ45 serial ports, with DNP 3.0, and Modbus RTU primary/secondary protocols, Cooper 2179 primary IED protocol and ACS7000, Harris 6000, L&G8979, SC-1801, & SCOMD secondary protocols for master communications. 32-bit ARM9E CPU running under an embedded version of the Linux operating system. Mini USB Maintenance port and USB for a thumb drive to update firmware and archive configuration files. IRIG-B Time Code Reader for unmodulated signaling and GPS Satellite Clock interface Mini-DIN connector using NMEA 0183 protocol included with optional clock antenna available for NTX-240 time synchronization only. Supports NTP Synchronization via an Ethernet Connection.</p> <p>Includes NTX Logic Controller- Programmable Logic Controller application for the NTX-series that includes:</p> <p>NTU Logic Run-Time License included for ACS or customer developed algorithms to be run on the System Controller in any NTX series so equipped, C/N 5080.</p>	\$12,128	\$24,256

		<p>One NTX Ethernet/Quad-Serial Gateway Node with Termination Module, P/N AS545008/DA050224 x 1, F/W P05-0105, with One 10/100baseT DNP3 and/or Modbus RTU over TCP/IP or UDP Ethernet Port, configurable for up to 64 IP clients, servers, or multiples of both. Includes Four configurable isolated EIA 561 RS-232 DTE/485 RJ45 serial ports, with DNP 3.0, and Modbus RTU primary/secondary protocols, Cooper 2179 primary IED protocol and ACS7000, Harris 6000, L&G8979, SC-1801, & SCOMD secondary protocols for master communications. 32-bit ARM9E CPU running under an embedded version of the Linux operating system.</p> <p>NTX Smart I/O Controller, P/N AS545084/050217 for up to 512 card file mounted digital inputs, 256 analog inputs and 2 Analog Output Channels. 2nd source upgrades I/O will be supported as originally defined for the specific model.</p> <p>NTX Binary Output Controller, P/N AS545016/050243 using an isolated 16 x 16 Binary Output relay driver Interface - for up to 256 External DIN Rail mounted control relay Interfaces.</p> <p>1 Spare NTX Gateway Node Slot\ available</p> <p>Bell 202 Modem, FSK, AS545045 / DA050461 x 1</p> <p>ACS card file mounted Bell 202 Modem using one Analog or Digital Input Module Slot. Includes isolated Radio Keying PTT output and serial port interface cable.</p> <p>Five Spare NTX I/O Slots available</p> <p>Two Analog Input Modules to Replace Existing 3010 Analog Multiplexer Modules P/N DA075301 / DA045440 X 2. Will use the same analog input signaling as scaled in the MPR-3010 Card File rear Termination Resistor.</p> <p>Analog interface Cable AA4650086</p> <p>Rear Panel AS545063 with Wetting Voltage connector and Cable for \pmV and 5Vdc logic power to rear 3010 card file connector and Analog 5Vdc Logic Power, AA401402 or equal.</p> <p>Digital Adapter 075302 for Digital Inputs (Status / Accum) installed in the MPM module slot for existing 480028-1 Optical Input Buffer modules. Accumulator and Status input external terminal blocks untouched in the upgrade.</p> <p>Digital Interface cable for 3010 DIMs, AA401204</p> <p>Cable AA401386 x 1 for connection to existing 24Vdc coil relay modules</p>		
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		<p>NTX Power Supply, P/N 540100, 125Vdc/115Vac input with 24Vdc output for contact wetting and control output relay drivers and 5Vdc logic power. Card Cage Mounted with Power Panel AS545043 for 130Vdc.</p> <p>For installation in existing NTU-7510 Cabinet</p> <p>Includes complete assembly and system level testing of complete unit, and custom NTX-220 drawings.</p> <p>NTX Explorer Configuration & Diagnostic USB Serial Cable - 10', USB 2.0 Cable, Type A-5 pin (mini-B). C/N 4194</p>		
5	1	<p>NTX-220 Maintenance Set of Spare Modules as follows:</p> <p>Two NTX System Controller Node with Termination, P/N AS545011/DA050205 x 2, without I/O Controller w/NTX Logic Run-Time License.</p> <p>Two Ethernet/Quad-Serial Gateway Node with Termination Module, P/N AS545008/DA050224 x 2, F/W P05-0105,</p> <p>Two NTX Smart I/O Controller, P/N AS545084/050217 x 2</p> <p>Two NTX Binary Output Controller, P/N AS545016/050243 x 2</p> <p>One Bell 202 Modem, FSK, AS545045 / DA050461 x 1</p> <p>Three NTU-7510 Analog Input Module P/N DA075300 / DA045440 x 3</p> <p>Three MPR-3010 Analog Input Modules P/N DA075301 / DA045440 x 3</p> <p>Two NTX Power Supply, P/N 540100, 125Vdc/115Vac x 2</p>	\$22,395	\$22,395
6	10	<p>ACS on-site installation, configuration, and site commissioning assistance by an ACS Engineer/Technician for upgrading all 8 units. One day per site plus travel time. Estimated travel & living expenses are a not-to-exceed.</p> <p>Not-to-exceed expenses for On-site assistance with 2 round-trip air fares and 4 nights per week hotel charges plus meals based on latest City of Columbus Consultant Reimbursement Policy with exception for hotel room with tax nightly charge adjusted.</p>	<p>\$ 1,680 per day</p> <p>\$4,510</p>	\$16,800
Total System			\$158,111	

The system will be manufactured and tested at our Norcross, Georgia USA factory

The above pricing is based on standard ACS MPR-3010 and NTU-7510 Upgrade configurations and is defined under the following conditions:

- Firm, in USD, for the validity of the Offer
- All taxes are excluded from price
- Prices quoted are F.O.B. Norcross, GA
- The Scope of supply identifies all components and interface cables to guarantee a complete NTX-220 upgrade kit that will work for each site.

4 TERMS AND CONDITIONS

The terms and conditions governing this offer are set forth in Attachment C – ACS General Terms and Conditions of Sales for NTX Product Line.

4.1 Terms of Payment

ACS will invoice in accordance with the payment schedule described below. Payments not received within this period will be subject to interest charges.

- 100% Due at Shipping, NET30 Days

4.2 Shipping & Handling

Standard shipping within the continental US is typically 5-7 business days.

A shipping & handling fee of \$35 will be added to each small package shipment. No separate freight invoice will be submitted. Packages exceeding \$35 freight charges will be pre-paid and invoiced at cost, or fixed pre-quoted cost if applicable.

Charges for premium shipping (next day morning delivery, afternoon delivery, etc.) will be pre-paid and invoiced at cost.

5 DELIVERY

The proposed delivery time is **90 days** from Purchase Order subject to further agreements.

- Orders for expedited delivery to less than 30 days will require a premium fee of +50% of quoted total price with a minimum adder of \$3,000 per NTX.
- Orders for expedited delivery between 30 and 60 days will require a premium of +20% with a minimum adder of \$500 per NTX.
- Orders for expedited delivery to 60-90 days will be addressed on a case-by-case basis.
- All expedite processes must be authorized in writing and cannot be cancelled once started.
- All expedite processes will also greatly depend on the availability of material and

production resources at the time of request and may not always be possible. If ACS does not meet the required delivery, the expedite premium will be forfeited, but not the additional shipping cost.

All purchase orders should be sent to the address below. Please include Billing and Shipping Information.

Advanced Control Systems, Inc.
2755 Northwoods Parkway Norcross, Georgia 30071
Attn: Order Entry Team
FAX: 01-770-448-0957
Email: ACSOOrderEntryTeam@acspower.com

6 VALIDITY

This Offer is valid for a period of **6 months** from presentation of this Offer.

7 EXCLUSIONS FROM OFFER

The following points must be considered as explicitly excluded from the offer:

- Any equipment or service not explicitly mentioned in our offer

8 WARRANTY

ACS warrants that the NTX Systems and components produced by ACS shall be free from original defects in materials and workmanship for a period of 10 (Ten) years from delivery, in accordance with the delivery terms agreed with the Contractor. All other previous ACS RTU systems and components supplied shall carry the original warranty period of 15 months from delivery. Warranties provided by outside purchased vendor components (e.g., Radios, etc.) will have the original vendor's warranty passed along with the supply.

ACS shall at its own cost repair or replace the defective materials within the adequate period of time to perform the necessary enquiries, changes, repairs and/or replacements and tests.

Any repair and/or replacement performed by the Contractor or by a third party during the warranty period, without ACS' prior written consent, shall immediately and definitively cease the warranty granted by ACS.

The warranty is exclusively limited to the supplies and does not cover improper and incorrect

use or maintenance, negligence, accidents, abuses, lack of vigilance, incorrect assembly, normal deterioration, inappropriate environment, external chemical, electrical or electro-chemical influences, unauthorized operation or modification, disregard for instructions contained in user's manual.

9 Supporting Documentation

Attachment A - Substation Automation Solutions – NTX Series

Attachment B - Substation Controller – NTX 220

Attachment C – ACS General Terms and Conditions of Sales for NTX Product Line

Substation automation solutions

Advanced Control Systems (ACS) is a leading provider of smart grid solutions to the global electric power industry. Our automation product lines include a wide range of flexible and cost-effective substation, distribution and feeder automation solutions. The ACS product line also includes the most sophisticated remote terminal units (RTU) in the industry—our NTX series of intelligent automation controllers, available in pole-top and substation models.

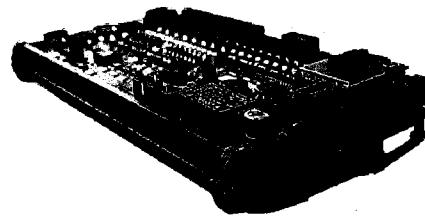
As older substations are modernized or new substations are built, more device integration capability and less local I/O will be required. We support all applications with highly reliable, technically advanced client/server, peer-to-peer distributed multiple 32-bit microprocessor technology. Incorporating an embedded Linux® operating system that is fully secured (with no user accessibility) provides a stable platform for all distributed microprocessor nodes in each model. Our integration of IEDs is completely vendor-transparent. And anyone with Windows® experience will find NTX Explorer Configuration and Monitor tools very intuitive. It's as close to plug-and-play as you can get.

All NTX series models can be configured with high-speed isolated RS-232 or RS-485 serial and 10/100 Base T DNP3 over TCP/IP or UDP Ethernet ports, as well as serial ports supporting most popular legacy protocols. The NTX series also incorporates both serial and TCP/IP or UDP Modbus RTU protocol. Both serial and TCP/IP DNP3 and Modbus RTU protocol emulations are configurable as a client, a server, or multiples of both.

We offer an NTX series product for every application. Additional information about these solutions, along with a comparison of the products, is available. Contact us to determine which of our substation automation/integration products is right for your utility.

NTX-20

The NTX-20 controller is a low-cost intelligent controller, ideal for data concentrator, protocol translation, and substation distributed circuit breaker/transformer bay automation or pole-top/pad-mount switch control for distribution automation. It is DIN rail-mounted, with a small complement of external I/O modules. When combined with the D 060 AC analog input module, it delivers a capable, cost-effective solution for automated Fault Detection, Isolation and Restoration (FDIR). The NTX-20 includes an Ethernet interface, and supports DNP over TCP/IP and Modbus RTU TCP/IP, as well as several legacy protocols. It supports two serial and one Ethernet port, with up to 7 virtual ports.

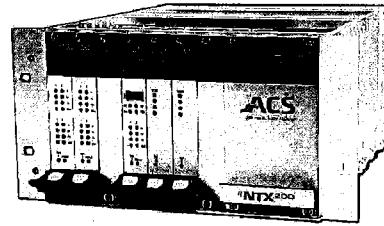


NTX-20 controller

NTX-200

The NTX-200 Substation controller is the smallest of our NTX series modular card file substation system designs. It incorporates complete substation management functionality in a compact unit, and adds the ability to interface to large amounts 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 can be used in a traditional centralized equipment rack- or wall-mounted cabinet. The standard NTX-200 has a half-width card file (9" W x 5.25" H x 12" D) that can be bottom-mounted with top/rear access. A 19" rack card file is available as an option, for front/rear access rack mounting. It has a three-slot I/O motherboard that supports up to three 16-point DC Analog Input Modules; three 32-point Digital Input Modules; or three Bell 202 FSK modems—or any combination of these modules in the three slots. The I/O is not expandable beyond the base 3-slot I/O motherboard. The NTX-200 can also serve as a remote Data Acquisition and Control node in a distributed substation system. It supports up to 14 serial and 4 Ethernet ports with up to 196 virtual IP ports.



NTX-200 controller

Substation automation solutions

NTX-220

Our mid-size option, providing complete substation management functionality. It has the ability to interface to a very large amount of data from integrated IEDs, and to a medium to large amount of data from hardwired local I/O devices in the substation. Multiple user-defined subsets of this data can be transmitted to one or more master stations in the master's native protocol. A medium amount of local analog and digital inputs or Bell 202 modems can be configured in the 6 I/O module motherboard slots available. When an external expansion card file is added, the inputs are expandable in groups of 12 additional I/O slots each. DNP3/IP interfaces to the NTX-220 using a built-in 2-port Ethernet switch.

Multiple high-performance ARM9E 32-bit RISC microprocessors, each programmed to support specific functions, are linked together using a peer-to-peer type network. The ARM9E microprocessor-controlled, high-capacity NTX quad-serial/Ethernet gateways make it an ideal, low-cost substation solution for data concentrator and protocol converter for small- to medium-sized transmission or distribution substation installation. A full-width 19" card file supports up to 18 serial and 5 Ethernet ports, with up to 259 virtual IP ports.

NTX-240

Used in small to large substation installations that have large serial and Ethernet port requirements for data concentration/integration applications. It is primarily used to upgrade legacy ACS RTUs, as well as legacy RTUs from other vendors. It is available in a standard half-width card file with front/rear or front-only access, which supports up to 18 serial and 5 Ethernet ports, with up to 259 virtual IP ports. An optional 19" rack-mounted full-width card file is also available.

NTX-260

Our top-of-the-line substation system. Ideal for very large substation or power plant installations, with extra-large serial and Ethernet port requirements, it incorporates complete substation management functionality with support for a sizable amount of local I/O for full integration of old and new substation designs. It is also ideal for applications requiring heavy-duty data concentration/protocol translators. Throughout the NTX-260, servers (such as NTX Gateway to IEDs) produce data, and clients (such as the NTX gateway supplying the virtual databases to the master) receive data. It can also transmit numerous selected subsets of this data to one or more master stations in the master's native protocol.

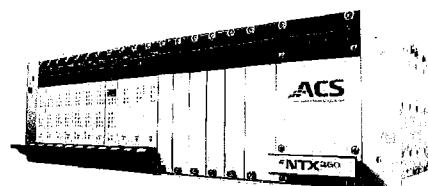
In order to take maximum advantage of the client/server model, the NTX-260 uses a distributed CPU processing architecture. Multiple high-performance ARM9E (Advanced RISC Machine) 32-bit microprocessors, each programmed to support specific functions, are linked together using a peer-to-peer type network. The ARM9E microprocessor-controlled high capacity NTX serial and Ethernet gateways makes it an ideal, high performance substation solution for data concentrator and protocol converter for large power plants, transmission and distribution substation installation. A full-width 19" card file supports up to 30 serial and 8 Ethernet ports, with up to 448 virtual IP ports. DNP3/IP interfaces to the NTX-260 using a built-in 2-port Ethernet switch.



NTX-220, front view



NTX-240 expanded chassis



NTX-260, front card file



D060 AC analog input module

The D 060 is an intelligent analog input module that uses Digital Signal Processing (DSP) technology. Designed for use with other modules and RTUs that have an RS-485 serial DNP3 communications interface, it enables additional distribution automation features. Feeder interface is through six 0-150 VAC PT and six 0-5 amp CT direct AC interfaces, for monitoring both sides of up to two distribution switches. It accomplishes intelligent, comprehensive feeder automation by providing crucial data to the automation platform, including fault reporting with direction, without requiring expensive recloser controls. The D 060 can also be used as an autonomous fault detection device. It is integrated with the NTX controllers and other devices through DNP3 protocol.

NTX Explorer Configuration and Monitor

The NTX Explorer and Monitor programs work on a personal computer using the Microsoft® Windows® (XP, WIN7 and WIN8) operating system. It emulates the standard PC Windows Explorer file management system in order 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 provides an easy way to remotely download or upload a configuration to or from the NTX 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 when it is convenient. Configuration in an NTX 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 grey background
- manually modified data is displayed with a red background

With a 10/100 Base T Ethernet interface to the NTX, NTX Explorer can be connected via a WAN for remote configuration.

Successful legacy RTU upgrade program

In the early 1980s, we began an upgrade program to upgrade our MPR-3000 series RTUs, which were built in the 1970s and 1980s. We have added successive generations of our RTU products, and continue this upgrade policy today with the latest in our line of substation automation controllers—the NTX series. We then began to examine legacy RTUs from other manufacturers to see where we could repeat these successes. We started with the Moore Power Systems RTUs—formally dropped from support by the original product vendor. These products have a card file design similar to our own models. We successfully implemented an Moore Power Systems MPS-9000 and MPS-9000S upgrade in a single day at a large mid-western utility, at a tremendous cost saving to the utility versus the replacement cost. The utility had previously replaced seven similar L&G legacy RTUs with another vendor's RTUs—a project that took over two years to complete.

Our success with upgrading these Moore Power Systems legacy RTUs led us to explore other upgrade opportunities. We have implemented programs at many utilities, upgrading more than 25 different models, including:

- BBC/CSI 7000 series
- CDC/EMPROS/Siemens 8890
- Ferranti Outpost
- Harris 5000/5500
- ILEX 8200
- Moore Systems MPS-9000/MPS-9000S
- L&G Telegyr 5300/5500
- L&G Telegyr 5310/5520
- L&G Telegyr 5700
- L&N Conitel C300
- L&N Conitel C2020
- QEI 4050/4151 (6CPP3)/Quics II (62P2)
- SNW SR-8000, Type 1 and 2
- SNW SR-8500 and SR-8550
- SNW IR-8600
- Tejas CAM/DAC
- Westronics M3 & M4/Harris 6000
- Westronics/Harris/GE D20/D200 & peripheral I/O panels

For more information about our upgrade program, see our Legacy RTU upgrade solutions document.

Substation automation solutions

NTX series model comparisons

The chart below briefly compares the NTX series models. This is not a comprehensive comparison; for a copy of the comprehensive product comparison, or detailed information on a specific product, please contact your ACS sales representative.

	NTX-20	NTX-200	NTX-220	NTX-240	NTX-260
Replaces previous ACS model	NTU-7575 base	Fully expanded NTU-7575; small Connex 30/ Connex 60	Small Connex 30/ larger Connex 60 gateway; smaller I/O capacity for Connex 30	Connex 60 or Connex 30 data concentrator/protocol translation applications	Fully-loaded Connex 30 plus
Carrier/card file dimensions	200 x 108 x 70 mm (8" x 4.25" x 2.75") Optional 19" 84 HP	42 HP wide, 3 U high (9" w x 5.25" h x 12" d)	84 HP wide, 3 U high (19" w x 5.25" h x 12" d) Optional 19" 84 HP	42 HP wide, 3 U high (9" w x 5.25" h x 12" d) Optional 19" 84 HP	84 HP wide, 3 U high (19" w x 5.25" h x 12" d)
Ethernet quad-serial gateway node: maximum installed	N/A	3	4; no I/O 1 slot (control output); 1 slot (optional expanded I/O)	4; no I/O 2 slots used for legacy I/O interfaces	7; no I/O 2 slots used for I/O
Virtual Ethernet ports	7	196	259	259	448
Total NTX ports supported: isolated serial ports	2	14	18; no control and DA050235 I/O controller used	18; no I/O; 2 node slots used for legacy I/O	30; no I/O; 2 node slots used for I/O
Local binary inputs supported	Base 16 + 4 expansion; groups of 8 inputs each (48 points maximum); isolated 18-36 VDC contact wetting	32 point modules; card file mounted; maximum of 3 slots (96 points maximum with no analog inputs); isolated 24 VDC contact wetting	32 point modules, card file mounted; maximum of 6 slots (192 points maximum with no analog inputs); isolated 24 VDC contact wetting; expansion card files with 12 slots each	For legacy ACS or 2nd source upgrades; can support maximum of 512 points	32 point modules, card file mounted; expansion card files with 12 slots each
Local DC analog inputs supported	6 (expansion) 35 mm DIN rail-mounted (groups of 6 inputs each); 36 points maximum	16 DC analog input modules, card file mounted; maximum of 3 slots (groups of 16 inputs each; 48 points maximum with no binary inputs)	16 DC analog input modules, card file mounted; maximum of 6 slots (groups of 16 inputs each; 96 points maximum with no binary input points) Expansion card files with 12 modules each	For legacy ACS and 2nd source upgrades with maximum of 256 DIN rail or card file analog input points	16 DC analog input modules, card file mounted: with 12 modules each
Local DC analog outputs supported	2; 35 mm DIN rail-mounted	4; 35 mm DIN rail-mounted	8; 35 mm DIN rail-mounted	8; 35 mm DIN rail-mounted	16; 35 mm DIN rail-mounted
Local control outputs supported	24	24	256 relays (less one quad-gateway) and for legacy ACS and 2nd source RTU control interfaces	256 relays (less one quad-gateway) and for legacy ACS and 2nd source RTU control interfaces	256 relays (less one quad-gateway) and for legacy ACS and 2nd source RTU control interfaces

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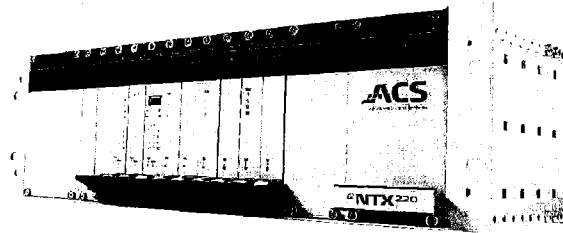
NTX-220 Substation Controller

The NTX-220 Substation Controller, the mid-size version of the ACS NTX series substation systems, provides complete substation management functionality. It also adds the ability to interface to a very large amount of data from integrated IEDs, and to a medium to large amount of data from hardwired local I/O devices in the substation. The NTX-220 is designed with multiple 32-bit CPUs operating within a client/server architecture. NTX-220 clients (such as the NTX gateway to IEDs) provide data that is received and processed at the server level in the NTX master gateway supplying the virtual databases to the master. Multiple user-defined subsets of this data can also be transmitted to one or more master stations in the master's native protocol. A medium amount of local analog and digital inputs can be configured in the six input module motherboard slots available. With the addition of an external expansion card file, these inputs are expandable to the maximum of 256 inputs per local interface node. Control relay outputs are also expandable to 256 relay outputs per control system node, utilizing externally mounted control relay modules with varying voltage and current contact ratings available.

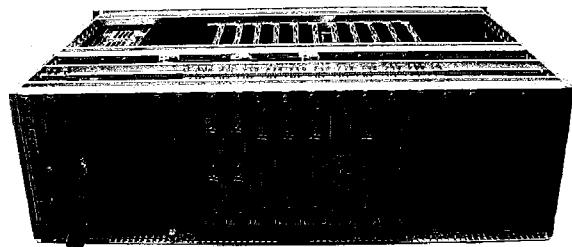
In order to take maximum advantage of the client/server model, the NTX-220 uses a distributed processing architecture. Multiple high-performance ARM9E 32-bit RISC microprocessors, each programmed to support specific functions, are linked together using a peer-to-peer type network. The ARM9E microprocessor-controlled, high capacity NTX quad-serial/Ethernet gateways make it an ideal, low-cost substation solution for data concentrator and protocol converter for small- to medium-sized transmission or distribution substation installation.

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 user-accessible, for secure operating conditions)
- Legacy protocols from previous Connex/NTU models will be supported, based on demand.
- Extended temperature range of -10 to 70°C (14 to 158°F)
- Multiple Virtual-RTU™ database mapping
- Field-programmable; remotely configurable via Ethernet WAN/LAN



NTX-220, front view



NTX-220, rear view

- Sequence-of-events reporting with 1ms resolution
- Built-in IRIG-B (unmodulated) Time Code Reader and GPS time reference (NMEA 0183) interface (optional external satellite clock/antenna required) or NTP time synchronization, supported via the Ethernet network
- Optional IEC 611131 and 61499-compliant NTX Logic PLC that executes user-defined control and/or calculation algorithms
- 2 USB channels: 1 for mini-USB to USB connections to the maintenance channel; 1 to support a thumb drive to update Flash firmware
- Multiple 10/100 BaseT Ethernet with DNP or Modbus RTU protocol over TCP/IP or UDP client, server or multiples of both, with a high quantity of IP connections available per port
- Euro card format (3U x 84HP; 19" W x 5.25" H x 12" D); mid-plane motherboard where the front modules contains the majority of the logic (system CPU nodes), and the rear modules contains 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)

NTX-220 Substation Controller

Application and expansion

The NTX-220 can be used in a traditional centralized equipment rack- or floor-mounted cabinet. The base NTX-220 has a six-slot I/O motherboard, which supports any combination of these modules in the slots:

- up to six 16-point DC analog input modules
- up to six 32-point digital input modules
- up to six Bell 202 FSK modems

The I/O is expandable beyond the base 6-slot I/O motherboard using a separate analog (up to 256 points maximum) and/or digital (up to 256 points maximum) input expansion card file(s) with 8 or 16 additional input module slots of the same card file dimensions. An NTX System Controller with termination provides a combination of router and dual-serial ports, with an Ethernet port as the base communications gateway. An NTX internal I/O network controller is

piggybacked on the NTX System Controller for up to 256 analog inputs, 256 digital inputs and 2 analog output channels. With the addition of a binary output controller that will utilize one of the 5 system motherboard slots, up to 256 external control relays can be equipped with both momentary (varying contact voltage/current ratings supported) and latching relays. The unit power supply and up to four additional NTX quad-serial with Ethernet port gateways (three with the binary output controller installed) can be incorporated in the card file mid-plane system motherboard—for a maximum of 18 isolated EIA561 RS-232/RS-485 RJ45 serial ports and 5 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.

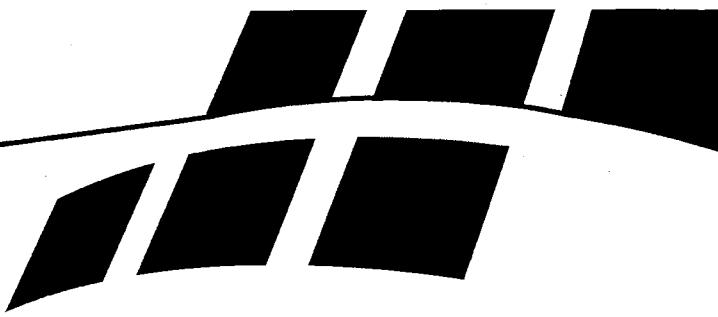
Technical specifications

Card file

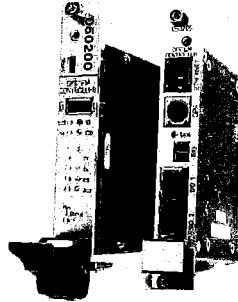
Card file dimensions	Complies with IEEE 1101/11 & IEEE 1011.10 standards; 84 HP wide x 3U high (19" W x 5.25" H x 12" D) for single Euro-card format modules, bottom wall- or 19" rack-mounted with front and rear access
Configuration	The full-size card file contains the power supply, a 5-slot node system mid-plane motherboard and a 6-slot I/O mid-plane motherboard

System nodes

NTX System Controller	One DNP3 or Modbus RTU over 10/100 BaseT TCP/IP or UDP Ethernet (RJ45), configurable as a server, a client, or multiples of both
	Includes two 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
Time clock	One mini-USB maintenance channel port; one USB for thumb drive firmware updates On-board UTC time/date clock, non-volatile; internal time code reader for unmodulated IRIG-B (with P1344 extensions) time synchronization; GPS clock time synchronization (NMEA 0183 protocol) with optional antenna, or NTP via Ethernet
I/O controller	Mounted on the NTX System Controller; provides interfaces to both the base (6) and maximum expansion card file analog (256) and digital (256) inputs, as well as the DIN-rail-mounted analog outputs (2) Not installed where local I/O is not required



Binary output controller	Utilizes one of the five system node motherboard slots for external DIN-rail mounted relay modules for up to 256 relays (momentary or latching)
NTX quad-serial/Ethernet gateway	Not installed where no local control outputs are required One DNP3 or Modbus RTU over 10/100 BaseT TCP/IP or UDP Ethernet (RJ45), configurable as a server, a client, or multiples of both Includes four isolated EIA561 serial ports with RJ45 connectors per quad serial/Ethernet gateway node, with expansion for up to four NTX quad serial/Ethernet gateway nodes Multiple legacy and modern protocols supported
Database capacity	14,000 data values per system controller and NTX gateway
Serial port connections	EIA561 RJ45 connectors
Ethernet connection	RJ45, with multiple client, server and multiples of both; IP configurable
Serial communication ports	Isolated digital RS-232C DTE (with or without handshaking) or RS-485 serial interfaces, configurable per 9-pin port Optional external fiber optic transceiver
Serial analog operation channel	Two- or four-wire (9600 baud with optional external modem; 1200 baud with optional internal Bell 202 modem)
Serial baud rate	300 to 115,200 bits per second, selectable per port
Alternate application	NTX Logic is a Programmable Logic Controller (PLC) application that runs on the NTX System Controller platform with termination module Firmware fitted with the Run-Time license and external programming accessibility NTU Logic supports all of the standard IEC 61131 and 61499 control program languages, as well as Flow Chart
IEC 61131/61499 languages supported	SFC: Sequential Function Chart FBD: Function Block Diagram LD: Ladder Diagram ST: Structured Text IL: Instruction List FC: Flow Chart



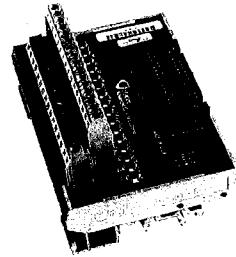
Local binary inputs ¹

Capacity	192 points, in groups of 32 inputs (for the available six base I/O module slots) 512 inputs maximum with an expansion I/O controller mode and card file 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

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

NTX-220 Substation Controller

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 \pm 28 VDC supplied by NTX-220 power supply; 32 inputs per module; optional 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
DA040310 term module dimensions	100 mm x 126 mm x \sim 90 mm (3.9" x 4.96" x \sim 3.54") with 34-pin header to 32 pole terminal block for each 16 digital inputs. Includes contact state LED indicators.
Mounting	35 mm DIN-rail mounted

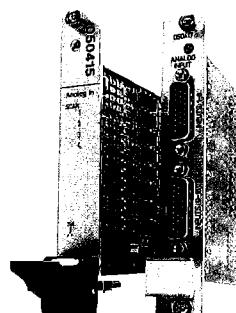


Local counter inputs¹

Capacity	128 Form C or 256 Form A points utilizing the six base card file and expansion card file I/O slots, 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

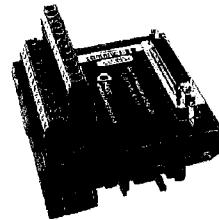
Local DC analog inputs

Capacity	96 points, in groups of 16 inputs (for the available six base I/O module slots)
Analog inputs	Standard: 0 \pm 1 mA Optional: 4-20 mA, 0 \pm 1.5 mA, 0 \pm 2 mA, 0 \pm 10 mA, 0 \pm 5 VDC, etc.
A/D resolution	16-bit
A/D conversion voltage	0 \pm 5 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 term 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 eight analog inputs
Mounting	35 mm DIN-rail mounted

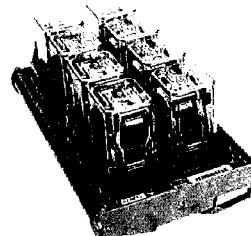


External local DC analog outputs

Capacity	2 analog outputs, in groups of 1 channel
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 16 x 16 matrix drivers for up to 256 relays (in groups of 6, 8 or 16 relays)
Relay coil	24 VDC
Control sequence	Internal select-before-operate
Local/remote switch	Standard: rear termination module fitted switch
Contact interface connections	10 mm removable compression terminal blocks, accepting up to #12 AWG (2.5mm ²) wire
	Relays with 20 amp, 150 VDC rated contacts use #8 screw terminals suitable for #10 wire
Module dimensions	202 mm x 108 mm x ~90 mm (7.9" x 4.96" x ~3.54")
Mounting	35 mm DIN-rail mounted (20 amp @ 150 VDC panel-mounted)
Momentary contact ratings	10 A @ 277 VAC (or 32 VDC)
	Optional: 10 A and/or 20 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

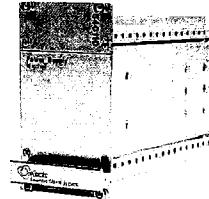
Inputs and outputs	IEEE SWC protected (certified to ANSI/IEEE C37.90.1) Impulse voltage protected (certified to IEC 255-5 Standards)
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¹ Binary inputs include binary with time (SOE), binary without time (Status/Alarm), and counter input points; ² Protocol-dependent

NTX-220 Substation Controller

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/VAC, 120 VAC Tolerance range: $\pm 15\%$ minimum
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	19" rack mounting or bottom card file panel mounting (with module removal clearance) DIN-rail mounted analog and digital input terminal block modules, control output modules, analog output modules, and 9-pin serial communication blocks external to card file (20 amp, 150 VDC relay modules are panel-mounted). RS-232/RS-485 9-pin plug interface modules. Optional bottom mounting.
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 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
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

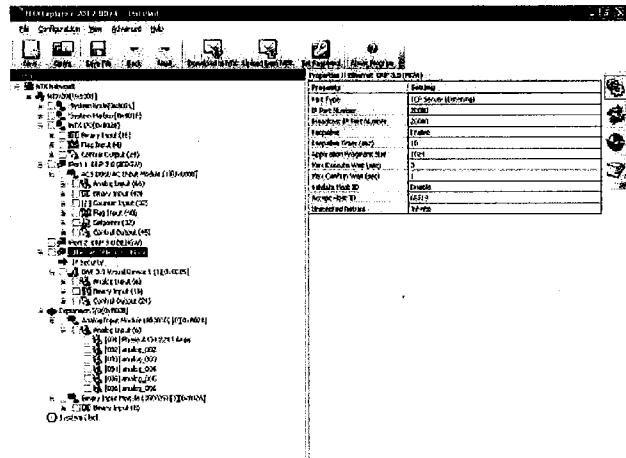
Custom enclosures, with or without optional heater
 Other external terminal block options
 Bell 202 or 9600 baud 4-wire multi-drop telephone modem
 External GPS satellite clock and antenna
 35 mm DIN-rail, in 2-meter lengths
 RS-232 RJ45 to 25-pin interface cables
 RS-485 RJ45 to 8 terminal block assembly interface cables
 4-way D060 AC Analog Input Module (for two-switch control)

Protocols

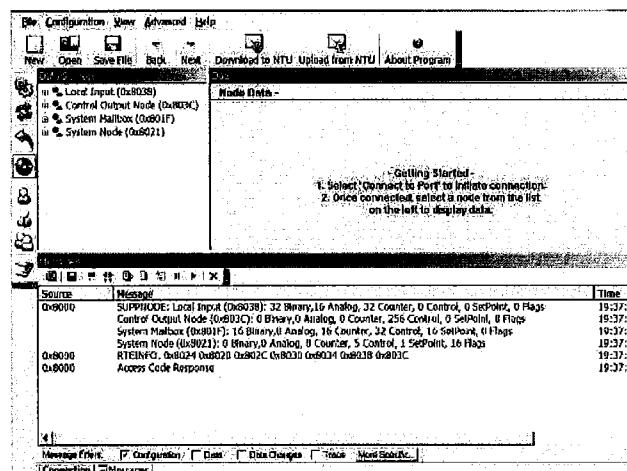
Master and IED protocol compatibility expands constantly. Visit our web site for a complete and up-to-date list.

NTX Explorer Configuration and Monitor software

The NTX Explorer and Monitor programs work on a personal computer using the Microsoft® Windows® (XP and WIN7) operating system. It emulates the standard PC Windows Explorer file management system in order 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-220 provides an easy way to remotely download or upload a configuration to or from the NTX-220 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-220 when it is convenient. Configuration in an NTX-220 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:

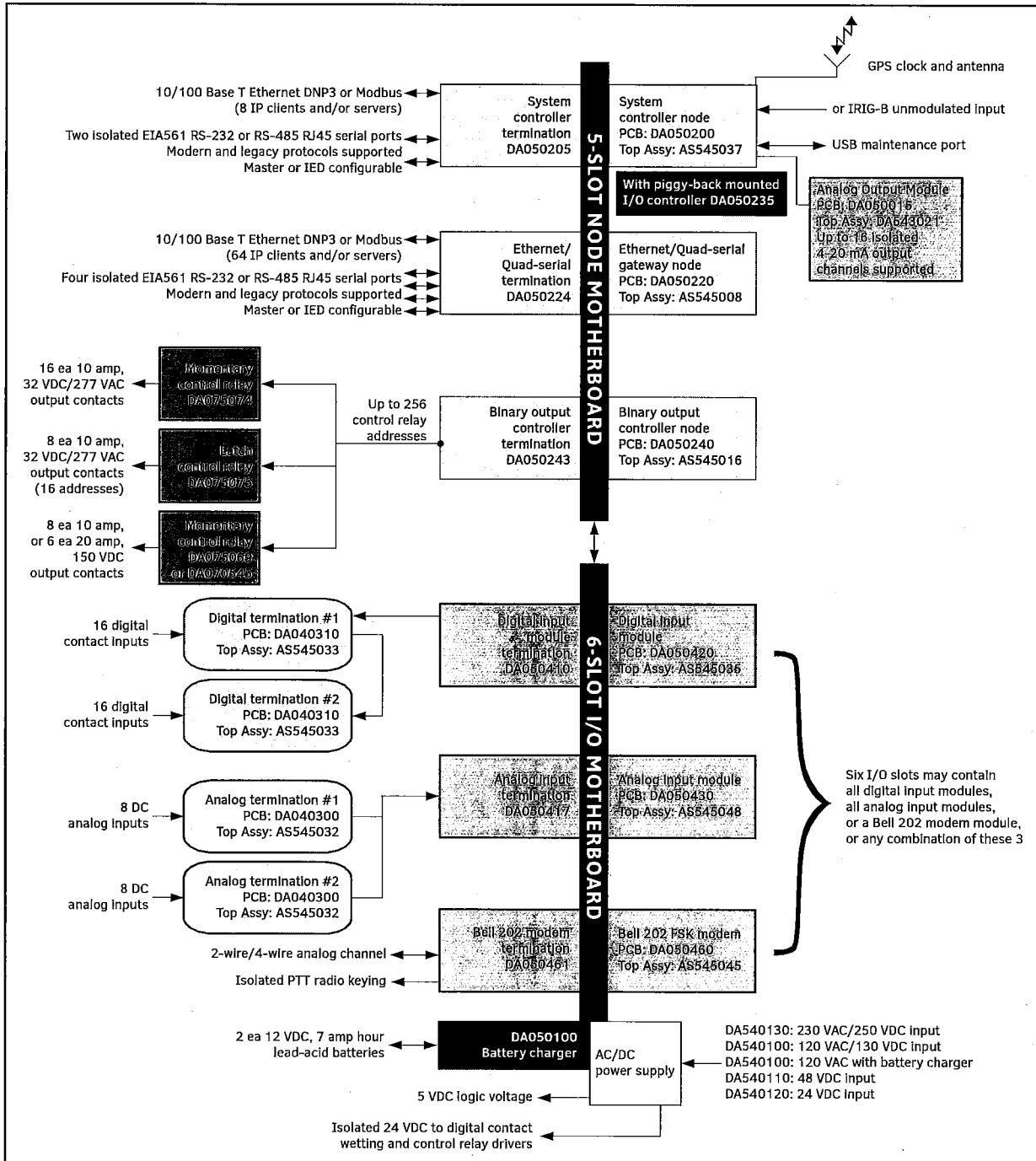
- data that is not updating from the external source (off-line IED, etc.) is displayed with a yellow background
- manually modified data is displayed with a red background

With a 10/100 BaseT Ethernet interface to the NTX-220, NTX Explorer can be connected via a WAN for remote configuration.

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

NTX-220 Substation Controller

NTX-220 block diagram





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General Management	Issue Date	1/30/2015
General Terms and Conditions of Sale for NTX Product Line	Revision Date	Rev 2 2/24/2015

Scope of Application. These Terms and Conditions apply to any and all goods and services supplied ("Deliverables") by Advanced Control Systems, Inc. (ACS) under any quote, purchaser order or other related order by Purchaser specifically for the NTX Product Line.

Agreement. Any acceptance of this Contract is limited to acceptance of the express terms in the Contract. Any proposal for different terms by Purchaser to vary any terms of this Contract is hereby rejected.

Documents. Unless otherwise agreed, brochures, catalogs and other marketing materials are not binding. Designs, drawings, technical documentation and data contained in software or other electronic or paper medium are binding insofar as they form an integral part of this Contract. ACS retains all rights to designs, drawings, documents, technical documents and software. Purchaser acknowledges these rights and shall not make such designs, drawings, documents and software available to any third party, either in whole or part, nor use them for any purposes other than the agreed purposes without prior written consent of ACS. If the Deliverables includes software, Purchaser is hereby granted the non-exclusive and non-transferable right to use the software for the agreed purpose subject to any other license agreement to which Purchaser may become a party.

Title and risk. Unless otherwise agreed, risk of loss shall immediately pass upon delivery of any of the Deliverables. Notwithstanding the same, ACS shall retain title of the Deliverables until receipt of full payment from Purchaser.

Delivery. The Purchaser shall inspect the Deliverables within two (2) days of receipt on Purchaser's premises and shall immediately notify ACS of any defects. If Purchaser fails to notify ACS of the same, within two (2) days delivery of conforming goods will be deemed to have occurred.

Acceptance. Acceptance of the Deliverables shall be deemed to have occurred if Purchaser puts the Deliverables to use.

Cancellation. ACS may cancel this Contract for breach of any provision of this Contract by Purchaser. If ACS cancels or intends to cancel this Contract, it shall immediately inform Purchaser and thereafter, ACS shall be entitled and Purchaser shall pay to ACS for all Deliverables (plus reasonable overhead and profit) which have already been produced or delivered to Purchaser. Purchaser shall have no recourse for any damages under this provision and ACS waives no rights to seek other damages it may be entitled for breach of this Contract.

Prices and Invoices. All prices are net. Any and all additional costs, such as freight, insurance, export fees, transportation, import fees and other permits or certifications shall be borne by Purchaser. Taxes, including without limitation value added tax, levies, fees, income, sales or any other taxes shall be borne solely by Purchaser. Invoices which apply to shipments and/or services will be made at the time of occurrence with payment due upon receipt of the invoice.

Expedited Delivery. Any request for expedited delivery shall incur a premium charge to Customer which shall be addressed on a case by case basis for determination of the applicable premium for such delivery.

Product Returns. Returns are accepted by ACS under the following conditions: (i) Deliverables must have never been installed and returned in their original packaging; (ii) Customer has obtained and included a return authorization number from ACS; (iii) all expenses associated with the return are borne by Customer including all freight, handling, insurance and other applicable charges; and (iv) Customer pays a minimum restocking fee on the returned Deliverable of twenty five percent (25%).

Confidentiality. ACS and Purchaser shall consider all information furnished by each other to be confidential and neither party shall disclose any such information to any other person, or use such information for any purpose other than performing its obligations under this Contract, unless it obtains written permission from the other party to do so.

Indemnification. Purchaser shall defend, indemnify, and hold harmless ACS against all damages, claims, liabilities, penalties, fines, costs and expenses (including legal fees) arising out of or resulting in any way from any act or omission of Purchaser, its agents, employees, or subcontractors, or from any breach of its obligations of this agreement.

Change Orders. The parties may agree at any time prior to final payment of the Agreement to make additions, deletions, or other revisions by written Change Order without invalidating the Agreement. When the change requires immediate action and the issuance of an executed Change Order with firm price would unreasonably delay the change; Purchaser shall place its signature upon a document authorizing ACS to proceed with the change. After the change has been completed, ACS will calculate the firm price using actual costs (including overhead and reasonable profit) current at time of performance of the work.

Warranty. ACS warrants its NTX produced product line to be free from defects in materials and workmanship for a period of 10 years for all NTX series and their respective modules from the date of shipment. This warranty only applies to ACS manufactured products and is governed by the following guidelines: Repairs shall be warranted for an additional period of ninety (90) days from the date of shipment or for the duration of the original warranty, whichever is greater. Customer is required to obtain an RMA from ACS prior to the return of any part or product. Customer shall be solely responsible for shipping and returning the repaired product to ACS for repair or replacement in accordance with warranty terms and conditions outlined herein. ACS shall be responsible for shipping the repaired or replaced product back to the customer. ACS reserves the right to substitute refurbished parts and components for any and all repair work. ACS reserves the right to utilize refurbished products as replacements.

The WARRANTIES FOR THE NTX PRODUCT LINE set forth herein are the only WARRANTIES made by ACS in connection with the specified NTX products. ACS cannot and does not make any implied WARRANTIES with respect to the PRODUCT LINE, and disclaims all other WARRANTIES, including, but not limited to, any WARRANTY of merchantability or fitness for a particular purpose. PRODUCT LINE sold by ACS is sold only to the specifications specifically set forth by ACS in writing. Other than the limited WARRANTY set forth herein, ACS makes no other WARRANTIES, express or implied. ACS' sole obligation under this WARRANTY shall be repair or replacement of non-conforming specified NTX products, or at the option of ACS, return of the PRODUCT and a refund of the purchase price. Buyer assumes all risk whatsoever as to the result of the use of the products purchased, whether used singularly or in combination with any other products or substances.

DISCLAIMER OF WARRANTIES FOR NTX PRODUCT LINE. ACS' specified NTX Products must be stored, handled, installed, used and maintained in accordance with instructions provided by ACS, and this Limited Warranty is conditioned upon compliance with all such instructions. Copies of the ACS User Manual are available from ACS at 2755 Northwoods Parkway, Norcross, GA 30071. You may also obtain this material by contacting the ACS HelpDesk at 1-800-831-7223 or by requesting the documentation and manual at the ACS website, www.acspower.com.

This WARRANTY does not cover defects caused by:

- 1) Non-compliance with ACS' User Manuals. Such Failures include, but are not limited to, [exposure to physical abuse, including, but not limited to extreme climate conditions, chemical abuse, (e.g. harsh cleansers and solvents), thermal abuse or shock (e.g. excessive heat or cold) or misuse];
- 2) Improper storage, installation, handling, use and/or fabrication of the PRODUCT;
- 3) Damage not resulting from manufacturing defects that occur while the PRODUCT is in the customer's possession;
- 4) Unreasonable or unintended use of PRODUCT;
- 5) Products installed with known or visible manufacturing defects at the time of installation, including, but not limited to physical damage, products not properly marked and/or identified as the product required;
- 6) Failure or dissatisfaction with the appearance of the PRODUCT.

Any information or suggestion by ACS with respect to the Products concerning applications, specification or compliance with codes and standards is provided solely for your convenient reference and are made without any representation as to accuracy or suitability. You must verify and test the suitability of any information with respect to the PRODUCTS for your specific application.

Whenever legally possible, Third party warranties shall be passed directly to the customer without modifications. This warranty is solely based upon the accuracy of the information and documentation, provided by the Purchaser, required for the selection of equipment or performance of services suitable to meet the requirements specified and Purchaser warrants and acknowledges ACS reliance on the same. Should any information or documentation provided by Purchaser be inaccurate and the same leads to a defect in materials and workmanship, the warranty shall be void.

OTHER THAN THE PRECEDING LIMITED WARRANTY, ACS DOES NOT MAKE AND SPECIFICALLY DISCLAIMS ALL OTHER EXPRESS OR IMPLIED WARRANTIES OF ANY KIND, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. OTHER THAN AS EXPRESSLY SET FORTH IN THIS AGREEMENT, PURCHASER ASSUMES FULL RESPONSIBILITY FOR THE SELECTION, POSSESSION, PERFORMANCE AND USE OF THE DELIVERABLES.

Limitation of Liability. THE LIABILITY OF ACS ARISING FROM THE SUPPLY OR USE OF THE DELIVERABLES, WHETHER IT ARISES UNDER WARRANTY OR OTHERWISE, SHALL BE LIMITED SOLELY TO CORRECTING THE DEFECTS OR PROVIDING REPLACEMENT PARTS TO THE PURCHASER FOR THE PERIOD OF THE WARRANTY. IN NO EVENT SHALL ACS BE LIABLE FOR SPECIAL,



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INCIDENTAL, CONSEQUENTIAL OR LIKE DAMAGES, SUCH AS, BUT NOT LIMITED TO, DAMAGE TO OR LOSS OF OTHER PROPERTY OR DELIVERABLES, LOSS OF PROFITS OR REVENUE, OR CLAIMS OF CUSTOMERS OF PURCHASER FOR SERVICE INTERRUPTIONS. THIS LIMITATION OF LIABILITY CLAUSE WILL PREVAIL OVER ANY CONFLICTING OR INCONSISTENT STATEMENT IN THIS AGREEMENT.

Force Majeure. If a Party is or will be prevented from performing any of its obligations under this Agreement by a Force Majeure event, then it shall give written notice to the other Party of the event or circumstances constituting the Force Majeure and shall specify the obligations the performance of which is or will be prevented. The Party shall, having given notice, be excused performance of such obligations for as long as such Force Majeure prevents it from performing them. "Force Majeure" includes but is not limited to storms or floods, lightning, tornadoes, hurricanes, earthquakes, solar storms and other forces of nature, wars, hostilities, civil disturbances, terrorist attacks, revolts, insurrections, sabotage, commercial embargoes, epidemics, fires, explosions, and actions of a governmental instrumentality that were not requested, promoted, or caused by the affected party, labor disorder or strike by persons other than the Purchaser's or ACS's personnel and other employees of Purchaser, ACS and subcontractors.

General. If any provision of this Agreement is held to be unenforceable, the other provisions shall nevertheless remain in full force and effect. This Agreement and all appendices attached hereto constitute the entire understanding between the Parties and may only be amended or modified by a writing signed by a duly authorized representative of each party. For the purposes of interpretation, the priority of the documents shall be in accordance with the following sequence: (y) Agreement general terms and conditions; (z) the appendices. This Agreement may be executed by facsimile or electronic mail. This Agreement may be signed in any number of counterparts. This Agreement replaces and supersedes any prior verbal or written understandings, communications, and representations between the Parties regarding the subject matter contained herein. This Agreement shall be binding upon and inure to the benefit of the successors and assigns of ACS and Purchaser. Purchaser shall not assign any rights or obligations under this Agreement without the express written authorization of ACS.

Choice of Law, Interpretation. This Agreement shall be deemed to be made in the State of Georgia and governed and construed in accordance with the laws of the State of Georgia without giving effect to its conflicts of laws to the extent such laws would require the application of the laws of another jurisdiction. The Parties hereby consent to the jurisdiction and venue of the courts of the State of Georgia and agree that any process may be served upon them outside of Georgia with the same effect as if such service had been made within Georgia.

Rev#	Date	Description	Author	Approver
00	12/16/2014	Initial Document	Ken Morgan	Jose Barbosa
01	1/30/2015	Review and Release	Ken Morgan	Jose Barbosa
02	2/24/2015	Change covered items to Product Line instead of models	Ken Morgan	Jose Barbosa