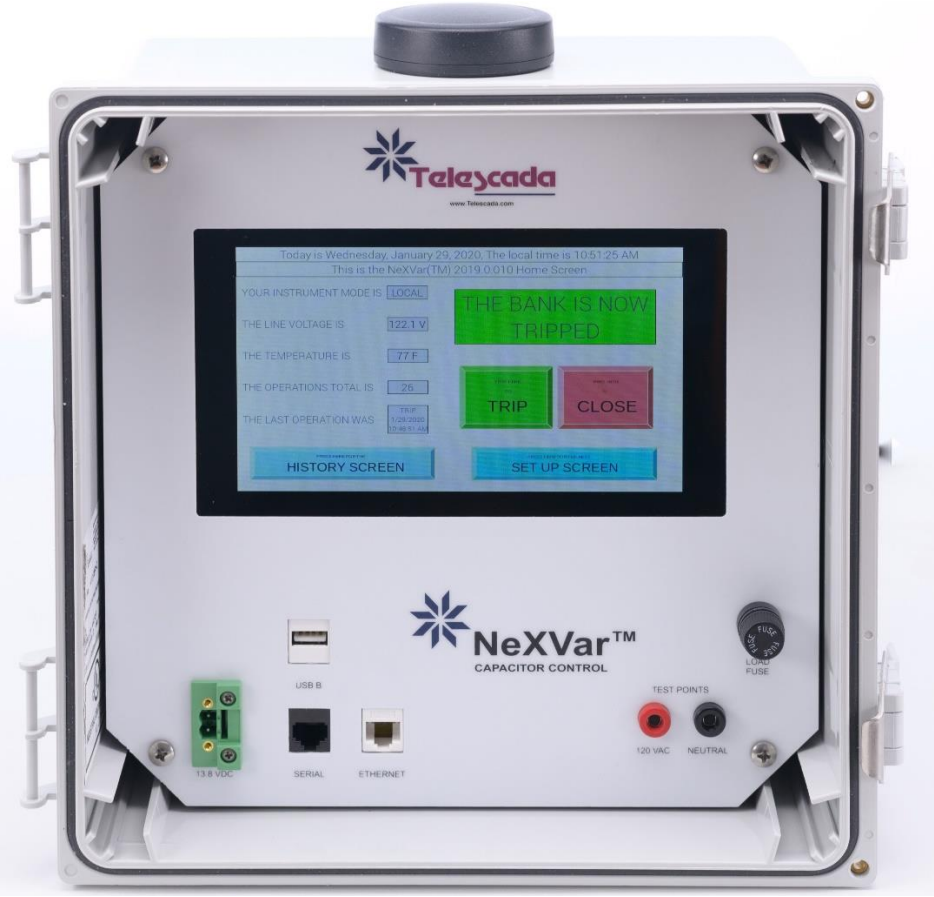
Product Manual and Reference Guide

NeXVar™

CAPACITOR CONTROL



Version 1.0 Revision C

SAFETY PRECAUTIONS AVOID INJURY

Safeguards are designed into this instrument to protect operators and maintenance personnel from most hazards during instrument operation. However, certain safety precautions must be taken by the operator and all personnel to avoid injury as well as damage to the instrument.

Carefully observe the following safety precautions before and during installation and operation on the instrument. Failure to comply can result in death, severe personal injury, and instrument damage.

- **ALWAYS** follow safety procedures listed in the instructions
- **ALWAYS** follow all locally approved procedures, codes and safety practices when working around high voltages and when testing, installing and/or operating this instrument
- **ALWAYS** wear approved safety gear when operating power equipment.
- **ALWAYS** wear approved ear protection when operating power equipment.
- **ALWAYS** wear approved eye protection when operating power equipment.
- **ALWAYS** insert power plug into properly grounded receptacle to avoid electrical shock
- **NEVER** disconnect any components unless area is known to be nonhazardous
- **NEVER** wear loose clothing or jewelry that may catch moving parts or circuits in the instrument.
- **NEVER** alter, modify or misuse the instrument
- **NEVER** rely on absence or function of Screen Displays nor LED indicators for presence of high voltages. Always establish a visible disconnect. Failure to follow proper safety practices can result in contact with high voltage which can cause death, or severe personal injury.
- **IMPORTANT** – These instructions are not a substitute for adequate training and experience in safety procedures. These instructions are intended for use by competent personnel who are trained and understanding of proper safety procedures.

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Advanced Control Systems Corporation/Telescada has prepared this manual for use by Telescada personnel, Telescada Authorized Representatives and Telescada Customers as a guide to proper installation, configuration, operation, and maintenance of this Telescada product. The drawings and specifications contained herein are the property of Advanced Control Systems Corporation/Telescada and shall neither be reproduced in whole or in part without Advanced Control Systems Corporation/Telescada's prior written approval nor be implied to grant any license to make, use or sell equipment manufactured in accordance herewith. Advanced Control Systems Corporation/Telescada reserves the right to make changes without notice in the specifications and materials contained herein and shall not be responsible for any damages (including consequential caused by reliance of the materials presented. Please consult the factory for the most recent documents pertaining to all products.

GENERAL INFORMATION

Advanced Control Systems Corporation/Telescada is dedicated to designing, developing and producing the highest quality hardware and software for Utility applications. Our goal is to provide our customers with reliable products and solutions that simplify and enhance day to day operations. We use state-of-the-art electronics to get the highest performance at the lowest cost. Our principal resources are our people and the support and confidence of our customers.

WARRANTY

Advanced Control Systems Corporation/Telescada warrants its products to operate within specifications under normal use and services for a standard period of one to five years from the date of shipment. Components products, spares, replacement parts and repairs are warranted for 90 days. Software is thoroughly tested and thought to be functional. It is supplied "as is" with no warranty of any kind covering detailed performance. Accessory products not manufactured by Advanced Control Systems Corporation/Telescada are covered by the original equipment manufacturer's warranty only. In exercising this warranty, Advanced Control Systems Corporation/Telescada will repair or at its option, replace, any product returned to the customer service department or an authorized service facility within the warranty period, provided that the warrantor's examination discloses that the product is defective due to workmanship or materials and has not been caused by misuse, neglect, accident or abnormal conditions or operations. The purchaser is responsible for the transportation and insurance charges arising from the return of products to the servicing facility. Advanced Control Systems Corporation/Telescada will return all in-warranty products with transportation prepaid. This warranty is in lieu of all other warranties, expressed or implied, including but not limited to any implied warranty of merchantability, fitness, or adequacy for any particular purpose or use. Advanced Control Systems Corporation/Telescada shall not be liable for any special, incidental or consequential damages whether in contract, or otherwise.

Revision History

VERSION	REVISION	DATE	AUTHOR	COMMENT
1.0	-	8-5-18	CWM	Original Release
	A	2-20-20	CWM	Technical Specification Update
	B		CWM	Security Features & Portuguese Language Support Update and algorithm test instruction.
	C	10-16-23	CWM	Spanish Language Support and Free Form Programming Guide Update

1. About This Product Manual

Purpose

This User's Manual provides a detailed technical overview of the Telescada NeXVar™ Capacitor Control. It is to be used to communicate the features, functionality and operation of the NeXVar™.

Additional Reference Documentation

Telescada NeXVar™ Users will also need to refer to the Telescada NeXGen™ NGC (NeXGen™ Configurator) Users Manual to assist with programming and interrogation of Telescada NeXVar™ and NeXGen™ instruments

- *Telescada NeXGen™ NGC User's Manual*

2. Technical Support

Answers to questions concerning the installation, operation, maintenance and use of Advanced Control Systems Corporation/Telescada products is available from our technical service department:

Telescada
222 Bolivar Street
Canton, Massachusetts, USA 02021
Telephone: 781-562-0475, 08:00 to 17:00 Eastern Standard Time
e-mail info.desk@telescada.com

3. Safety Information

When reading this manual, pay particular attention to

Denotes an imminent hazard which may result in moderate or severe injury

Denotes an environment hazard which may result in moderate or severe injury

Denotes a condition which may result in instrument damage

Highlights special or important information

4. Product Overview

A revolution in Distribution Capacitor Controls, the Telescada NeXVar™ Capacitor Control incorporates a simple to use, intuitive touchscreen to view control status and real-time information. Quickly and easily view and modify autonomous Capacitor Control schemes and Control functionality or choose from a library of pre-set, 1-click Control “personalities” ™

The NeXVar’s™ wide angle, full color display makes obsolete the ancient blinking lights, rotary dials, toggle switches and 2-line displays of old-fashioned capacitor controls.

Password protected WiFi connectivity makes viewing, modifying and controlling the NeXVar™ a snap from the comfort and safety of your vehicle with your Smart Phone.

With the installation of a 2-Way transceiver the NeXVar™ communicates with distributed capacitor control SCADA programs via DNP3 or MODBUS protocols.

5. Feature Set

5.1. Features Overview

- **Analog Inputs**
  - 6 (six) 0-5VDC Analog Inputs for External Voltage/Current Transducers
  - 7 (seven) 0-10VAC Analog Inputs for External Voltage/Current Sensors
  - 1 (one) Single Phase AC Secondary Line Voltage Input
    - +/-1% accuracy at 120VAC
  - Data Recording on Each Input

- **Digital Inputs**
  - 4 (four) Optically Isolated Digital Inputs
  - Data Recording on Each Input

- **Capacitor Bank Control Relays**
  - 2 (two) Rated 30A at 240 VAC
  - Configurable TRIP/CLOSE timing
  - Configurable Safety Timer
  - Configurable TRIP/CLOSE Local Delay
  - Digital Counter with Data Recording

- **Temperature Sensor**
  - TTT-1 Ambient Temperature Transducer

- **Full Color LCD Capacitive Display**
  - 6.1” Wide x 3.4” High
  - 800 x 480 Pixel Resolution
  - English and Portuguese Language Support

- **Communications**
  - 1 (one) USB (B-Type) Comm. Port (Local)
  - 1 (one) RS-232 COM1 Comm. Port (Local or remote)
  - 1 (one) Ethernet Communication Port
  - DNP3.0 and MODBUS Protocols (programmable - one active)

- **GPS Synchronized Real Time Clock**

- **Power Supply & Physical Form Factor**
  - 120 VAC Input
  - 11.50” x 10.75” x 6.50” NEMA 4X Enclosure

- 7.0 Lbs. (excluding optional transceiver)
- 4 or 6 Stab Socket or Pole Mount Options

- **Local Controls & Feedback Indicators**
  - Full Color LCD Capacitive Display
  - High Brightness External RED/GREEN/YELLOW State Indicator LED

6. Technical Specifications

6.1. Electrical Specification

- Operating Voltages
  90-150 VAC, 60Hz

6.2. Certified Electrical Test Standards

- IEEE C37.90-2005 Standard for relays and relay systems
- IEEE C37.90.1-2012 Standard for surge withstanding capability for relays and relay systems
- IEEE C37.90.2-2004 Standard for withstand capability of relay systems to radiated electromagnetic interference
- IEEE C37.90.3-2001 Standard electrostatic discharge tests for protective relays
- IEEE C62.41 Recommended practice on surge voltages in low voltage AC power circuits

6.3. Cyber Security Standards

- IEEE 1686-2013 Standard for intelligent electronic devices cyber security capabilities.

  Instrument Firmware - The Telescada NeXVar™ Capacitor Control is a contemporary control designed for full functionality and ease of use. Seeing that many of our customers are willing to sacrifice certain use aspects for the security advantages of IEEE-1686 compliance, Telescada offers two distinct versions of control firmware. For the NeXVar™ Capacitor Control to meet or exceed the requirements established in IEEE Std 1686, Standard for Intelligent Electronic Devices Cyber Security Capabilities, the Control must be ordered with NeXVar™-1686 Firmware to the latest release.

Configuration Software - The Telescada NeXVar™ Capacitor Control is a contemporary control designed for full functionality and ease of use. Seeing that many of our customers are willing to sacrifice certain use aspects for the security advantages of IEEE-1686 compliance, Telescada offers two distinct versions of control configuration software. For the NeXVar™ Capacitor Control to meet or exceed the requirements established in IEEE Std 1686, Standard for Intelligent Electronic Devices Cyber Security Capabilities, the Control must be configured with NeXGen™ NGC-1686 Firmware to the latest release

6.4. Analog Inputs

- 6 (six) GPIO analog inputs
    - 0-5VDC nominal
    - Data recording on each channel
    - Statistical data recording (min – max – average)
    - Event reporting on each channel
        - Accuracy – 0.1% of full scale
        - Analog connectors have +5VDC and VBatt+ (13.8VDC) for sensor loop power
        - 20 K ohm input impedance – ESD protected

- 7 (seven) Primary specific analog inputs
    - 0-10VAC
        - Φ A Voltage
        - Φ B Voltage
        - Φ C Voltage
        - Φ A Current
        - Φ B Current
        - Φ C Current
        - Neutral Current
    - Data recording on each channel
    - Statistical data recording (min – max – ave)
    - Event reporting on each channel

- Analog Input Measurements
    - Φ A Total Apparent Power
    - Φ A Total Reactive Power
    - Φ A Power Factor

- Internal Temperature Sensor

- Telescada P/N TTT-1
  - Typical error @ 25 deg. C (77 deg. F) of .5 deg. C (~ 1 deg. F). Worst case 1 deg. C. Rated over -40 deg. C (-40 deg. F) to 125 deg. C (257 deg. F) with a max error over that range of 3 deg. C.

6.5. Digital (Status) Inputs

- 4 (four) Digital Inputs
  - Data recording on each channel
  - Event reporting on each channel
- Wetted (pulled up to 13.8VDC by 2.7K ohms) - Appropriate for dry relay contacts
- Digital timing input accuracy of +/-1 ms
- Report limiting for the accumulators
- Digital Inputs are internally pulled up to 13.8 VDC via 2.7K ohms
- Digital inputs are ESD protected

External Digital Inputs
Connector pins labeled STATUS IN 0, 1, 2, 3 are external digital inputs. These 4 inputs are protected from surges and pulled up to +13.8 VDC by 2.7K ohm resistors. The NeXVar™ uses these inputs as state indicators, and in pairs as KYZ inputs for pulse counters. Inputs 0 (Z), 1 (Y) and GND (K) form one of 2 KYZ inputs. Inputs 2 (Z), 3 (Y) and GND (K) combine to form a second KYZ input. KYZ inputs count only when Z is pulled low followed by Y being pulled low when Z is high. KYZ inputs are used to connect meter pulse outputs to the NeXVar™.

Note: To insure a state change is counted each status input must pull down below 1 volt with respect to the “K” (GND) input. A closed set of relay contacts with less than 200 feet 22 AWG of wire will create this condition.

6.6. Capacitor Bank Control Relays

- 1 (one) TRIP Control Relay
- 1 (one) CLOSE Control Relay
  - SPST semi-sealed, Rated for 30A @ 240 VAC
    - Configurable OPEN/CLOSE contact closure time
    - Configurable Safety Timer (Close Lockout)
    - Digital Counter with Data Recording

6.7. Autonomous Control Capabilities

The NeXVar™ can execute standalone capacitor control functions in the absence of 2-way communications, or as a back up to distributed (SCADA) control via one of the following methods

- Autonomous Voltage Control
- Autonomous Temperature Control
- Autonomous Time of Day Control
- Autonomous Var Control

ATTENTION The programmable relay timer parameter setting in Telescada NeXVar Set Up Screen and the NeXGen™ NGC Configuration Software only applies to Local Mode. When using DNP, the Control Relay TRIP and CLOSE duration is determined by the DNP master and specified in the DNP message.

6.8. Communications

• Remote Communications

- 1 (one) Ethernet communication port
  - Default IP address 192.168.1.120
  - Router ID 192.168.1.1
  - Default Mask 255.255.255.0
  - Default Port 2300
- 1 (one) RS-232 serial communication port
- Configurable baud rates up to 38.4kbps
- Connectors for serial communications ports are RJ-12 3-wire type
- DNP3.0, Modbus RTU / ASCII Protocols installed and Configurable

• Local Communications

- Server assignable ports – 2 servers can operate simultaneously
- 1 (one) USB B-Type serial maintenance port for “LOCAL” interrogation, NeXVar™ database programming and data transfer.
- 1 (one) Proprietary RS-232 (RJ45) Firmware port for loading firmware
- Configurable USB1 and IED1 baud rates up to 38.4kbps
- Connector for IED1 port is 3-wire RJ-12 type
- Interrogation, database programming and data transfer via USB1 or IED1 is achieved using Telescada NeXGen™ *NGC* Utility Software

- **Language Support**

- English
- Portuguese
- Spanish

6.9. Power Supply

- The NeXVar™ is powered by an internal transformer from a 120VAC external supply – line voltage.
- Input power – 90 - 150 VAC (120 VAC Nominal)
- Always on when power is applied
- Short circuit protection via resettable fuse in 120 VAC circuits
- 3.3 VDC, 5 VDC and 13.8 VDC operating power supplies
- 13.8 VDC is brought out to “+” and “-“ terminals to power external communications devices, e.g. radios, modems, …
- 12 W (1A @ 12VDC) continuous duty input supply draw

6.10. Processor, Memory and Time Keeping

- The Core module processor is the R3000.
- Memory:
    - FLASH: 512K
    - RAM: 1MB
    - EEROM: 4MB
    - Battery Backed RTC (Real Time Clock)
    - Watchdog timer
    -
- Time Keeping
    - Internal GPS Clock

6.11. Physical & Environmental

- **Physical Specifications**

- The standard NeXVar™ is housed in a NEMA 4 protective polycarbonate enclosure 10.12"H x 10.12”W x 6.38” D

- Other enclosure sizes and materials options on request.
- 4-Stab Socket Mount
- 6-Stab Socket Mount
- Utility Pole Bracket Mount
- Motherboard diagnostic LED status indicators
- Optional sealed external LED
- Standard USB B-Type for local interrogation and configuration
- Standard RJ-12 connectors for communications
- #14 Compression Terminal Blocks provided for field terminations -analogs, status inputs and power
- All field termination locations are clearly labeled on the PCB and enclosure cover

• Environmental Operating Conditions

- Operating Temperature range: -40° to +70°C
- Storage Temperature: -40° to +70°C
- Humidity: 5% to 95% Non-condensing

7. Installation and Power-Up

ATTENTION For accurate and reliable operation of your NeXVar™ the following practices and recommendations must be considered at all times. The instrument warranty may be null and void if you do not follow these practices and recommendations. If you have any concerns, do not hesitate to contact Telescada.

CAUTION Do not attempt the installation of your NeXVar™ if it has been dropped, damaged or the packaging indicates it may have been dropped or damaged.

Follow all locally approved procedures, codes and safety practices when working around high voltages and when testing, installing and/or operating this instrument. Based upon the instrument configuration the instrument power supply **MAY BE UNGROUNDED**.

7.1. Instrument Connection Overview

The NeXVar™ is supplied by the factory in either a 4/6 stab socket mount, or utility pole mount enclosure style. The following wiring diagrams describe the most popular wiring styles; however the NeXVar™ can be wired to meet the specific needs of the individual utility.

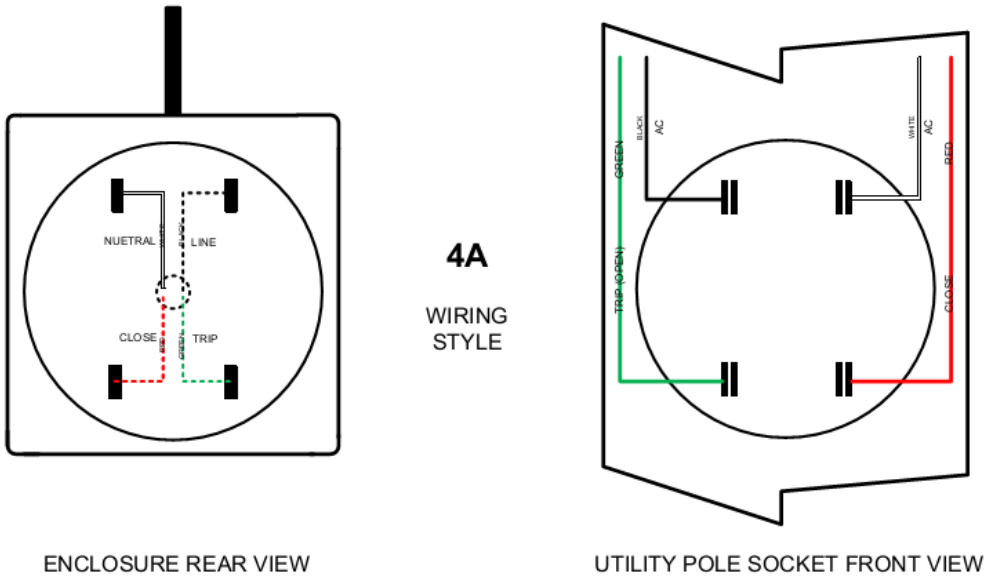


FIG. 7.1 NeXVar™ 4A Wiring Diagram

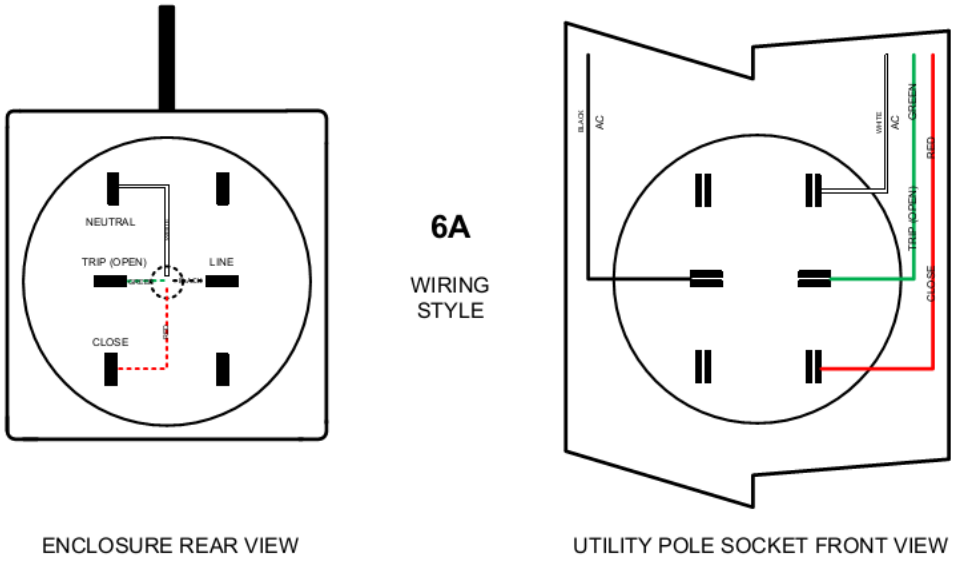


FIG. 7.2 NeXVar™ 6A Wiring Diagram

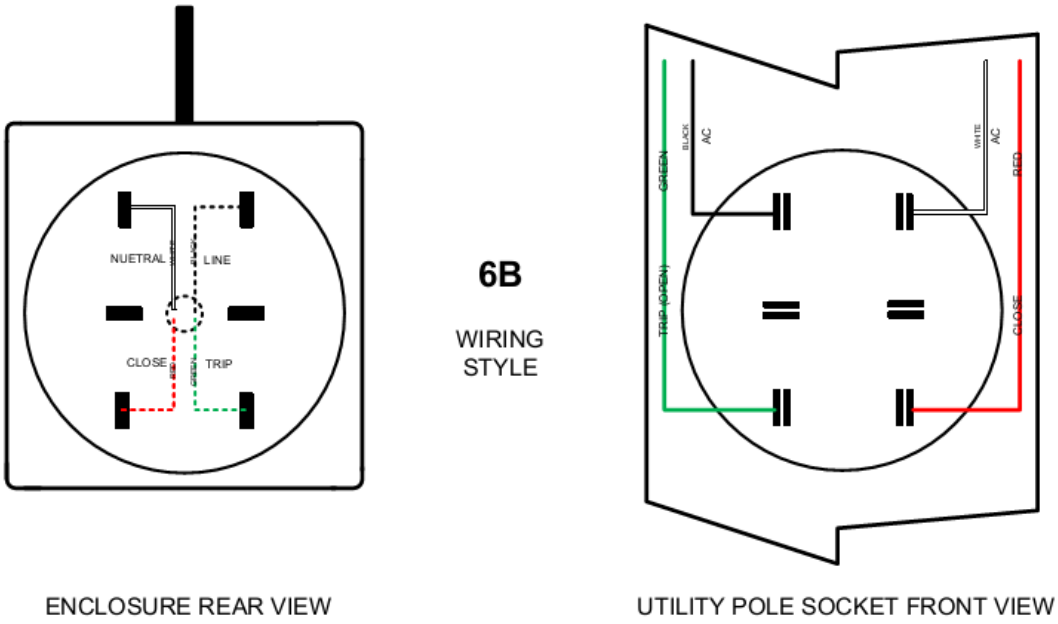


FIG. 7.3 NeXVar™ 6B Wiring Diagram

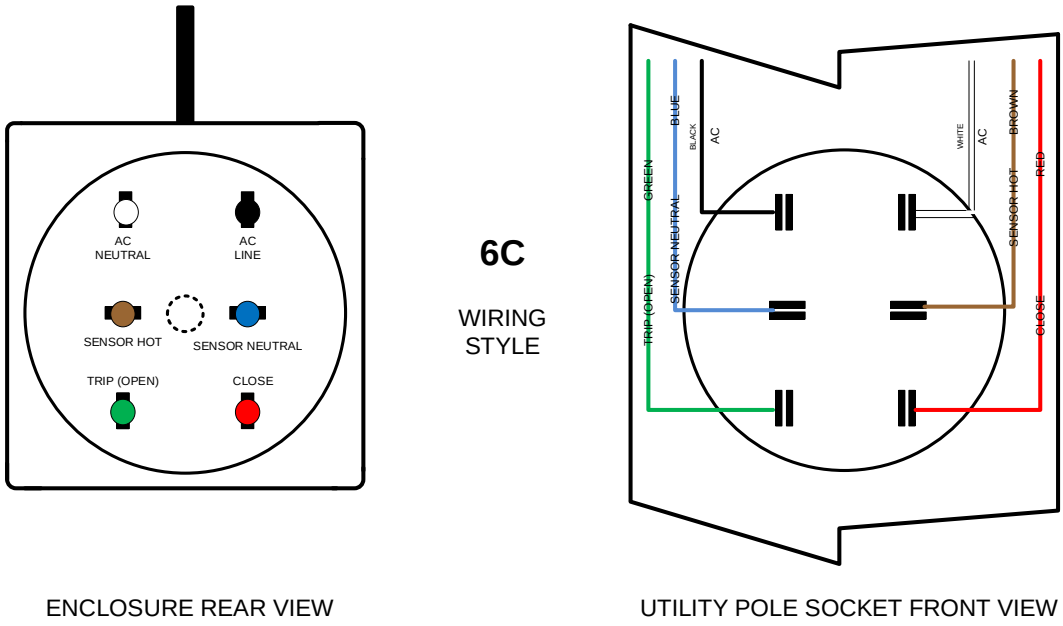


FIG. 7.4 NeXVar™ 6C Wiring Diagram

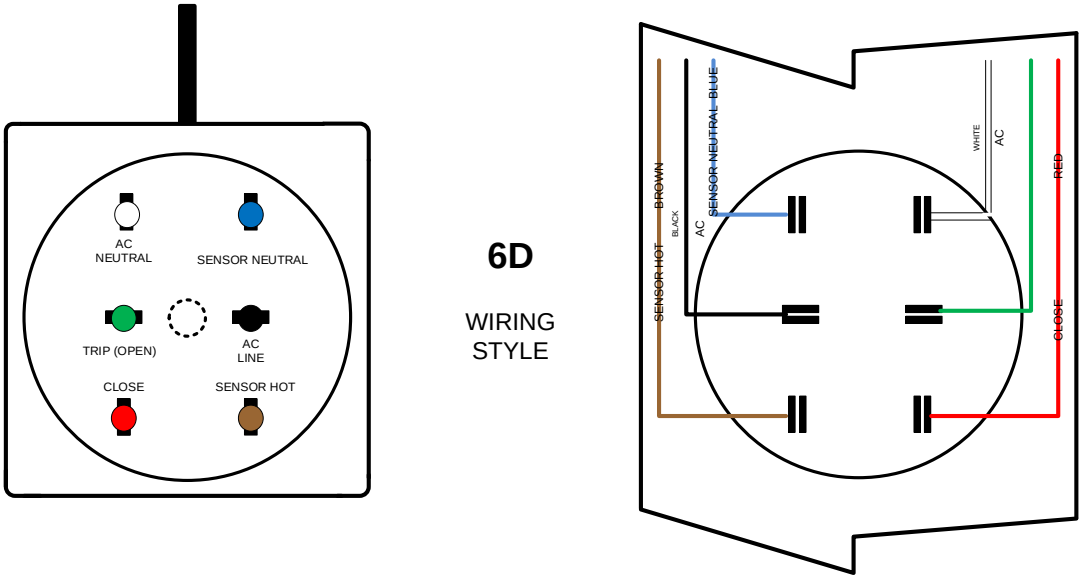
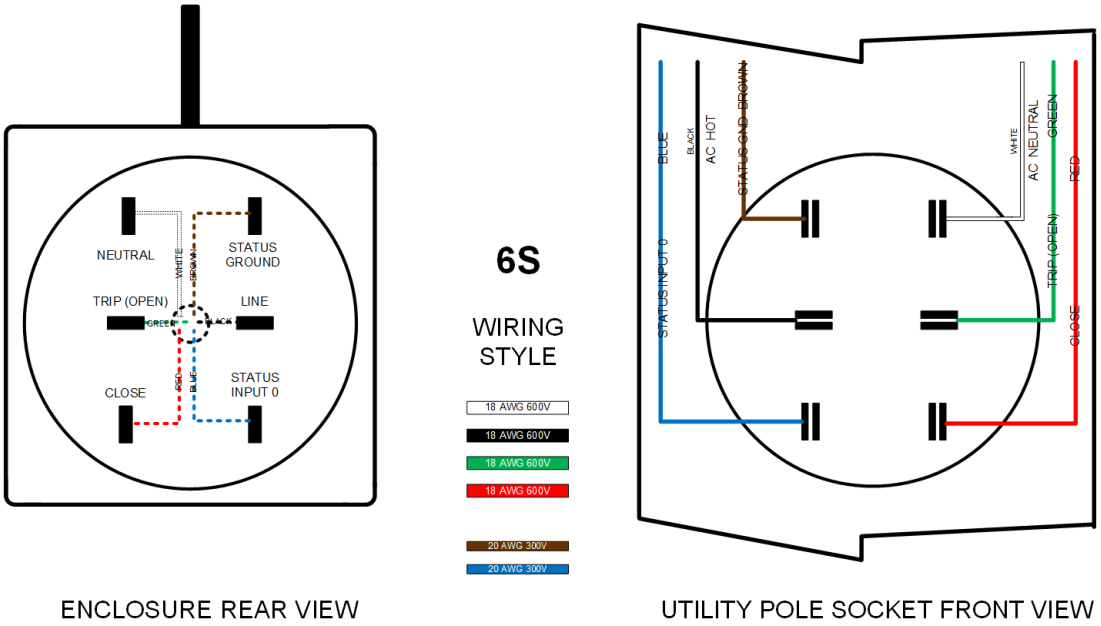


FIG. 7.5 NeXVar™ 6D Wiring Diagram



ENCLOSURE REAR VIEW

UTILITY POLE SOCKET FRONT VIEW

FIG. 7.6 NeXVar™ 6S Wiring Diagram

For Utility Pole Mounting the NeXVar can be supplied with a standard MIL-DTL-5015 circular connector configured with 5, 7, 8 or 14 Pins.

5-Pin MIL-DTL-5015 Pin assignments:

Pin	Input
A	Line
B	Neutral
C	Close
D	Trip
E	Not Assigned

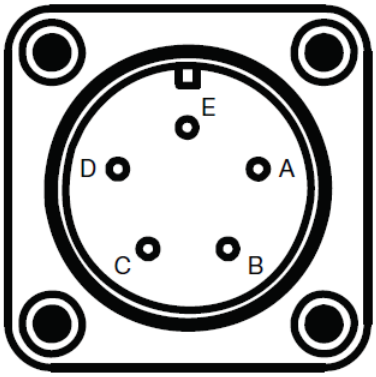


FIG. 7.7 NeXVar™ 5-Pin Connector Pin Assignments

The corresponding wiring harness for the 5-Pin connector is supplied with 2 mating 5 pin MIL-DTE-5015 Plugs in a custom length. The wiring harness P/N is TCA-5015-5-XX, where XX indicates the desired cable length in feet.

5-Strand Wire Color Assignments:

Pin	Wire Color
A	Black
B	White
C	Red
D	Green
E	Not Used

7-Pin MIL-DTL-5015 Pin assignments:

Pin	Input
A	Line
B	Trip
C	Close
D	Sensor Return
E	Neutral Current
F	Line Current Sensor Hot
G	Neutral

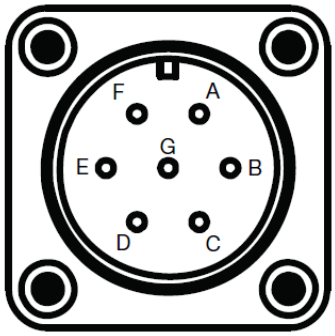


FIG. 7.8 NeXVar™ 7-Pin Connector Pin Assignments

The corresponding wiring harness for the 7-Pin connector is supplied with 2 mating 7 pin MIL-DTE-5015 Plugs in a custom length. The wiring harness P/N is TCA-5015-7-XX, where XX indicates the desired cable length in feet.

7-Strand Wire Color Assignments:

Pin	Wire Color
A	Black
B	Green
C	Red
D	Blue
E	Yellow
F	Brown
G	White

8-Pin MIL-DTL-5015 Pin assignments:

Pin	Input
A	Voltage A
B	Voltage B
C	Voltage C
D	Current A
E	Current B
F	Current C
G	Neutral Current
H	Neutral Common

NOTE: In this configuration the NeXVar™ will also require a 4 or 6 stab socket to provide LINE and TRIP/CLOSE input connections.

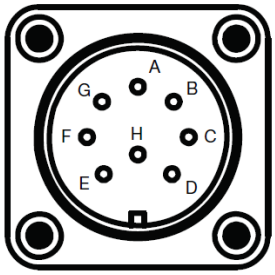


FIG. 7.9 NeXVar™ 8-Pin Connector Pin Assignments

The corresponding wiring harness for the 8-Pin connector is supplied with 2 mating 8 pin MIL-DTE-5015 Plugs in a custom length. The wiring harness P/N is TCA-5015-8-XX, where XX indicates the desired cable length in feet.

8-Strand Wire Color Assignments:

Pin	Wire Color
A	Red with White Stripe
B	Yellow with White Stripe
C	Orange with White Stripe
D	Brown
E	Black with White Stripe
F	Brown with White Stripe
G	Yellow
H	Blue

14-Pin MIL-DTL-5015 Pin assignments:

Pin	Input
A	Line
B	Neutral
C	Trip
D	Close
E	Voltage A
F	Voltage B
G	Voltage C
H	Current A
I	Current B
J	Current C
K	Neutral Current
L	Not Assigned
M	Neutral
N	Not Assigned

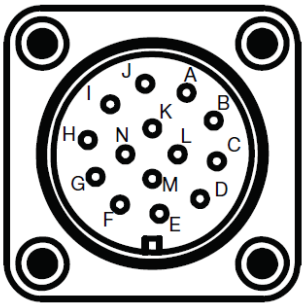


FIG. 7.10 NeXVar™ 14-Pin Connector Pin Assignments

The corresponding wiring harness for the 14-Pin connector is supplied with 2 mating 14 pin MIL-DTE-5015 Plugs in a custom length. The wiring harness P/N is TCA-5015-14-XX, where XX indicates the desired cable length in feet.

14-Strand Wire Color Assignments:

Pin	Wire Color
A	Black
B	White
C	Green
D	Red

E	Red with White Stripe
F	Yellow with White Stripe
G	Orange with White Stripe
H	Brown
I	Black with White Stripe
J	Brown with White Stripe
K	Yellow
L	None
M	Blue
N	None

7.2. Installation Environment

The NeXVar™ installation must be acceptable to the regulatory authority having legal jurisdiction over the installation. The NeXVar™ polycarbonate enclosure is designed for outdoor use.

The NeXVar™ employs spring based and clamp type compression terminals for all inputs.

Ensure that all input wires are securely contained in the appropriate spring clamps prior to powering up the instrument.

Follow all locally approved procedures, codes and safety practices when working around high voltages and when testing, installing and/or operating this instrument. Based upon the instrument configuration the instrument power supply **MAY BE UNGROUNDED**.

7.3. Input Power Supply

- ### Input Power Configuration

The NeXVar™ is powered by an on board transformer and multiple DC power supplies. Input voltage for the NeXVar™ is 85 – 135 VAC (120 VAC nominal). The NeXVar™ is always-on when powered, i.e. there is no power switch.

Make sure that the external AC power supply is within the proper range for the instrument and polarity of the wiring matches that indicated on the terminal block.

- ## Transient Voltage Protection

The NeXVar™ instrument is protected by a metal-oxide varistor located between the 120VAC input HOT and NEUTRAL lines. The varistor is located on the NeXVar™ instrument main PCB.

A catastrophic overvoltage event may destroy the MOV and require it to be replaced. Remove the NeXVar™ from service and return it to the factory for repair.

- ## NeXVar™ Control Resettable Fuse

The NeXVar™ control circuit board is protected by a resettable fuse located on the instrument main PCB.

The input voltage is connected to the internal power supplies through a resettable fuse. If the input current exceeds the fuse current rating the fuse will open. Resettable fuses take some time to recover. Remove the input voltage and allow 30 minutes for fuse recovery.

- ## NeXVar™ Control Load Fuse

The NeXVar™ control load circuit is protected by a sacrificial fuse located on the instrument front panel. The standard load fuse is 12Amps; however, customer designated ratings can be supplied. Fuse type is 3AG Fast Blow, Busmann BK/AGC-12-R or equal.

The load voltage is connected to the control through a sacrificial fuse. If the input current exceeds the fuse current

rating the fuse will blow. Replace the fuse with a replacement of equal capacity.

- **Grounding**

In many instances the NeXVar™ instrument is not connected to an earth ground. If a ground connection is desired, connect the NeXVar™ enclosure to earth ground using a braided cable or heavy solid copper conductor. When making ground connections ensure that all grounding surfaces are free of dirt, residue and corrosion. The ground wire must be the largest gauge of all wires used for field termination. A 12 AWG green and yellow wire is recommended. For spring based compression terminals the maximum wire gauge is 12 AWG.

8. Communications

8.1. Serial Connections

The NeXVar™ has 3 serial interfaces for local and remote communications. Serial interfaces are USB and RS-232 type. Serial interfaces are configured using the Telescada NeXGen™ NGC Configuration Software.

The Local, IED1 and COM1 serial interfaces on the NeXVar™ printed circuit board are standard 6 position modular jacks (RJ12). The mating 6 position modular plug: Tyco Electronics P/N 5-555176-3, or equal.

ATTENTION When using remote serial communications, such as digital radio, digital cellular, digital fiber optic transceivers communications devices may be plugged into the Local Port or IED ports. Serial communications is programmed using the configuration software, NGC. Most remote communications devices are plugged in to the COM1 port.

- **Local/Programming/Serial Port**

The NeXVar™ Serial port programming functions are accomplished using the Telescada NeXGen™ NGC Configuration Software and a USB B-Type connector that allows for a standard USB B-Type to A-Type cable.

- **Test and Reset Push Buttons**

All normal NeXVar™ functionality should be completed using the NeXVar™ front panel graphic user's interface. The NeXVar™ Test pushbutton is used for remote field diagnostics and instrument configuration directly with the motherboard PCB. The NeXVar™ Test Pushbutton is a large square yellow button located on the PCB and labeled as "TEST PB" at position S1.

The NeXVar™ Processor "Reset" Pushbutton is used to reset the instrument's processor. The reset button is a small white round momentary switch located at S3 of the NeXVar™ PCB motherboard.

The NeXVar™ Test and reset pushbuttons are accessed by removing the front panel display.

CAUTION

Prior to removing the front panel display, contact the factory for assistance.

8.1.1 Test Pushbutton Functionality

The NeXVar™ Test Pushbutton, when depressed momentarily, will send a message from the NeXGen™ core processor, to the Local/Serial Port.

If the NeXVar™ is connected to a PC or Laptop running the NGC configuration software, the NeXGen™ core processor will send a message to NGC with the instrument's programmed address and some configuration information.

ATTENTION Holding down the Test Pushbutton for 10 (ten) seconds or longer will default the NeXVar™ core processor and reset the instrument to local address #1, and set all parameters to their default settings.

9 Touchscreen Control Functionality

The NeXVar™ can execute standalone capacitor control functions in the absence of 2-way communications, or as a back up to distributed (SCADA) control via one of the following methods

- Autonomous Voltage Override Control
- Autonomous Temperature Control
- Autonomous Time of Day Control
- Autonomous Var Control

Telescada NeXVar™ Users should refer to the Telescada NeXGen™ NGC (NeXGen™ Configurator) Users Manual to assist with programming and interrogation of Telescada NeXVar™ for remote DNP control.

ATTENTION Only beveled touchscreen buttons can be actuated by the user. All non-beveled buttons will display system or setting information, but when pressed will not provide access to that system or setting.

10 Language Support

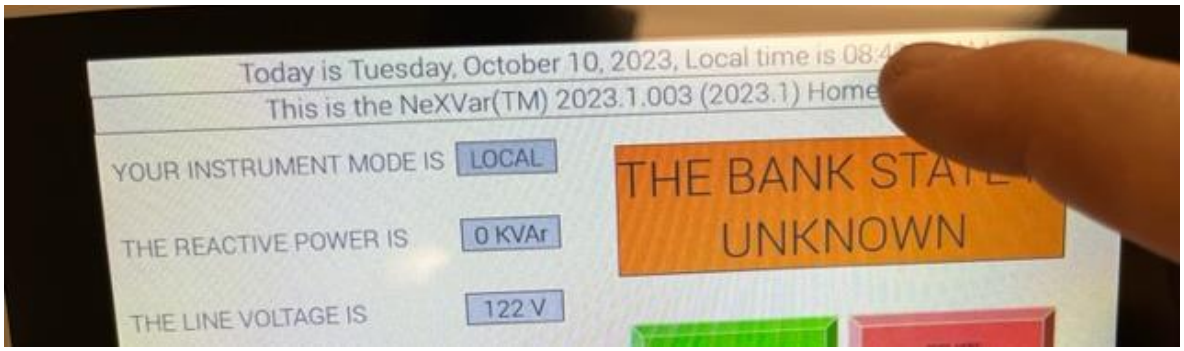
Once loaded the User Interface defaults to English.

To switch to Portuguese, or Spanish, login as an administrator in any personality

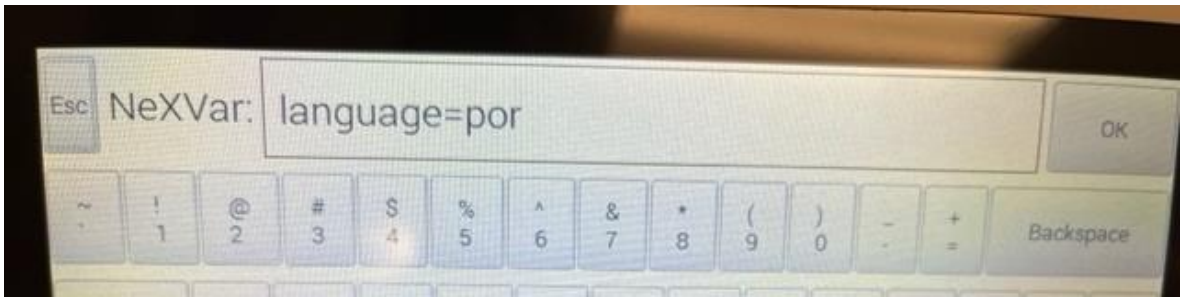
Return to the home screen

From the home screen, touch the upper ribbon on the screen near the time indicator. This will bring up the special commands screen.

\



On the command screen type your language preference.



language=por to change the screen language to Portuguese
language=spa to change the screen language to Spanish
language=eng to change the screen language to English

The language preference survives reboots.

If the NeXVar™ does not prompt you for a password (when you are in the 32767 configuration), try changing the configuration (personality setting). When the keyboard screen prompts you for new configuration, you can enter the language preference at that time.

11 Home Screen

The NeXVar™ Home Screen provides clear intuitive control over the primary functions of the NeXVar™ Capacitor Control. From the Home Screen the user can manually TRIP, or CLOSE the capacitor bank, as well as view the status of the system. The user can also recall system historical events and proceed with configuration of alternate parameters. With each successive screen choice, the NeXVar™ Capacitor Control will always prompt the user to Save All Changes, Cancel All Changes, or return to the Home Screen.

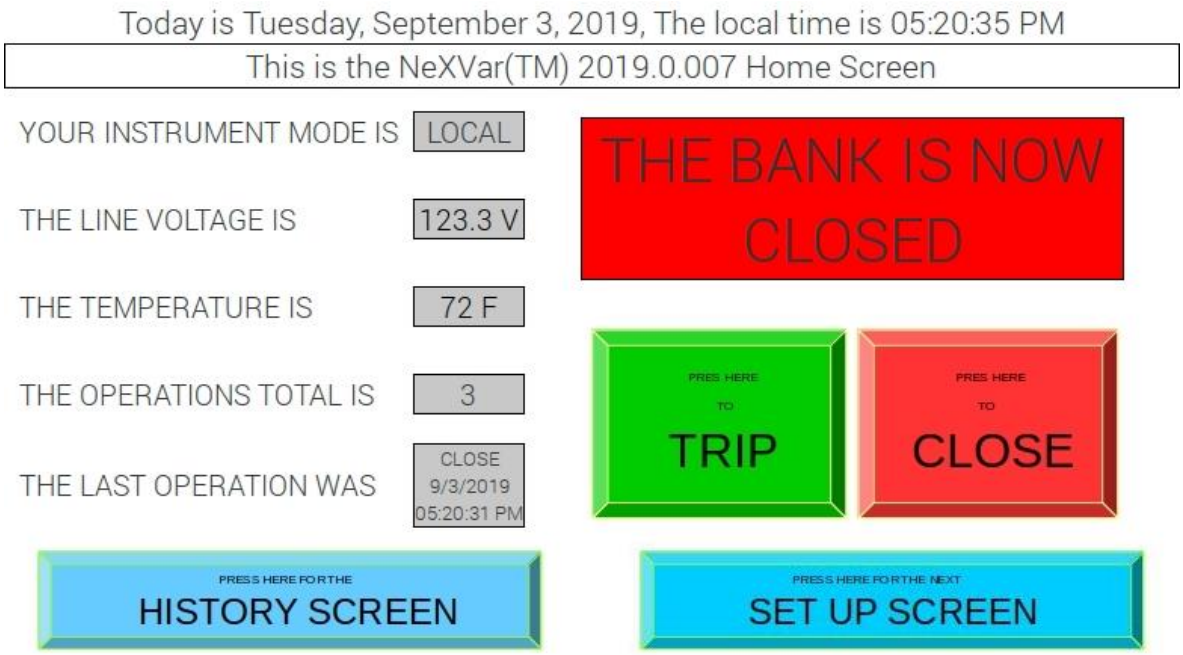


FIG. 10.1 NeXVar™ Home Screen in the closed condition

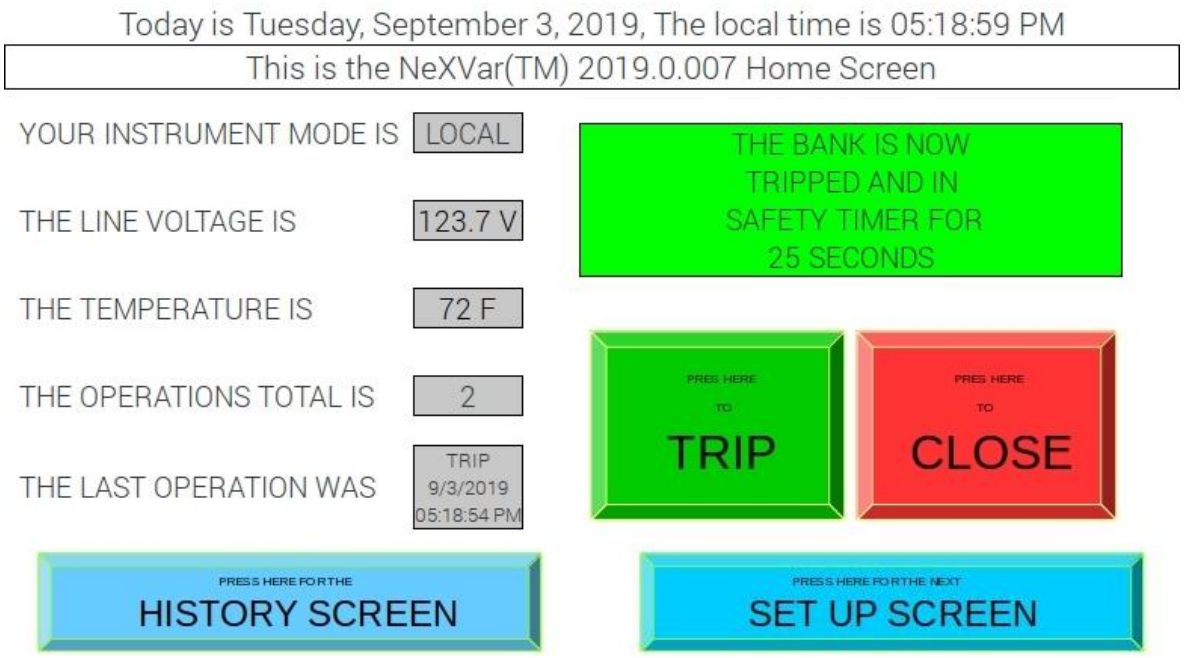


FIG. 10.2 NeXVar™ Home Screen in the tripped condition with the safety timer countdown

FIG. 10.3 NeXVar™ Save Screen

12 Password Screen

The NeXVar™ Password Screen provides user configurable secure access to the NeXVar™ Capacitor Control. When the password function is enabled, the user will be prompted to enter a password for access to the full functionality and programmability of the NeXVar™ Capacitor Control.

FIG. 11.1 NeXVar™ Password Screen

Passwords are assigned to the different default configurations enumerated by our Personality Matrix setup. For example, for configuration N the password is configN. For configuration 32767 the password is NONE. The NONE password makes the system not prompt for authentication. This is useful when testing the system.

A password can be changed at any time using NeXGen™ NGC instrument configuration software. Passwords cannot be change locally using the NeXVar™ Graphic User Interface (GUI)

NeXVar™ user is prompted for password whenever the User attempts to operate the capacitor bank, or enter any screen other than the home screen. Once correct password is entered the system allows access to all screens. After 5 minutes of no activity entered password is cleared, i.e. the user is logged out. Logout duration can be changed at any time using NeXGen™ NGC instrument configuration software.

The NeXVar™ has 3 standard levels of password-controlled user access.

There are two passwords stored in the NeXVar™ database: operator password, and admin password. Admin password allows all access. Operator password does not allow system reconfiguration. No password has a view only privileges. The two passwords are configN and adminconfigN, respectively, where N is the matrix number in effect. These are defaults and matrix value dependent.

Every time matrix number is changed new matrix value specific defaults, ***including default passwords***, are loaded. This means that any password changes done using the NeXGen™ NGC instrument configuration software by the user to create a custom password are lost whenever the active matrix number changes.

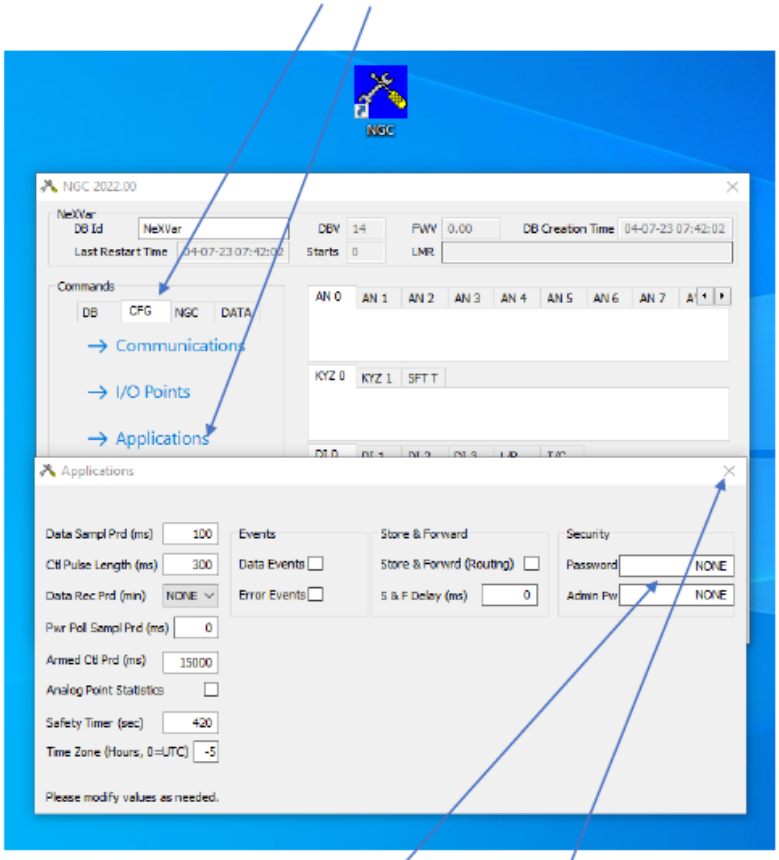
The implication is that the user should first decide, for every NeXVar™ they deploy, which matrix value will be in effect on that NeXVar™, and then change the instrument password, if desired. The matrix value on that NeXVar™ should then never change again. If the matrix value on that NeXVar™ should change, any custom user-generated passwords will have to be re-entered on that NeXVar™.

12.1 Configuring Your NeXVar For Custom Password Access – 4 Steps

The password settings for both user and administrator access can be changed to your custom values using the NeXGen™ NGC instrument configuration software.

Use the 4-Steps below to set your custom passwords.

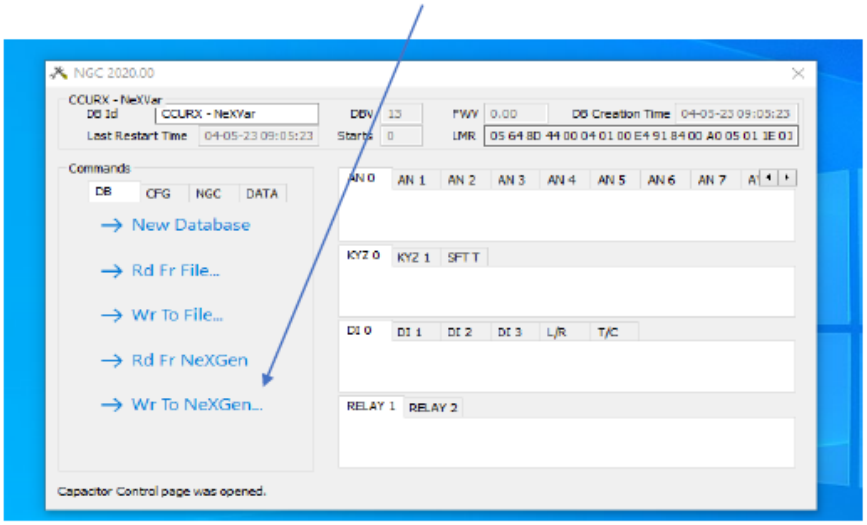
STEP 1: FROM THE CFG TAB, SELECT APPLICATIONS



STEP 2: ENTER YOUR CUSTOM ADMINISTRATOR (Admin) ALL ACCESS PASSWORD, AND YOUR CUSTOM LIMITED ACCESS (TRIP/CLOSE/VIEW) PASSWORD

STEP 3: AFTER PASSORD CHANGES ARE MADE. CLOSE THE PANEL BY CLICKING THE "X"

STEP 4: TO FINISH, SELECT THE DB TAB AND Wr (WRITE) THE NEW SETTINGS TO YOUR NeXVar



NOTE: THE NEW CAPACITOR CONTROL PASSWORD ARE NOW PROGRAMMED INTO YOUR NeXVar.

THERE ARE NO "DEFAULT" PASSWORDS THAT CAN OVERIDE YOUR NEW PASSWORD. THE PASSWORD PROTECTION IN THE NeXVar IS NOW YOURS EXCLUSIVELY.

ATTENTION Only beveled touchscreen buttons can be actuated by the user. All non-beveled buttons will display system or setting information, but when pressed will not provide access to that system or setting.

13 Set Up Screen

The NeXVar™ Set Up Screen provides user configurable access to the NeXVar™ Capacitor Control primary parameters. From this screen the user can view and adjust the behavior of some common NeXVar™ Capacitor Control functions. For user convenience Telescada has pre-programmed a series of common “personalities” into the NeXVar™. By choosing the users desired “personality” the ease of configuration is simplified and speed of configuration is drastically reduced.

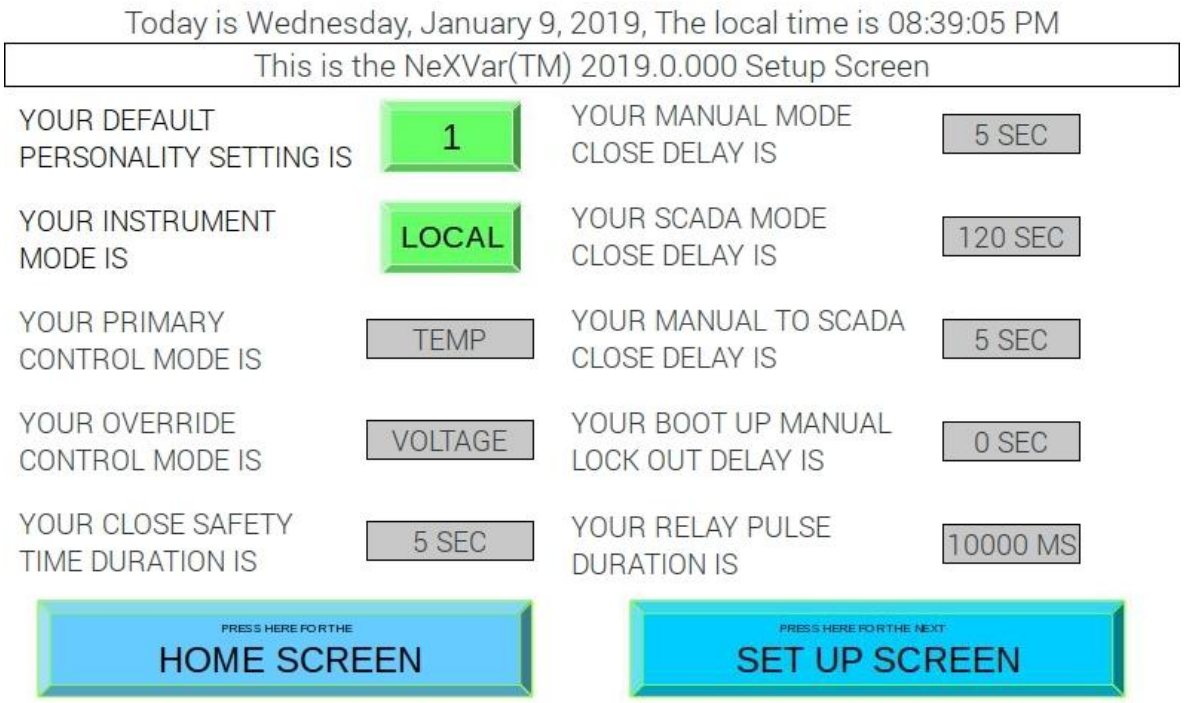


FIG. 12.1 NeXVar™ Set Up Screen

The NeXVar™ On Screen Keyboard provides user configurable access to the NeXVar™ Capacitor Control primary parameters. From this screen the user can view and adjust the behavior of some common NeXVar™ Capacitor Control functions. With a single click, a series of pre-programmed “personalities” for the NeXVar™ can be reviewed and chosen. By choosing the users desired “personality” the ease of configuration is simplified and speed of configuration is drastically reduced.

FIG. 12.2 NeXVar™ Selecting the Control “Personality” with the On Screen Keyboard

14 Set Up Screen - Autonomous Voltage Control

The NeXVar™ Voltage Control Screen provides user configurable access to the NeXVar™ Capacitor Control Voltage Control parameters. From this screen the user can view and adjust the voltage control behavior of the NeXVar™ Capacitor Control. For user convenience Telescada has pre-programmed a series of common “personalities” into the NeXVar™. By choosing the users desired “personality” the ease of configuration is simplified and speed of configuration is drastically reduced

The NeXVar™ autonomous voltage override capability allows the NeXVar™ to provide independent Capacitor Control using line voltage input. When Voltage Override functionality is either Enabled or Disabled A field engineer can manually operate the bank. The line voltage measurement has no influence on manual operation.

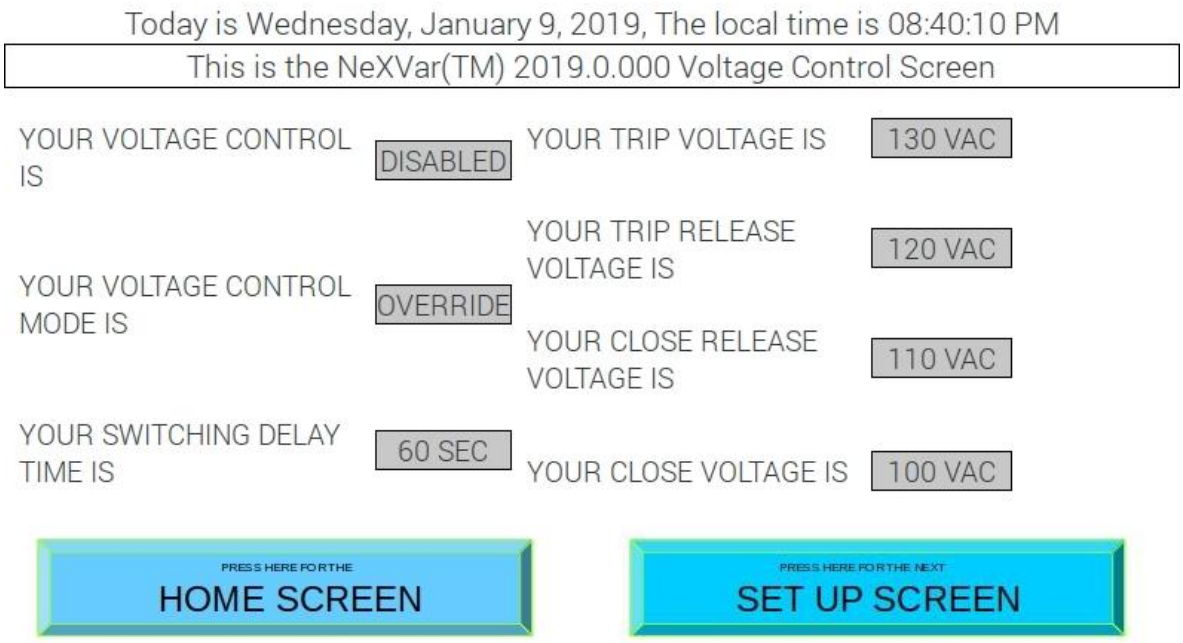


FIG. 13.1 NeXVar™ Set Up Screen 2 – Voltage Control

15 Set Up Screen - Autonomous Temperature Control

The NeXVar™ Temperature Control Screen provides user configurable access to the NeXVar™ Capacitor Control Temperature Control parameters. From this screen the user can view and adjust the temperature control behavior of the NeXVar™ Capacitor Control. For user convenience Telescada has pre-programmed a series of common “personalities” into the NeXVar™. By choosing the users desired “personality” the ease of configuration is simplified and speed of configuration is drastically reduced.

The NeXVar™ autonomous temperature override capability allows the NeXVar™ to provide independent Capacitor Control using an internal ambient temperature input. When Temperature Override functionality is either Enabled or Disabled A field engineer can manually operate the bank. The temperature measurement has no influence on manual operation.

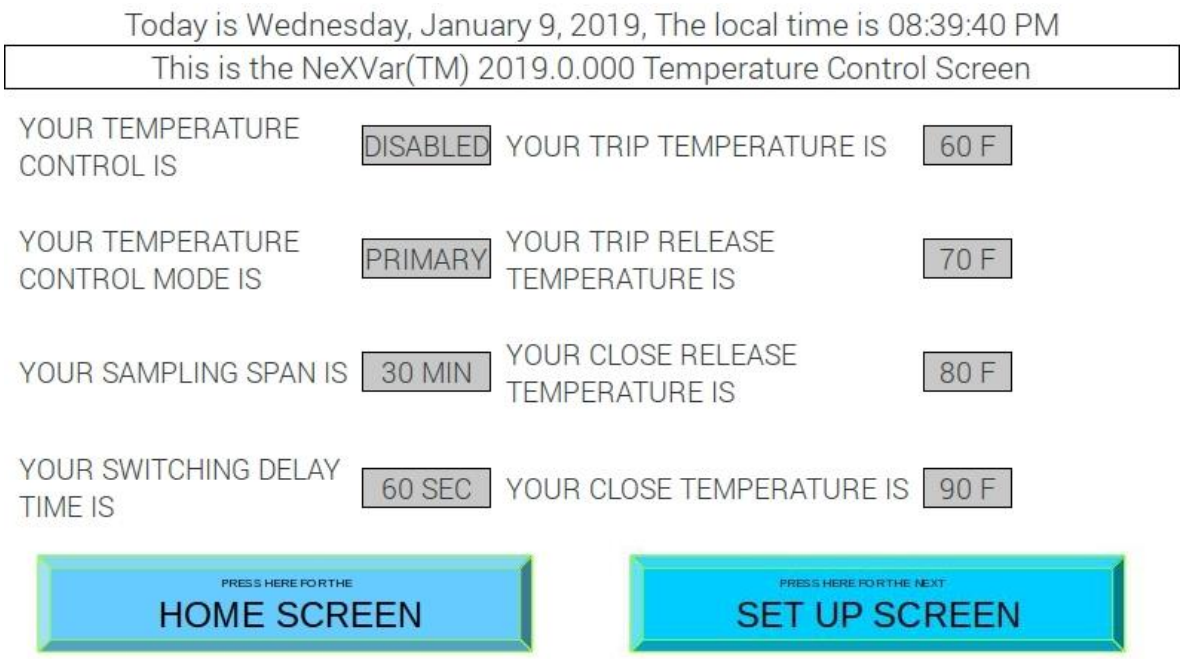


FIG. 14.1 NeXVar™ Set Up Screen 3 – Temperature Control

16 Set Up Screen - Autonomous Time of Day Control

The NeXVar™ Time of Day Override Screen provides user configurable access to the NeXVar™ Capacitor Control Time of Day Control parameters. From this screen the user can view and adjust the time of the day and day of the week control behavior of the NeXVar™ Capacitor Control. For user convenience Telescada has pre-programmed a series of common “personalities” into the NeXVar™. By choosing the users desired “personality” the ease of configuration is simplified and speed of configuration is drastically reduced

The NeXVar™ autonomous time override capability allows the NeXVar™ to provide independent Capacitor Control using an internal real time clock. When Time of Day Override functionality is either Enabled or Disabled A field engineer can manually operate the bank. The time of day has no influence on manual operation.

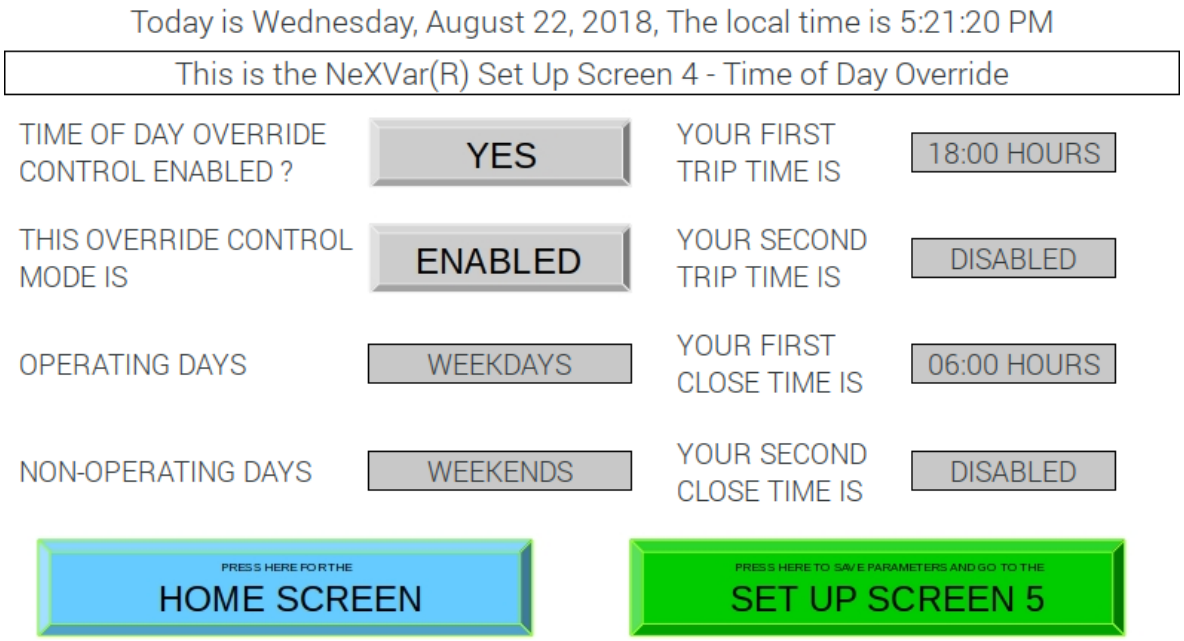


FIG. 15.1 NeXVar™ Set Up Screen – Time of Day Control

17 Set Up Screen - Autonomous VAR Control

The NeXVar™ Var Override Screen provides user configurable access to the NeXVar™ Capacitor Control Var Control parameters. From this screen the user can view and adjust the Var control behavior of the NeXVar™ Capacitor Control. For user convenience Telescada has pre-programmed a series of common “personalities” into the NeXVar™. By choosing the users desired “personality” the ease of configuration is simplified and speed of configuration is drastically reduced

The NeXVar™ Var override capability allows the NeXVar™ to provide independent Capacitor Control using external primary current and voltage sensors. When Var Override functionality is either Enabled or Disabled A field engineer can manually operate the bank. The Var setting has no influence on manual operation

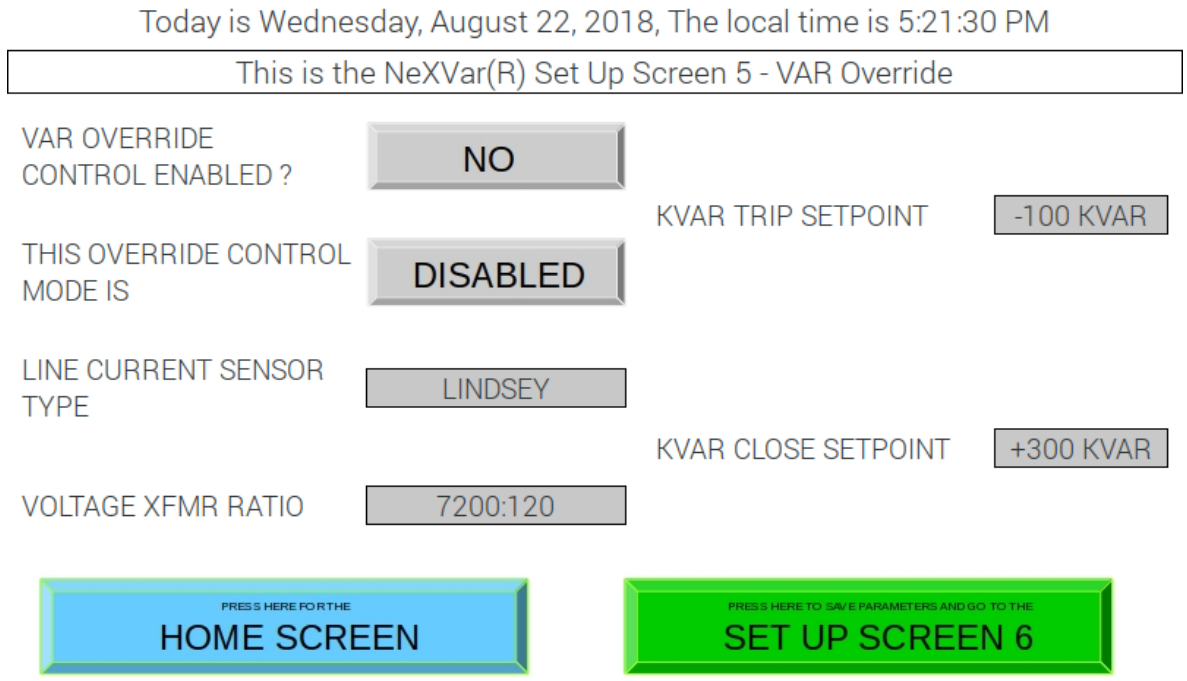


FIG. 16.1 NeXVar™ Set Up Screen – Var Control

17.1 Autonomous Var Control External Hardware Requirements

For NeXVar™ Capacitor Control Autonomous Var Control external sensors are required. In most cases line post sensors installed on the primary are used to bring back primary voltage and current from each phase. While the NeXVar™ monitors and records all three primary phases, it uses only the A phase for primary Var control.

Autonomous Var Control is also possible by using the NeXVar™ internal secondary line voltage measurement and a current CT installed on the secondary phase powering the NeXVar™ control. In this manner only an external current CT is required for autonomous Var control.

.

18 Autonomous Control Algorithms and Testing

The NeXVar™ can be in one of the following modes:
1. Local
2. SCADA
3. Auto

The NeXVar™ contains the following capacitor control algorithms:
1. NONE
2. SCADA
3. Temperature
4. Time of Day
5. VAr
6. Voltage

Each one of these algorithms can be assigned as the primary algorithm, and only NONE, Temperature, VAr, and Voltage can be assigned as the override algorithm.

The simplest possible instrument configuration is to set the override algorithm to NONE, and the primary algorithm to one of the remaining five choices. The first set of tests should be run in this simplest configuration.

In no case should there be two CLOSE operations in less time than specified by the safety timer. This can subsequently be checked by reviewing the test unit's bank operation log.

In no case should there be two bank operations in less time than specified by the mode switching delay. This can subsequently be checked by reviewing the test unit's bank operation log.

Primary = NONE, Override = NONE

a. Set the instrument into **Local** or **Auto** mode, vary any control parameter, no capacitor bank operations should be observed
b. Cap. Bank operation by external SCADA must fail
c. Set the instrument into **SCADA** mode, Cap. Bank operation by external SCADA must fail

Primary = SCADA, Override = NONE

a. Set the instrument into **Local** mode
b. Cap. Bank operation by external SCADA must fail
c. Set the instrument into **Auto** mode

d. Cap. Bank operation by external SCADA must fail
e. Set the instrument into **SCADA** mode, Cap. Bank operation by external SCADA must succeed

Primary = Temperature, Override = NONE

a. Set the instrument into **Local** or **SCADA** modes, vary control parameter, no capacitor bank operation should be observed
b. Set the Temperature to Normal range (between TRIP and CLOSE values)
c. Set the instrument to **Auto** mode
d. Set the Temperature >= CLOSE Temperature, capacitor bank CLOSE operation should be observed
e. Set the Temperature to Normal range, no capacitor bank operation should be observed
f. Set the Temperature <= TRIP Temperature, capacitor bank TRIP operation should be observed
g. Set the Temperature to Normal range, no capacitor bank operation should be observed

Primary = Time of Day, Override = NONE

a. Set the instrument into **Local** or **SCADA** modes, vary control parameter, no capacitor bank operations should be observed
b. Make sure that time of day is < Weekday CLOSE TOD 1
c. Set the instrument to **Auto** mode, no bank operation should be observed
d. Wait until time of day is > Weekday CLOSE TOD 1 and < TRIP TOD 1, at which time capacitor bank CLOSE operation should be observed
e. Wait until time of day is > Weekday TRIP TOD 1 and < CLOSE TOD 2, at which time capacitor bank TRIP operation should be observed
f. Wait until time of day is > Weekday CLOSE TOD 2 and < TRIP TOD 2, at which time capacitor bank CLOSE operation should be observed
g. Wait until time of day is > Weekday TRIP TOD 2, at which time capacitor bank TRIP operation should be observed
h. Repeat above for weekend times of day

Primary = VAr, Override = NONE

a. Set the instrument into **Local** or **SCADA** modes, vary control parameter, no capacitor bank operation should be observed
b. Set the VAr to Normal range (between TRIP and CLOSE values)
c. Set the instrument to **Auto** mode
d. Set the VAr >= CLOSE VAr, capacitor bank CLOSE operation should be observed
e. Set the VAr to Normal range, no capacitor bank operation should be observed
f. Set the VAr <= TRIP VAr, capacitor bank TRIP operation should be observed
g. Set the VAr to Normal range, no capacitor bank operation should be observed

Primary = Voltage, Override = NONE

a. Set the instrument into **Local** or **SCADA** modes, vary control parameter, no capacitor bank operation should be observed
b. Set the Voltage to Normal range (between TRIP and CLOSE values)
c. Set the instrument to **Auto** mode
d. Set the Voltage <= CLOSE Voltage, capacitor bank CLOSE operation should be observed
e. Set the Voltage to Normal range, no capacitor bank operation should be observed
f. Set the Voltage >= TRIP Voltage, capacitor bank TRIP operation should be observed
g. Set the Voltage to Normal range, no capacitor bank operation should be observed

Following are Override Algorithm tests. The Release thresholds are used in override algorithms only; they are ignored in primary algorithms. When control input value is between the release thresholds the override algorithm yields control to the primary algorithm. In all other cases the override algorithm manages capacitor bank state.
The case where Override Algorithm is NONE was tested above.

Primary = Temperature, Override = Voltage

a. Set the unit to **Local** mode
b. Set the Temperature to Normal range (between TRIP and CLOSE values)
c. Set the Voltage between the TRIP Release and CLOSE Release values
d. Set the unit into **Auto** mode, no capacitor bank operation should be observed, instrument should be running the **primary** algorithm.
e. Vary the Temperature as described in the **Primary=Temperature, Override = NONE** test, same behavior should be observed as in that test.
f. Set the Temperature to Normal range (between TRIP and CLOSE values)
g. Set the voltage between TRIP Release and TRIP values, no capacitor bank operation should be observed, instrument should be running the **primary** algorithm.
h. Set the voltage >= TRIP value, capacitor bank TRIP operation should be observed, instrument should be running the **override** algorithm.
i. Set the voltage between TRIP Release and TRIP values, no capacitor bank operation should be observed, instrument should be running the **override** algorithm.
j. Set the Voltage between the TRIP Release and CLOSE Release values, capacitor bank operation should be consistent with primary algorithm; instrument should be running the **primary** algorithm.
k. Set the voltage between CLOSE Release and CLOSE values, no capacitor bank operation should be observed, instrument should be running the **primary** algorithm.
l. Set the voltage <= CLOSE value, capacitor bank CLOSE operation should be observed, instrument should be running the **override** algorithm.
m. Set the voltage between CLOSE Release and CLOSE values, no capacitor bank operation should be observed, instrument should be running the **override** algorithm.

n. Set the Voltage between the TRIP Release and CLOSE Release values, capacitor bank operation should be consistent with primary algorithm; instrument should be running the **primary** algorithm.

19 Set Up Screen – Neutral Current Detection and Lock Out

When equipped with input from a suitable 0-10 VAC external neutral current sensor, the NeXVar™ Capacitor Control will monitor neutral current input from the sensor, and Trip the bank offline if a fault is detected. The control algorithm works in the following way:

If the neutral current average is less than the limit set all is normal and autonomous functions execute as programmed.

If neutral current reaches the set limit, the capacitor bank is TRIPED and the high neutral current flag is set. All autonomous control algorithms are now prevented from running.

The high neutral current flag can only be reset by restarting the NeXVar™.

20 History Screens

The NeXVar™ History Screens provides users the ability to quickly and easily view historical events stored in the memory of the NeXVar™ Capacitor Control. The history screens provide both tabulated data in columnar and graphed formats. Historical event data is stored in non-volatile memory and can be downloaded to a storage device using the NeXVar™ USB or serial ports.
The NeXVar™ internal memory can hold 100,000 data points. Data recording intervals are programmable. The standard data recording interval is 5 minutes.

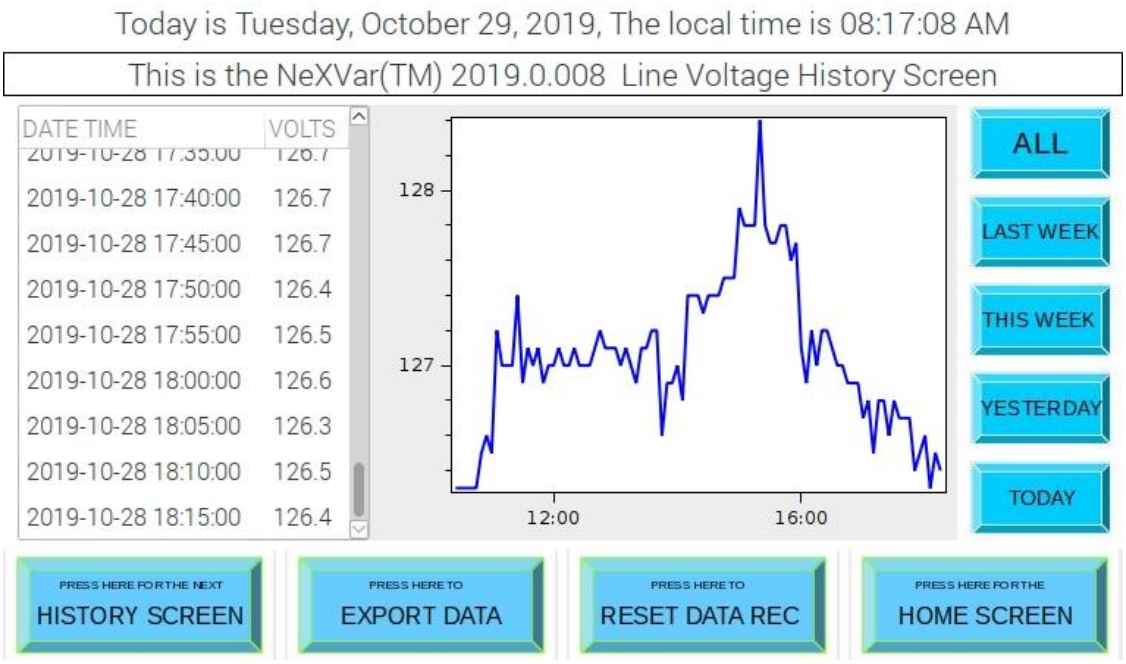


FIG. 18.1 NeXVar™ History Screen – Line Voltage History

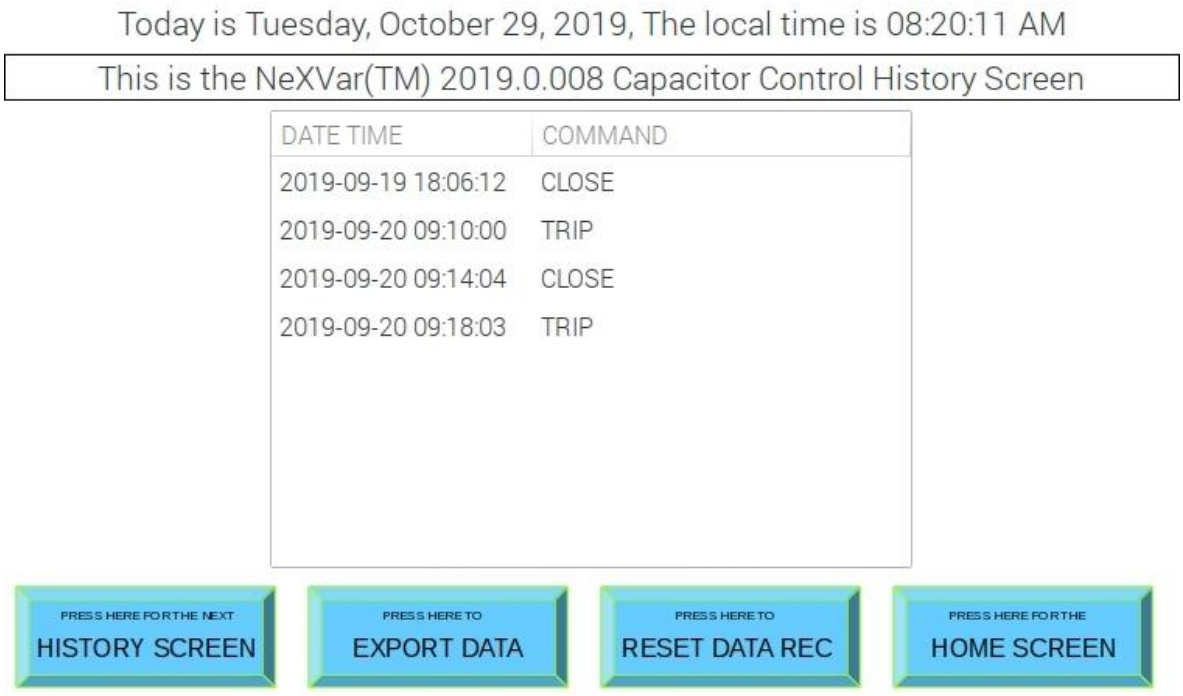


FIG. 18.2 NeXVar™ History Screen – Operation History

21 NeXVar Personality Configuration

The NeXVar™ Personality configuration provides users the ability to quickly and easily set the control functionality to one of a variety of standard control settings, or customer specific personalities without the need for an external program or laptop interface.

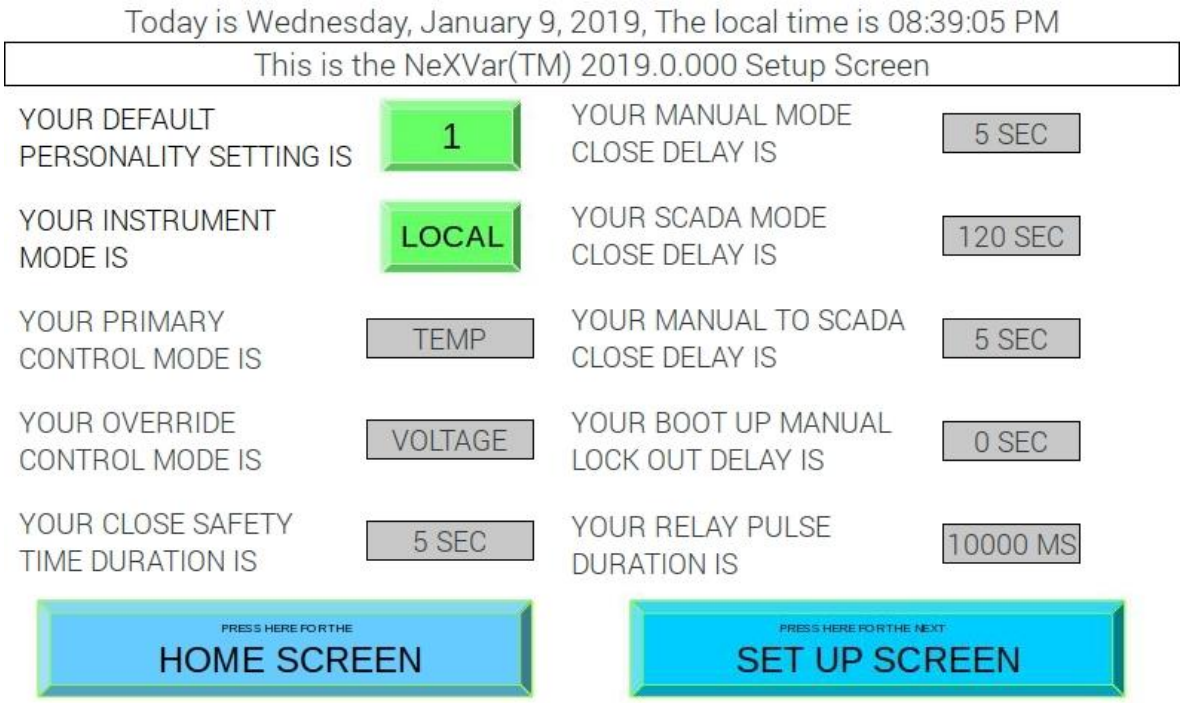


FIG. 19.1 NeXVar™ Set Up Screen

Personality Settings Matrix - NeXVar

Personality Name/Customer	Default- Time/Volts
Personality Number	0
Re-Enter Password Timer	5 minutes
Default Password (NONE = No Password)	config0

Close Safety Timer Duration (CSTD)	7 minutes
Ignore CSTD in Local Mode	No
Manual (Local) Close Delay	Disabled
Manual (Local) Trip Delay	Disabled
Remote (SCADA) Close Delay	Disabled
Remote (SCADA) Trip Delay	Disabled
Relay Pulse Duration	10,000ms (10sec)
Local To Remote Delay	0 Seconds
Restart Delay Timer	0
Amber LED flashing when any delay active	Disabled
Daily Close Count Limit (0 = Disabled)	10
Neutral Current Limit (0 = Disabled)	0
Voltage Control	
Trip Voltage	129
Trip Release Voltage	124
Close Release Voltage	119
Close Voltage	115
Switching Delay	60 seconds
Temperature Control	
Trip Temperature	NA
Trip Release Temperature	NA
Close Release Temperature	NA
Close Temperature	NA
Switching Delay	60 seconds
Time of Day Control	
Weekday Close TOD 1	6:00
Weekday Trip TOD 1	9:00
Weekday Close TOD 2	16:00
Weekday Trip TOD 2	21:00
Weekend Close TOD 1	6:00
Weekend Trip TOD 1	9:00
Weekend Close TOD 2	16:00
Weekend Trip TOD 2	21:00
VAr Control	
Voltage XFMR Ratio	NA
Trip KVAr	-350
Trip Release KVAr	-150

Close Release KVAr	200
Close KVAr	400
Switching Delay	60 seconds
SEASONS	
Season 1 Start Date	1/1
Season 1 Control Algorithm	Time
Season 1 Override Algorithm	Voltage
Season 2 Start Date	None
Season 2 Control Algorithm	None
Season 2 Override Algorithm	None
Season 3 Start Date	None
Season 3 Control Algorithm	None
Season 3 Override Algorithm	None
Season 4 Start Date	None
Season 4 Control Algorithm	None
Season 4 Override Algorithm	None

FIG. 19.2 NeXVar™ Personality Settings – Time/Volts

Personality Settings Matrix - NeXVar

Personality Name/Customer	Var/Voltage
Personality Number	1
Re-Enter Password Timer	5 minutes
Default Password (NONE = No Password)	config1
Close Safety Timer Duration (CSTD)	7 minutes
Ignore CSTD in Local Mode	No
Manual (Local) Close Delay	Disabled
Manual (Local) Trip Delay	Disabled
Remote (SCADA) Close Delay	Disabled
Remote (SCADA) Trip Delay	Disabled
Relay Pulse Duration	10,000ms (10sec)
Local To Remote Delay	0 Seconds
Restart Delay Timer	0
Amber LED flashing when any delay active	Disabled
Daily Close Count Limit (0 = Disabled)	10

Neutral Current Limit (0 = Disabled)	0
Voltage Control	
Trip Voltage	129
Trip Release Voltage	124
Close Release Voltage	119
Close Voltage	115
Switching Delay	60 seconds
Temperature Control	
Trip Temperature	NA
Trip Release Temperature	NA
Close Release Temperature	NA
Close Temperature	NA
Switching Delay	60 seconds
Time of Day Control	
Weekday Close TOD 1	NA
Weekday Trip TOD 1	NA
Weekday Close TOD 2	NA
Weekday Trip TOD 2	NA
Weekend Close TOD 1	NA
Weekend Trip TOD 1	NA
Weekend Close TOD 2	NA
Weekend Trip TOD 2	NA
VAr Control	
Voltage XFMR Ratio	7200:120
Trip KVAr	-100
Trip Release KVAr	-50
Close Release KVAr	200
Close KVAr	300
Switching Delay	60 seconds
SEASONS	
Season 1 Start Date	1/1
Season 1 Control Algorithm	Var
Season 1 Override Algorithm	Voltage
Season 2 Start Date	None
Season 2 Control Algorithm	None
Season 2 Override Algorithm	None
Season 3 Start Date	None

Season 3 Control Algorithm	None
Season 3 Override Algorithm	None
Season 4 Start Date	None
Season 4 Control Algorithm	None
Season 4 Override Algorithm	None

FIG. 19.3 NeXVar™ Personality Settings – VAR/Volts

Personality Settings Matrix - NeXVar

Personality Name/Customer	Voltage
Personality Number	2
Re-Enter Password Timer	5 minutes
Default Password (NONE = No Password)	config2
Close Safety Timer Duration (CSTD)	7 minutes
Ignore CSTD in Local Mode	No
Manual (Local) Close Delay	Disabled
Manual (Local) Trip Delay	Disabled
Remote (SCADA) Close Delay	Disabled
Remote (SCADA) Trip Delay	Disabled
Relay Pulse Duration	10,000ms (10sec)
Local To Remote Delay	0 Seconds
Restart Delay Timer	0
Amber LED flashing when any delay active	Disabled
Daily Close Count Limit (0 = Disabled)	10
Neutral Current Limit (0 = Disabled)	0
Voltage Control	
Trip Voltage	129
Trip Release Voltage	124
Close Release Voltage	119
Close Voltage	115
Switching Delay	60 seconds
Temperature Control	
Trip Temperature	NA

Trip Release Temperature	NA
Close Release Temperature	NA
Close Temperature	NA
Switching Delay	60 seconds
Time of Day Control	
Weekday Close TOD 1	NA
Weekday Trip TOD 1	NA
Weekday Close TOD 2	NA
Weekday Trip TOD 2	NA
Weekend Close TOD 1	NA
Weekend Trip TOD 1	NA
Weekend Close TOD 2	NA
Weekend Trip TOD 2	NA
VAr Control	
Voltage XFMR Ratio	NA
Trip KVAr	NA
Trip Release KVAr	NA
Close Release KVAr	NA
Close KVAr	NA
Switching Delay	60 seconds
SEASONS	
Season 1 Start Date	1/1
Season 1 Control Algorithm	Voltage
Season 1 Override Algorithm	None
Season 2 Start Date	None
Season 2 Control Algorithm	None
Season 2 Override Algorithm	None
Season 3 Start Date	None
Season 3 Control Algorithm	None
Season 3 Override Algorithm	None
Season 4 Start Date	None
Season 4 Control Algorithm	None
Season 4 Override Algorithm	None

FIG. 19.4 NeXVar™ Personality Settings – Voltage

Personality Settings Matrix - NeXVar

Personality Name/Customer	Temperature
Personality Number	3
Re-Enter Password Timer	5 minutes
Default Password (NONE = No Password)	config3
Close Safety Timer Duration (CSTD)	7 minutes
Ignore CSTD in Local Mode	No
Manual (Local) Close Delay	Disabled
Manual (Local) Trip Delay	Disabled
Remote (SCADA) Close Delay	Disabled
Remote (SCADA) Trip Delay	Disabled
Relay Pulse Duration	10,000ms (10sec)
Local To Remote Delay	0 Seconds
Restart Delay Timer	0
Amber LED flashing when any delay active	Disabled
Daily Close Count Limit (0 = Disabled)	10
Neutral Current Limit (0 = Disabled)	0
Voltage Control	
Trip Voltage	NA
Trip Release Voltage	NA
Close Release Voltage	NA
Close Voltage	NA
Switching Delay	60 seconds
Temperature Control	
Trip Temperature	60 F
Trip Release Temperature	70 F
Close Release Temperature	80 F
Close Temperature	90 F
Switching Delay	60 seconds
Time of Day Control	
Weekday Close TOD 1	NA
Weekday Trip TOD 1	NA
Weekday Close TOD 2	NA
Weekday Trip TOD 2	NA
Weekend Close TOD 1	NA
Weekend Trip TOD 1	NA
Weekend Close TOD 2	NA

Weekend Trip TOD 2	NA
VAr Control	
Voltage XFMR Ratio	NA
Trip KVAr	NA
Trip Release KVAr	NA
Close Release KVAr	NA
Close KVAr	NA
Switching Delay	60 seconds
SEASONS	
Season 1 Start Date	1/1
Season 1 Control Algorithm	Temperature
Season 1 Override Algorithm	None
Season 2 Start Date	None
Season 2 Control Algorithm	None
Season 2 Override Algorithm	None
Season 3 Start Date	None
Season 3 Control Algorithm	None
Season 3 Override Algorithm	None
Season 4 Start Date	None
Season 4 Control Algorithm	None
Season 4 Override Algorithm	None

FIG. 19.5 NeXVar™ Personality Settings – Temperature

Personality Settings Matrix - NeXVar

Personality Name/Customer	SCADA
Personality Number	4
Re-Enter Password Timer	5 minutes
Default Password (NONE = No Password)	config4
Close Safety Timer Duration (CSTD)	7 minutes
Ignore CSTD in Local Mode	No
Manual (Local) Close Delay	60 Seconds
Manual (Local) Trip Delay	Disabled
Remote (SCADA) Close Delay	60 Seconds
Remote (SCADA) Trip Delay	Disabled

Relay Pulse Duration	10,000ms (10sec)
Local To Remote Delay	2 Minutes
Restart Delay Timer	0
Amber LED flashing when any delay active	Enabled
Daily Close Count Limit (0 = Disabled)	10
Neutral Current Limit (0 = Disabled)	10A
Voltage Control	
Trip Voltage	NA
Trip Release Voltage	NA
Close Release Voltage	NA
Close Voltage	NA
Switching Delay	60 seconds
Temperature Control	
Trip Temperature	NA
Trip Release Temperature	NA
Close Release Temperature	NA
Close Temperature	NA
Switching Delay	60 seconds
Time of Day Control	
Weekday Close TOD 1	NA
Weekday Trip TOD 1	NA
Weekday Close TOD 2	NA
Weekday Trip TOD 2	NA
Weekend Close TOD 1	NA
Weekend Trip TOD 1	NA
Weekend Close TOD 2	NA
Weekend Trip TOD 2	NA
VAr Control	
Voltage XFMR Ratio	NA
Trip KVAr	NA
Trip Release KVAr	NA
Close Release KVAr	NA
Close KVAr	NA
Switching Delay	60 seconds
SEASONS	
Season 1 Start Date	1/1

Season 1 Control Algorithm	SCADA
Season 1 Override Algorithm	None
Season 2 Start Date	None
Season 2 Control Algorithm	None
Season 2 Override Algorithm	None
Season 3 Start Date	None
Season 3 Control Algorithm	None
Season 3 Override Algorithm	None
Season 4 Start Date	None
Season 4 Control Algorithm	None
Season 4 Override Algorithm	None

FIG. 19.6 NeXVar™ Personality Settings – SCADA

Personality Settings Matrix - NeXVar

Personality Name/Customer	Test Mode
Personality Number	32767
Re-Enter Password Timer	Disabled
Default Password (NONE = No Password)	NONE
Close Safety Timer Duration (CSTD)	30 Seconds
Ignore CSTD in Local Mode	No
Manual (Local) Close Delay	5 Seconds
Manual (Local) Trip Delay	Disabled
Remote (SCADA) Close Delay	Disabled
Remote (SCADA) Trip Delay	Disabled
Relay Pulse Duration	5000ms (5sec)
Local To Remote Delay	0 Seconds
Restart Delay Timer	5000
Amber LED flashing when any delay active	Enabled
Daily Close Count Limit (0 = Disabled)	0
Neutral Current Limit (0 = Disabled)	0
Voltage Control	
Trip Voltage	129
Trip Release Voltage	124
Close Release Voltage	119
Close Voltage	115

Switching Delay	60 seconds
Temperature Control	
Trip Temperature	60 F
Trip Release Temperature	70 F
Close Release Temperature	80 F
Close Temperature	90 F
Switching Delay	60 seconds
Time of Day Control	
Weekday Close TOD 1	6:00
Weekday Trip TOD 1	9:00
Weekday Close TOD 2	16:00
Weekday Trip TOD 2	21:00
Weekend Close TOD 1	6:00
Weekend Trip TOD 1	9:00
Weekend Close TOD 2	16:00
Weekend Trip TOD 2	21:00
VAr Control	
Voltage XFMR Ratio	NA
Trip KVAr	-350
Trip Release KVAr	-150
Close Release KVAr	200
Close KVAr	400
Switching Delay	60 seconds
SEASONS	
Season 1 Start Date	1/1
Season 1 Control Algorithm	Voltage
Season 1 Override Algorithm	Temperature
Season 2 Start Date	None
Season 2 Control Algorithm	None
Season 2 Override Algorithm	None
Season 3 Start Date	None
Season 3 Control Algorithm	None
Season 3 Override Algorithm	None
Season 4 Start Date	None
Season 4 Control Algorithm	None
Season 4 Override Algorithm	None

FIG. 19.7 NeXVar™ Personality Settings – Test Mode

Given the reduced Closed Safety Timer Duration the control should not be deployed into the field in Test Mode

22 Free Form Configuration

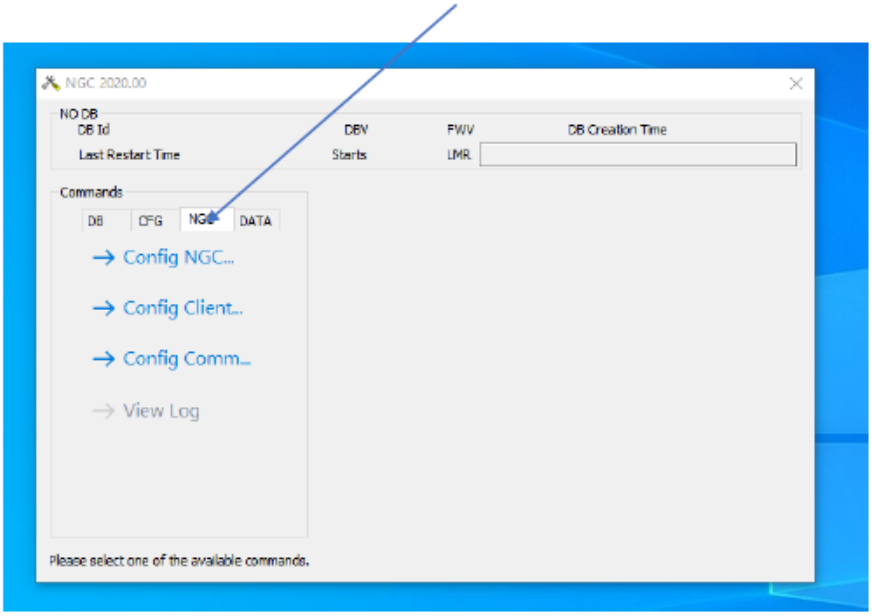
The concept behind the Matrix personality settings in the NeXVar™ are to make typical configuration, and customer specific configurations quick and easy and not dependent upon an external laptop or programming.

There may be times when a user wants subtle deviations from a specific matrix value and those deviations are not coded into the NeXVar™ matrix.

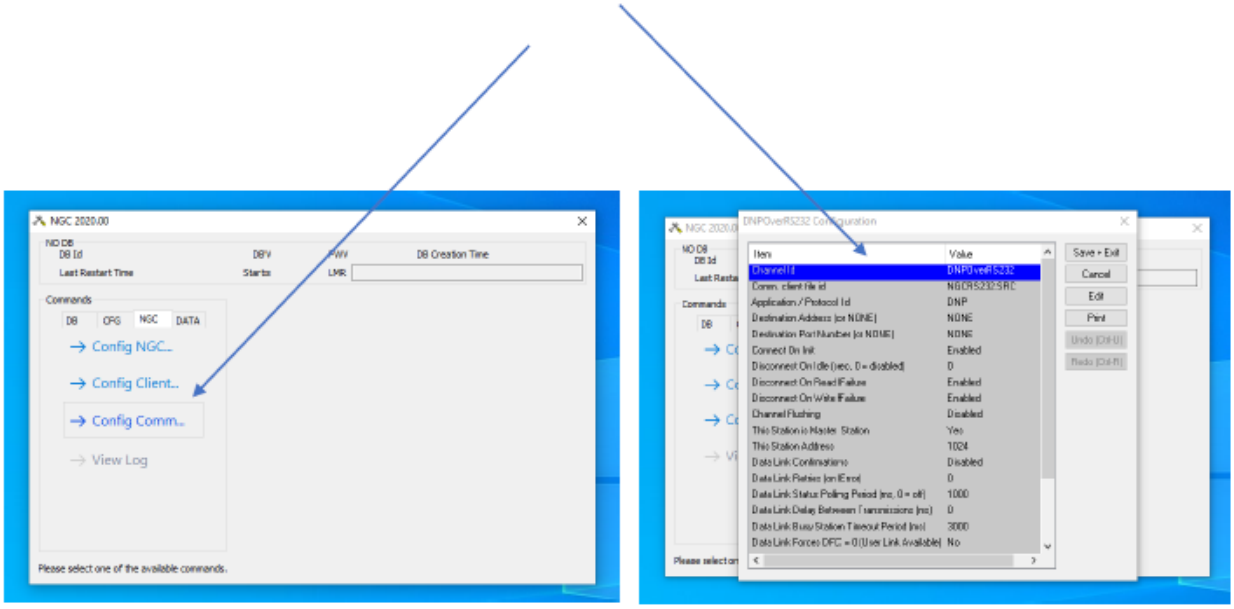
The NeXVar™ supports “Free Form” configuration changes via the Telescada NGC Configuration Software tool.

TASK 1: CONFIGURING NGC TO COMMUNICATE WITH YOUR NeXVar – 6 STEPS

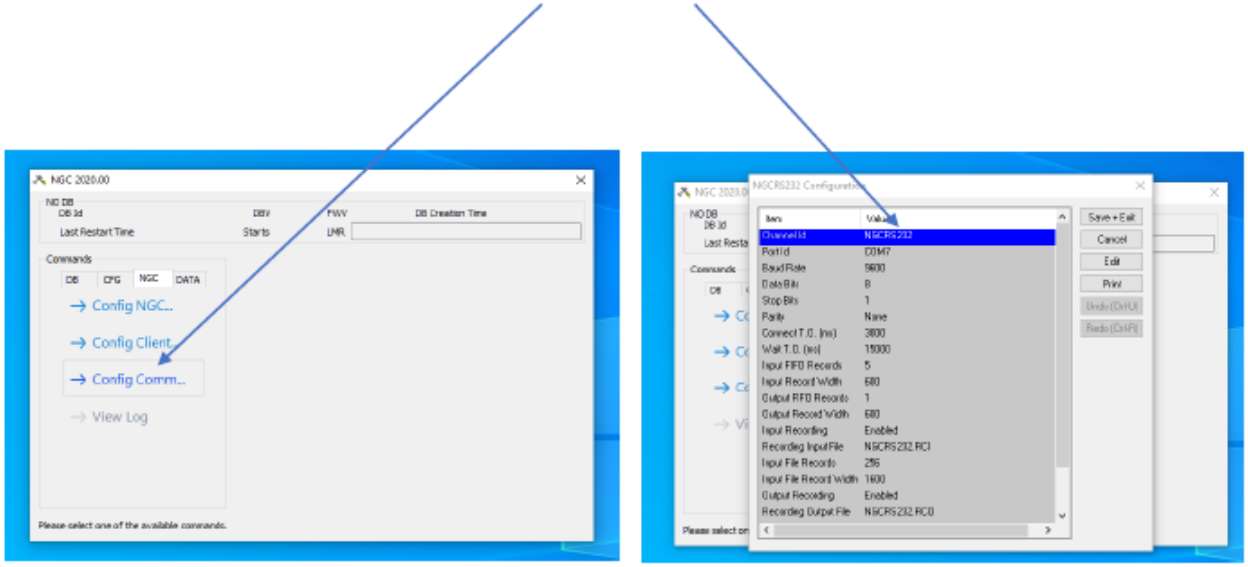
STEP 1: LAUNCH THE NGC SOFTWARE AND SELECT THE NGC TAB FROM THE COMMANDS BOX



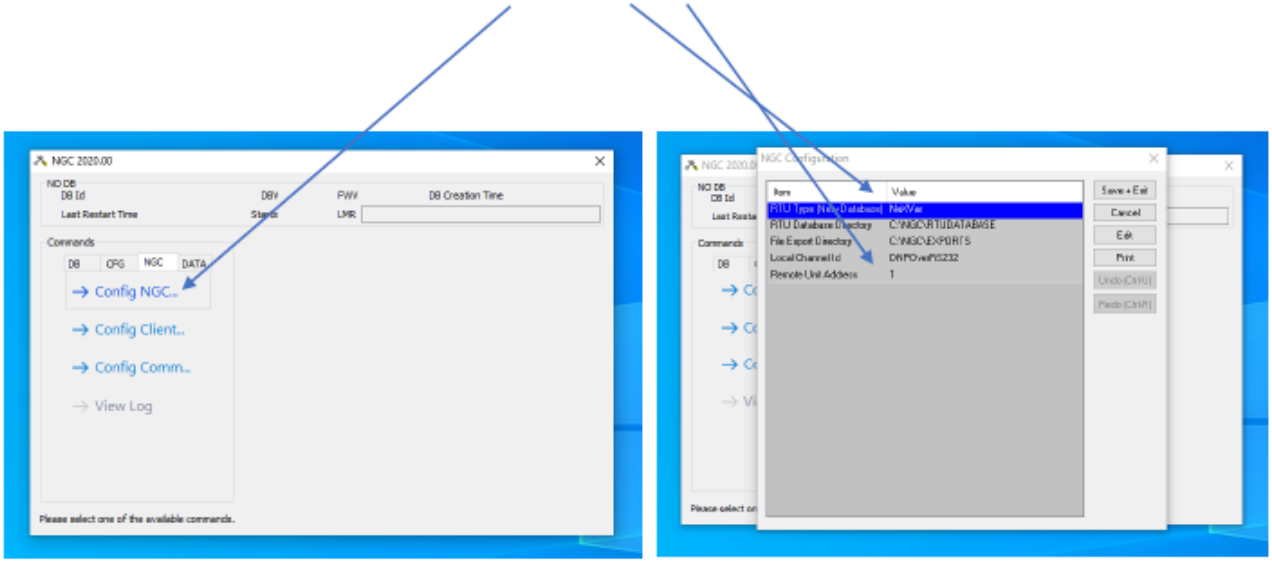
STEP 2: CONFIGURE YOUR COMMUNICATIONS CLIENT FROM YOUR PC RUNNING THE NGC SOFTWARE TO THE NEXVAR CONTROLLER. MAKE SURE THE CHANNEL ID IS DNPOverRS232, AND YOUR APPLICATION PROTOCOL IS DNP



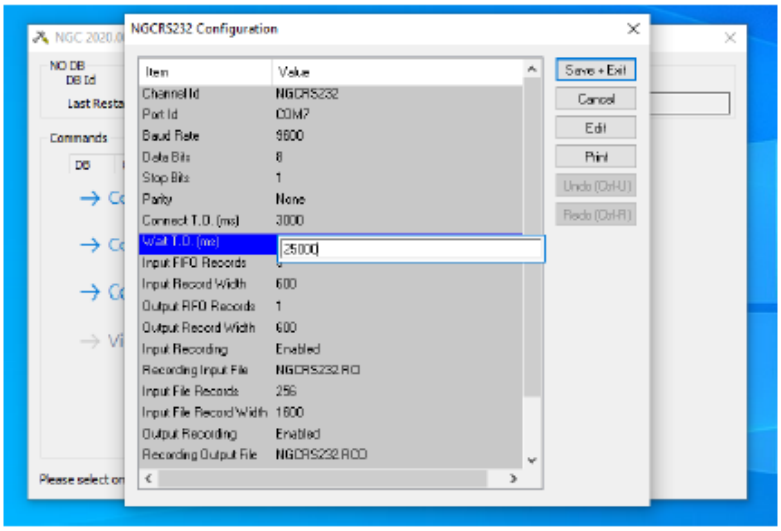
STEP 3: CONFIGURE YOUR COMMUNICATIONS CHANNEL FROM YOUR PC RUNNING THE NGC SOFTWARE TO THE NEXVAR CONTROLLER. MAKE SURE THE CHANNEL ID IS RS232, AND YOUR COMMUNICATION PORT IS CORRECT



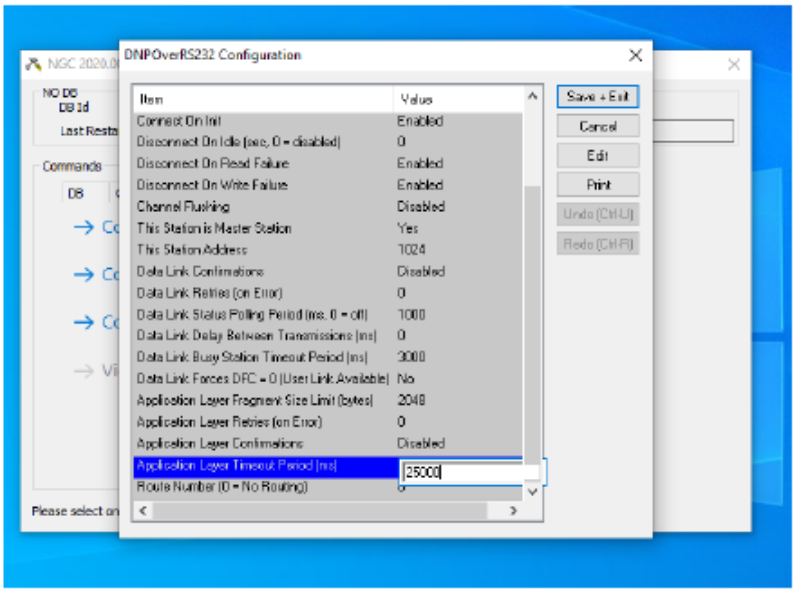
STEP 4: CONFIGURE NGC TO SELECT THE NEXVAR CONTROLLER AS THE RTU TYPE, AND THE LOCAL CHANNEL Id IS DNPOverRS232



STEP 5: CONFIGURE YOUR COMMUNICATIONS CLIENT FROM YOUR PC RUNNING THE NGC SOFTWARE TO THE NEXVAR CONTROLLER.CHANGE WAIT T.O. TO 25,000MS

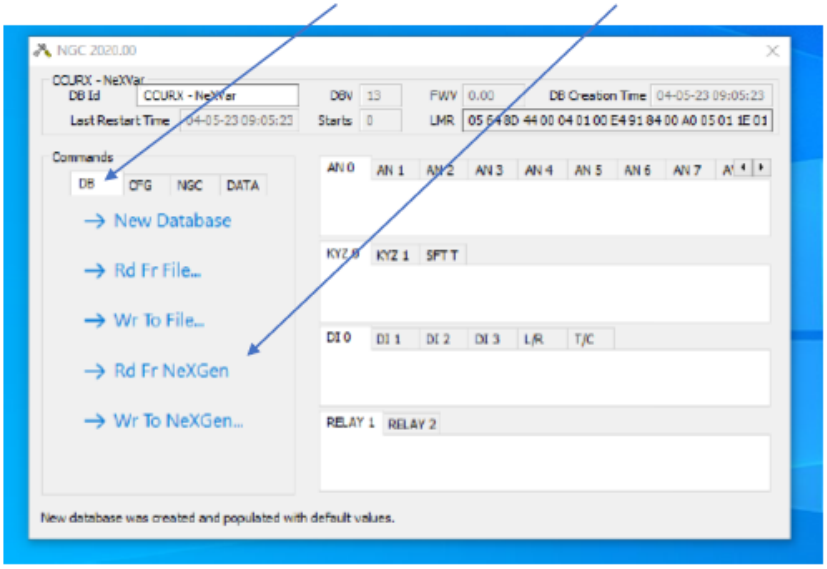


STEP 6: CONFIGURE YOUR CONFIGURATION CLIENT FROM YOUR PC RUNNING THE NGC SOFTWARE TO THE NEXVAR CONTROLLER.CHANGE APPLICATION LAYER TO 25,000MS

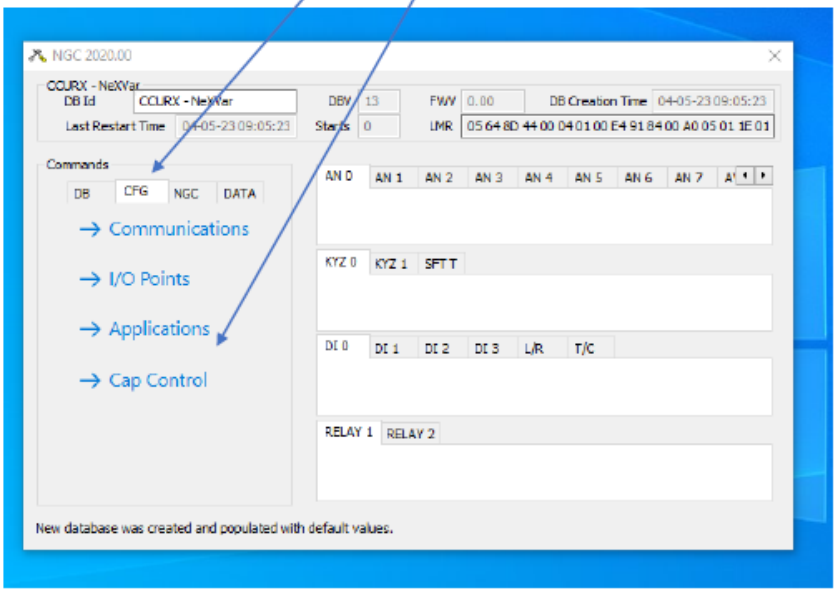


TASK 2: CONFIGURING YOUR NeXVar TO CUSTOM CAPACITOR CONTROL PARAMETERS – 5 STEPS

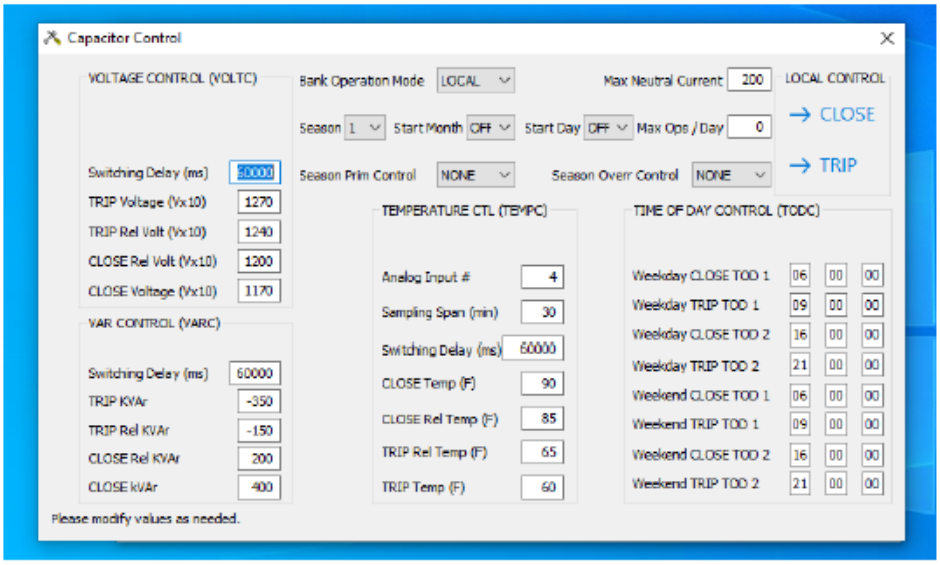
STEP 1: FROM THE DB TAB, SELECT RD (READ) Fr NeXGen



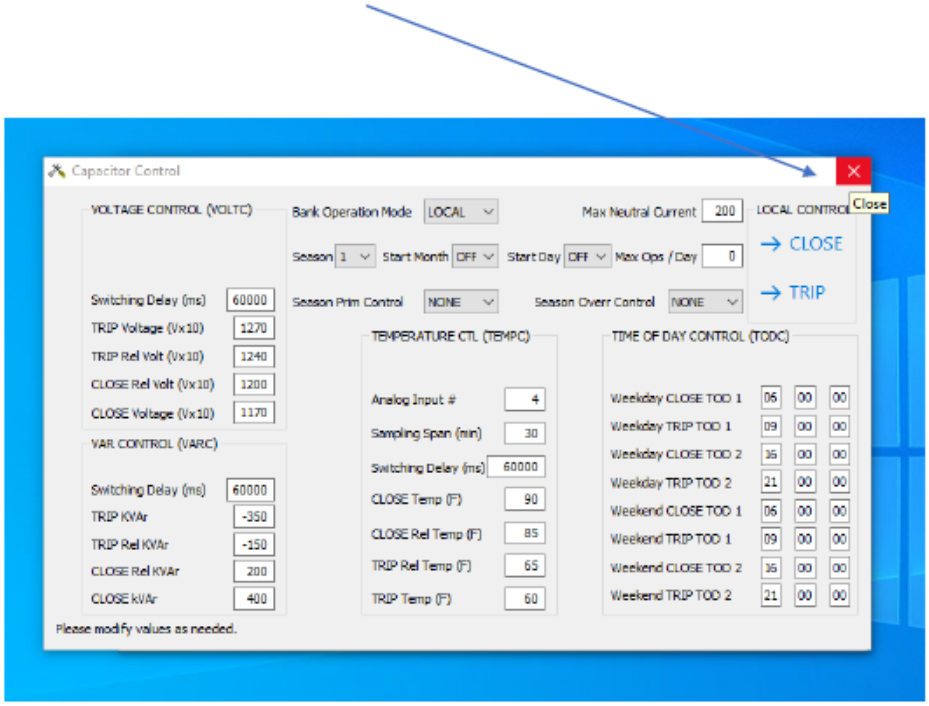
STEP 2: CLICK ON THE CFG TAB AND SELECT CAP CONTROL



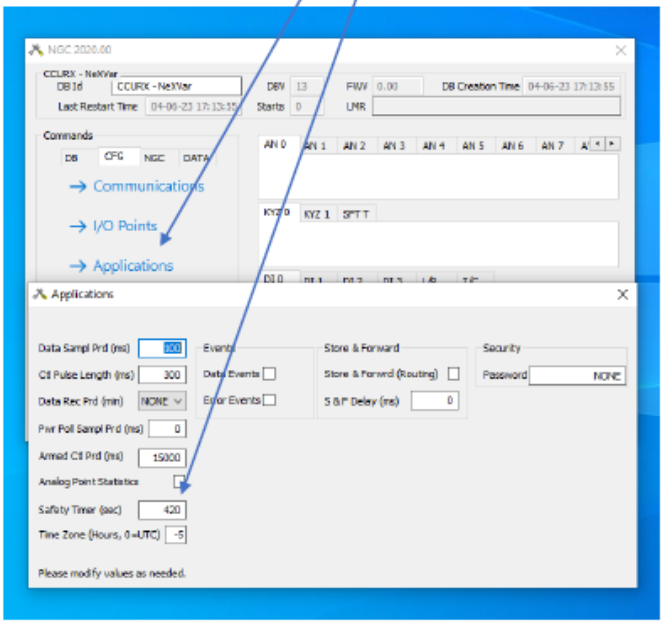
STEP 3: MAKE ANY CAP CONTROL PARAMETER CHANGES YOU DESIRE



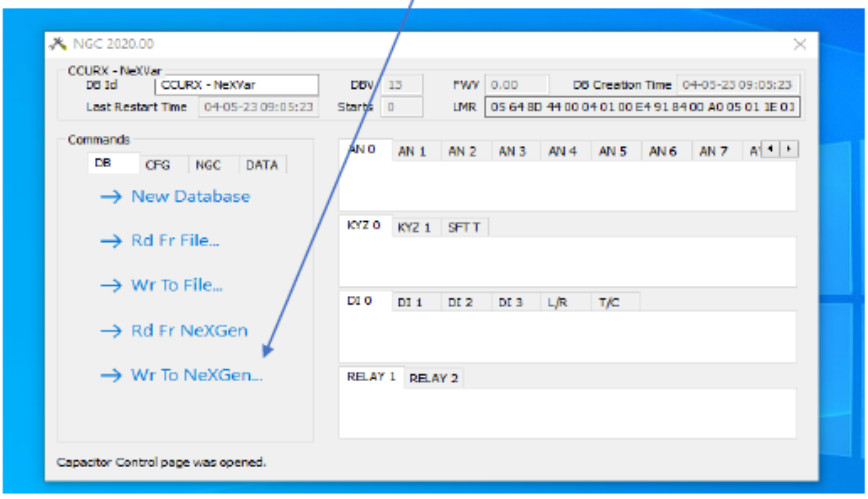
STEP 4: AFTER CHANGES ARE MADE. CLOSE THE PANEL BY CLICKING THE "X"



STEP 5: THE ONLY PARAMETER NOT ON THE CAPACITOR CONTROL SCREEN IS THE SAFETY TIMER. IT CAN BE CHANGED FROM THE APPLICATIONS PAGE



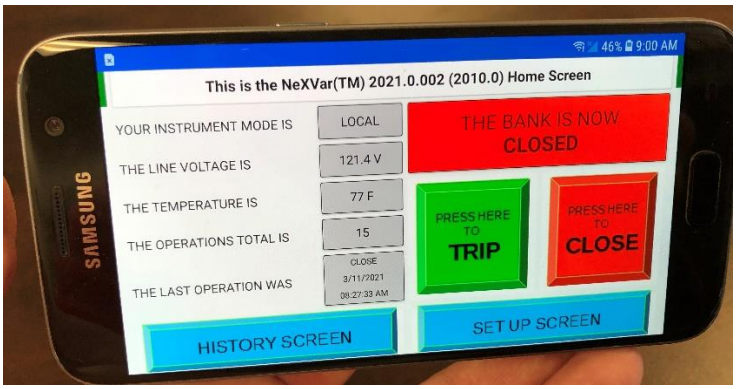
STEP 6: TO FINISH, SELECT THE DB TAB AND Wr (WRITE) THE NEW SETTINGS TO YOUR NeXVar



NOTE: THE NEW CAPACITOR CONTROL SETTINGS ARE NOW PROGRAMMED INTO YOUR NeXVar.

ANY SELECTION OF AN ALTERNATE "MATRIX PERSONALITY" FROM THE TOUCH PANEL WILL ERASE THESE SETTINGS AND REQUIRE REPROGRAMMING

23 Smartphone and Tablet App



Telescada has developed smartphone and tablet applications for connecting to the NeXVar™ Capacitor Control wirelessly

1. iPhone and iPad – The NeXVar™ application can be downloaded from the Apple App store.
2. Android – An installation file for the NeXVar™ application can be requested from Telescada.

Connecting with the NeXVar™ is done by secure WiFi. The NeXVar™ instrument creates a local WiFi connection that can be accessed within a 300-foot range. The WiFi connection only exists between the NeXVar™ controller and a device running the Telescada application. No other external WiFi communication or connection is possible.

1. Make sure the latest NeXVar™ Interface Screen code is running on your NeXVar™ Control. Should be **2023.1.004** or higher as displayed on the Home Screen.

2. Within 300 feet of the NeXVar™ Control, connect your phone to the NeXVar™ Wi-Fi generated by your NeXVar Control

3. Log into the NeXVar™ WiFi Network using the factory provided password

4. Launch the NeXVar™ App

5. Enter your NeXVar™ Control password to access the full functionality of the NeXVar™ from your phone or tablet.

23.1 Disabling WiFi

If utility security policies require, the NeXVar WiFi can be disabled on any NeXVar instrument from the main screen. Once disabled, the WiFi will not work.

To re-enable, the WiFI can only be activated from the home screen.

To disable the WiFi

- Log on as Administrator
- Click on the Upper Ribbon
- Enter **WiFi=Off**

24 DNP Device Profile

24.1 Device Profile

DNP V3.0 DEVICE PROFILE DOCUMENT	
Vendor Name:	Telescada
Device Name:	NeXGen™ 3700 Instrument Platform
Device Function:	Slave
Maximum Data Link Frame Size (octets):	Transmitted: 292 Received 292
Maximum Data Link Re-Tries:	Configurable, range 0 to 5, via NGC
Maximum Application Layer Fragment Size (octets):	Transmitted: 2048 Received: 2048
Maximum Application Layer Re-Tries:	Configurable, range 0 to 5, via NGC
Requires Data Link Confirmation:	Configurable, via NGC
Requires Application Layer Confirmation:	Configurable, via NGC
Timeouts While Waiting For:	Data Link Confirm: Configurable via NGC Complete Appl. Fragment: Configurable via NGC Application Confirm: Configurable via NGC Complete Appl. Response: Configurable via NGC
Executes Control Operations:	WRITE Binary Outputs: Never SELECT/OPERATE: Always DIRECT OPERATE: Always DIRECT OPERATE - NO ACK: Configurable via NGC Count > 1: Never Pulse On: Always Pulse Off: Always Latch On: Always Latch Off: Always Queue: Never Clear Queue: Never
Reports Binary Input Change Events When No Specific Variation Requested:	

Configurable via NGC, Never or Time-tagged
Reports Time-tagged Binary Input Change Events When No Specific Variation Requested: Configurable via NGC, Never or Change With Time
Sends Unsolicited Responses: Configurable via NGC, See Explanation Below
Sends Static Data in Unsolicited Responses: Never

24.2 Instrument I/O Map – DNP

NeXVar™ Capacitor Control I/O Map

Index#	Analog Input	Analog Input Description	Comments
0	Per connected sensor	0 to 5 VDC, 11 bits	Requires external sensor
1	Per connected sensor	0 to 5 VDC, 11 bits	Requires external sensor
2	Per connected sensor	0 to 5 VDC, 11 bits	Requires external sensor
3	Per connected sensor	0 to 5 VDC, 11 bits	Requires external sensor
4	Temperature	Instrument Temperature	NeXVar Internal Measurement
5	Per connected sensor	0 to 5 VDC, 11 bits	Requires external sensor
6	Per connected sensor	0 to 5 VDC, 11 bits	Requires external sensor
7	Line Voltage	Secondary Voltage Measurement	NeXVar Internal Measurement
8	Phase A Voltage RMS	Phase A Voltage RMS – 0-10VAC	Requires Primary Phase Transducer
9	Phase B Voltage RMS	Phase B Voltage RMS – 0-10VAC	Requires Primary Phase Transducer
10	Phase C Voltage RMS	Phase C Voltage RMS – 0-10VAC	Requires Primary Phase Transducer
11	Phase A Current RMS	Phase A Current RMS – 0-10VAC	Requires Primary Phase Transducer
12	Phase B Current RMS	Phase B Current RMS – 0-10VAC	Requires Primary Phase Transducer

13	Phase C Current RMS	Phase C Current RMS – 0-10VAC	Requires Primary Phase Transducer
14	Neutral Current RMS	Neutral Current RMS – 0-10VAC	Requires Neutral Current Sensor
15	Real Power (kW)	Phase A Real Power (kW)	Requires Primary Phase Transducer
16	Reactive Power (kVAr)	Phase A Reactive Power (kVAr)	Requires Primary Phase Transducer
17	Power Factor (%)	Power Factor (%)	Requires Primary Phase Transducer

Index#	**Status Input**	**Status Input Description**	**Comments**
0	Door Switch	Per Connected Door Switch	NeXVar Internal Status
1	Per Connected Input	Per Connected Switch	Inputs Have 1500 VDC Isolation
2	Per Connected Input	Per Connected Switch	Inputs Have 1500 VDC Isolation
3	Per Connected Input	Per Connected Switch	Inputs Have 1500 VDC Isolation
4	Toggle In Local Control Mode	Toggle In Local Control Mode	Virtual Status
5	Last Operation	Last Operation	Virtual Status
6	Load Fuse	Fuse Status	Virtual Status

Index#	**Counter Inputs**	**Counter Input Descprition**	**Comments**
0	Pulse 0	For External Mechanical Counter. N/A	Virtual Counter
1	Pulse 1	For External Mechanical Counter. N/A	Virtual Counter
2	Safety Timer	Safety Timer	Virtual Timer
3	Close Operation Counter	Close Operation Counter	Virtual Counter

Index#	**Control Output - Momentary Relays**	**Control Output Description**	**Comments**

0	CLOSE	CLOSE (N.O. Contacts - Switches 120 VAC)	Connects the "HOT" Side to CLOSE
1	TRIP	TRIP (N.O. Contacts - Switches 120 VAC)	Connects the "HOT" Side to TRIP

24.3 Unsolicited Responses

The unit sends unsolicited responses only when configured to do so, using NGC. Only events (no static data) are reported in this manner.

Event generation can be enabled or disabled.

Event reporting can be enabled or disabled. Events can be retrieved via active polling by the master, or in unsolicited fashion. In the latter case the unit can be configured to let the master know events are available (after which the master must poll for events), or it can be configured to send all available event data.

In case of analog inputs, for an event to be generated, analog input value must cross configurable high or low threshold. Configurable chatter filter and event class are available.

In case of counters, for an event to be generated, counter value change since last report must cross configurable threshold. Configurable chatter filter and event class are available.

In case of status (binary) inputs, for an event to be generated, binary input value must change. Configurable chatter filter and event class are available.

In case of control (binary) outputs, for an event to be generated, binary output value must be changed by someone other than the slave. Configurable chatter filter and event class are available.

24.4 Implementation Table

Request columns identify all requests parsed by the device. Response columns identify all responses sent by the device.

Obj	Var	Description * = Default Responses ** = Event Unsolicited Responses	Req. Func. Codes	Req. Qual. Codes (hex)	Resp. Func. Codes	Resp. Qual. Codes (hex)
01	01	SINGLE-BIT BINARY INPUT	1	All	129	27
01	02	BINARY INPUT WITH STATUS*	1	All	129	27
02	01	BINARY INPUT CHANGE WITHOUT TIME	1	All	129	27
02	02	BINARY INPUT CHANGE WITH TIME* **	1	All	129, 130	27
10	01	BINARY OUTPUT	3,4,5, 6	All	129	27
10	02	BINARY OUTPUT STATUS**	1	All	129, 130	27
12	01	CONTROL RELAY OUTPUT BLOCK	2	All	129	27
20	01	32-BIT BINARY COUNTER*	1	All	129	27
20	02	16-BIT BINARY COUNTER	1	All	129	27
21	05	32-BIT FROZEN COUNTER WITH TIME OF FREEZE**	1	All	129, 130	27
30	01	32-BIT ANALOG INPUT*	1	All	129	27
30	02	16-BIT ANALOG INPUT	1	All	129	27
30	03	32-BIT ANALOG INPUT WITHOUT FLAG	1	All	129	27
30	04	16-BIT ANALOG INPUT WITHOUT FLAG	1	All	129	27
31	03	32-BIT FROZEN ANALOG INPUT WITH TIME OF FREEZE**	1	All	129, 130	27
50	01	TIME AND DATE	2	All	129	
50	02	TIME DELAY FINE	17	All	129	
60	01	CLASS 0 DATA	1	All		27
60	02	CLASS 1 DATA	1	All		27
60	03	CLASS 2 DATA	1	All		27
60	04	CLASS 3 DATA	1	All		27
80	01	INTERNAL INDICATIONS	1, 2	All	129	
83	01	PRIVATE REGISTRATION OBJECT – See Below.	1, 2	All	129	27

24.5 Private Registration Object

Private registration object is used to implement device specific functionality. In all cases:

- The four ‘Vendor’ bytes are (hex) 42 54 45 00.
- The six byte (48 bit) time is in standard DNP time format.

The table below shows this object Private Registration Numbers (PRN), and associated functionality.

PRN	F	DATA
0	2	Set data recording period, in ms (4 bytes)
1	1	Download analog point data 'since' time (6 bytes), point index (4 bytes), max readings (4 bytes)
2	1	Download pulse counter data 'since' time (6 bytes), point index (4 bytes), max readings (4 bytes)
3	1	Download status point data 'since' time (6 bytes), point index (4 bytes), max readings (4 bytes)
4	1	Reserved.
5	2	Analog point data recording Enable == 1, Disable == 0 (1 byte), point index (4 bytes)
6	2	Pulse counter data recording Enable == 1, Disable == 0 (1 byte), point index (4 bytes)
7	2	Status point data recording Enable == 1, Disable == 0 (1 byte), point index (4 bytes)
8	2	Reserved.
9	2	Reserved.
10	1,2	Reserved

In above Table:

- Column Header ‘F’ is Application Layer function: 1 = Read, 2 = Write.
- Response to data downloads consists of standard DNP time stamped objects.

Control Point Operation

Control point operation is implemented via DNP object Group 12, Variation 01. The software follows minimum implementation outlined in *DNP Technical Bulletin 9701-002*. The following combinations are implemented (object fields, as expected by CCDC for the various functions):

Control	Ctl. Code	Count	On Time	Off Time
Latching OFF (Conditional – 2WLM)	0x4	0	0	0
Latching ON	0x3	Ignored	0	0
Latching OFF (Unconditional)	0x4	1	0	0
Latching ON	0x3	Ignored	0	0

Pulse / Timed OFF	0x81	Ignored	n > 0 (ms)	0
Pulse ON	0x41	Ignored	n > 0 (ms)	0

The following functions are supported in conjunction with above object: *select before operate*, *operate*, and *direct operate*. Success or failure of operation is returned via returned object Status field. Possible values:

0 Request accepted, initiated, or queued.
1 Request not accepted as the operate message was received after the arm timer timed out. The arm timer was started when the select operation for the same point was received.
2 No previous matching select message (i.e. an operate message was sent to activate a control point that was not previously armed with the select message.
3 Request not accepted as there were formatting errors in the *control* request (select*, operate,* or *direct operate*).
4 Control operation not supported for this point.
5 Request not accepted, as the control queue is full or the point is already active.
6 Request not accepted because of control hardware problems.

The actual relay operations (processor board → I/O board) are done via the SPI.

DNP 3.0 Slave (**DNPS**)

DNP slaves communicate with assigned external master stations. Two independent, asynchronous slaves are available, one on each port. When both slaves are mapped to the same communications port, secondary slave is disabled. Each slave

- Responds to polls for data from the master station,
- Reports data events and software error events to the master station (unsolicited reports)
- Executes commands issued by the master station, including
  - Clock synchronization with the master station
  - Operation of relays on attached I/O board
  - Database updates (RTU configuration editing)
  - Data recording management and data downloads
- Stores and forwards messages to the local DNP master running concurrently with the slave (in support of message routing).

The following DNP objects are supported:

Group	Variation	Format
01	1	SINGLE-BIT BINARY INPUT

01	2	BINARY INPUT WITH STATUS
02	1	BINARY INPUT CHANGE WITHOUT TIME
02	2	BINARY INPUT CHANGE WITH TIME
10	1	BINARY OUTPUT
10	2	BINARY OUTPUT STATUS
12	1	CONTROL RELAY OUTPUT BLOCK
20	1	32-BIT BINARY COUNTER
20	2	16-BIT BINARY COUNTER
21	5	32-BIT FROZEN COUNTER WITH TIME OF FREEZE
30	1	32-BIT ANALOG INPUT
30	2	16-BIT ANALOG INPUT
30	3	32-BIT ANALOG INPUT WITHOUT FLAG
30	4	16-BIT ANALOG INPUT WITHOUT FLAG
31	3	32-BIT FROZEN ANALOG INPUT WITH TIME
50	1	TIME AND DATE
52	2	TIME DELAY FINE
60	1	CLASS 0 DATA
60	2	CLASS 1 DATA
60	3	CLASS 2 DATA
60	4	CLASS 3 DATA
80	1	INTERNAL INDICATIONS
83	1	PRIVATE REGISTRATION OBJECT

Data Recording Control

Data recording can be controlled via DNP object G83V01 write operations. The following table lists supported PRN values and their corresponding functionality.

PRN	DATA
0	Set data recording period, in milliseconds (4 bytes), 0 == Off
5	Analog point data recording Enable == 1, Disable == 0 (1 byte), point index (4 bytes)
6	Counter data recording Enable == 1, Disable == 0 (1 byte), point index (4 bytes)
7	Status point data recording Enable == 1, Disable == 0 (1 byte), point index (4 bytes)

DNP 3.0 Master (**DNPM**)

DNP master communicates with external DNP slave stations. The master

- Forwards messages received from the local, concurrently running DNP slave to remote slave stations (store and forward routing)

- Stores replies from external slaves, and forwards them to the local, concurrently running DNP slave (store and forward routing)
- Stores unsolicited reports from external slaves, and forwards them to the local, concurrently running DNP slave (store and forward routing)

Master functions are not available when two slaves are being used. For supported DNP objects please see the table in the *DNP 3.0 Slave (DNPS)* section.

Modbus Slaves

Modbus slaves communicate with assigned external master stations. Two independent, asynchronous slaves are available, one on each port. When both slaves are mapped to the same communications port, secondary slave is disabled.

Base Register Map

Complexity of NeXGen platform prohibits existence of one simple register map. The map changes as programming of the instrument changes. For this reason a 'base' register map exists, in a sense a map of maps (metadata), which publishes numeric values for all other register maps for a given instrument configuration that is in effect at the time when the base register map is downloaded.

Register Number	Symbol	Description
0	AN	Base register # for analog points (including PowerPoll).
1	NAN	Number of analog point registers (including PowerPoll), including point addresses
2	A0	Base register # for analog points Min. values
3	NA0	Number of analog point Min. value registers, including point addresses
4	A1	Base register # for analog points Max. values
5	NA1	Number of analog point Max. value registers, including point addresses
6	A2	Base register # for analog points Ave. values
7	NA2	Number of analog point Ave. value registers, including point addresses
8	CN	Base register # for counters
9	NCN	Number of counter registers, including point addresses
10	ST	Base register # for status points
11	NST	Number of status point registers, including point addresses
12	CT	Base register # for control points
13	NCT	Number of control point registers, including point addresses

14	DC	Base register # for data recording control
15	NDC	Number of registers for data recording control
16	DL	Base register # for data recording downloads
17	NDL	Number of registers for data recording downloads
18	NPT	Base register number for programming of the unit - unit time
19	NNPT	Number of registers used for transferring time from master to unit
20	P0	Base register number for programming of the unit - unit configuration
21	NP0	Number of registers used for transferring unit configuration
22	P1	Base register number for programming of the unit - I/O point attributes
23	NP1	Number of registers used for transferring unit configuration - I/O point attributes
24	P2	Base register number for programming of the unit - DNP configuration
25	NP2	Number of registers used for transferring unit configuration - DNP configuration
26	P3	Base register number for programming of the unit - Modbus configuration
27	NP3	Number of registers used for transferring unit configuration - Modbus configuration

Current Data Register Map

To poll for current data, a master uses values obtained from the base table. Let ‘R’ represent a general register symbol (AN, AP, CN, etc.), and let ‘NR’ represent the number of those registers obtained from the same table. Standard Modbus (16 bit registers) Latest Data map looks like this:

Byte No.	Reg. No.	Item
0	R	Point Index – MSB
1	R	Point Index
2	R + 1	Point Index
3	R + 1	Point Index – LSB
4	R + 2	Point Value – MSB
5	R + 2	Point Value
6	R + 3	Point Value
7	R + 3	Point Value – LSB
8	R + 4	Point Index – MSB
Etc.		

Enron Modbus (32 bit registers) Latest Data map looks like this:

Byte No.	Reg. No.	Item
0	R	Point Index – MSB
1	R	Point Index
2	R	Point Index
3	R	Point Index – LSB
4	R + 1	Point Value – MSB
5	R + 1	Point Value
6	R + 1	Point Value
7	R + 1	Point Value – LSB
8	R + 2	Point Index – MSB
Etc.		

Example: Suppose an instrument, running standard Modbus (registers are 16 bits wide), has four counters with addresses 0, 1, 2, 3, but only three of them are enabled – 0, 1, and 3 (pulse counter #2 is disabled). Suppose one wants to poll for values of the three enabled counters (R = CN), and suppose that polling base register map returns R = CN = 1000, and NR = NCN = 12. In this case, the counter portion of Latest Data table looks like this:

Byte No.	Reg. No.	Item
0	1000	0
1	1000	0
2	1001	0
3	1001	0
4	1002	Point Value – MSB
5	1002	Point Value
6	1003	Point Value
7	1003	Point Value – LSB
8	1004	0
9	1004	0
10	1005	0
11	1005	1
12	1006	Point Value – MSB
13	1006	Point Value
14	1007	Point Value
15	1007	Point Value – LSB
16	1008	0
17	1008	0
18	1009	0
19	1009	3

20	1010	Point Value – MSB
21	1010	Point Value
22	1011	Point Value
23	1011	Point Value – LSB

In above case, function 03 poll needs to request 12 registers, starting with register address 1000.

In general, Modbus function 03 poll needs to request base register address R, and number of registers 4*NR (2*NR for Enron Modbus). If more registers are requested, only number of registers available is returned. If fewer registers are requested, only requested number of registers is returned.

In order to be able to retrieve all current data with a single poll, the following equations can always be assumed to be true:

A0 = AN + NAN
A1 = A0 + NA0
A2 = A1 + NA1
CN = A2 + NA2
ST = CN + NCN
CT = ST + NST

This means that data mapping listed in base register map registers 0 – 13 is made contiguous. So to poll for all current data, Modbus 03 function call with base register number AN, and number of registers 4*(NAN + NCN + NST + NCT + NA0 + NA1 + NA2) needs to be made (once again, above multiplier is 2 instead of 4 in case of Enron Modbus).

One should be aware of Modbus protocol limitations though. Response length limit is governed by the ‘Number of Bytes’ field which is 8 bits wide. Maximum number of data bytes in a response is, therefore, limited to 256. For standard Modbus flavors (16 bit registers) this means at most 128 registers can be returned at any one time, while Enron flavors of Modbus (32 bit registers) can only return 64 registers at a time.

Data Recording Control

Data recording can be controlled by writing to register DC, and adjacent registers. Number of registers is not to exceed NDC. The following tables show register values and interpretation:

Register#	Data
DC	PRN (See table below)
DC + 1	Data, as needed per PRN (above) and table (below)
DC + 2	Data, as needed per PRN (above) and table (below)
DC + 3	Data, as needed per PRN (above) and table (below)

PRN	DATA
0	Set data recording period, in milliseconds (4 bytes, one register for Enron format, two registers otherwise), 0 == Off
5	Analog point data recording Enable == 1, Disable == 0 (1 byte, one register), point index (4 bytes, one register for Enron format, two registers otherwise).
6	Counter data recording Enable == 1, Disable == 0 (1 byte, one register), point index (4 bytes, one register for Enron format, two registers otherwise).
7	Status point data recording Enable == 1, Disable == 0 (1 byte), point index (4 bytes, one register for Enron format, two registers otherwise).

Data Recording Control Example

Message To NeXGen - Turn on Data Recording, period = 1 minute
01 - NeXGen Address
10 - Function 16
05 - Start Address Hi
00 - Start Address Lo
00 - No. of Registers Hi
03 - No. of Registers Lo
06 - Byte Count
00 - PRN Hi
00 - PRN - Lo
00 - Data Recording Milliseconds
00 - Data Recording Milliseconds
EA - Data Recording Milliseconds
60 - Data Recording Milliseconds
B8 - CRC
04 - CRC

Response From NeXGen
01 - NeXGen Address
10 - Function 16
05 - Start Address Hi
00 - Start Address Lo

00 - No. of Registers Hi
03 - No. of Registers Lo
80 - CRC
C4 - CRC

Message To NeXGen - Start data recording on one analog point, point address = 1
01 - NeXGen Address
10 - Function 16
05 - Start Address Hi
00 - Start Address Lo
00 - No. of Registers Hi
04 - No. of Registers Lo
08 - Byte Count
00 - PRN Hi
05 - PRN - Lo
00 - Data Recording Enable / Disable Hi
01 - Data Recording Enable / Disable Lo
00 - Point Address
00 - Point Address
00 - Point Address
01 - Point Address
13 - CRC
7F - CRC

Response From NeXGen
01 - GCU Address
10 - Function 16
05 - Start Address Hi
00 - Start Address Lo
00 - No. of Registers Hi
04 - No. of Registers Lo
C1 - CRC
06 - CRC

Data Downloads

Data downloads are done by writing to register DL, and adjacent registers. Number of registers is not to exceed NDL. The following table shows register values and interpretation:

Each download of data recorded by the unit is done in two steps:

First, download request parameters are uploaded (written to unit registers) per tables below.

Register#	Data
DL	PRN, 1 = analog point data, 2 = counter data, 3 = status point data (4 bytes, one register for Enron format, two registers otherwise)
DL + …	Data, as needed per PRN (above) and table (below)

# of bytes	DATA
6	Oldest time stamp of data to download, 48 bit AT format.
4	I/O point index (address) (One register for Enron format, two registers otherwise)
4	Max. number of readings to download (One register for Enron format, two registers otherwise)

Second, data is downloaded per above request by requesting maximum number of readings, starting with register number DL. The unit returns maximum number of readings worth of data or less, depending on whether enough data is available. For regular Modbus flavors (16 bit registers), downloaded data is returned as shown below:

Register#	Data
DL	Bytes 5 and 4 of AT format time stamp.
DL + 1	Bytes 3 and 2 of AT format time stamp.
DL + 2	Bytes 1 and 0 of AT format time stamp.
DL + 3	Bytes 3 and 2 of I/O point value
DL + 4	Bytes 1 and 0 of I/O point value

For Enron Modbus flavors (32 bit registers), downloaded data is returned as shown below:

Register#	Data
DL	Bytes 5 and 4 of AT format time stamp.
DL + 1	Bytes 3, 2, 1, and 0 of AT format time stamp.
DL + 2	I/O point value

Data Downloads Example

Below is example of data download conversation with NeXGen, in Modbus. Please note, all internal NeXVar™ time stamps are UTC time, so time keeping within units is invariant with respect to time zones:

Message To NeXVar™ - Request Data Newer than 12/4/2010 11:10:00 Eastern Time, No More than 10 values Max.:

01 - NeXVar Address
10 - Function 16
06 - Start Address Hi
00 - Start Address Lo
00 - No. of Registers Hi
08 - No. of Registers Lo
10 - Byte Count
00 - PRN Hi
01 - PRN Lo
01 - AT Time - MSB
2C - AT Time
B2 - AT Time
DD - AT Time
A9 - AT Time
20 - AT Time - LSB
00 - Point Address
00 - Point Address
00 - Point Address
01 - Point Address
00 - Max Readings
00 - Max Readings
00 - Max Readings
0A - Max Readings
0A - CRC
FB - CRC

Response From NeXVar - Standard Modbus Function Confirmation 16 Response

01 - NeXVar Address
10 - Function 16
06 - Start Address Hi
00 - Start Address Lo
00 - No. of Registers Hi
08 - No. of Registers Lo
C1 - CRC
47 - CRC

Message To NeXVar - Download Data Specified in Above Request
01 - NeXVar Address

03 - Function 3
06 - Start Address Hi
00 - Start Address Lo
00 - No. of Registers Hi
80 - No. of Registers Lo
44 - CRC
E2 - CRC

Message From NeXVar - Requested Data

01 - NeXVar Address
03 - Function 3
6E - Byte Count
01 - AT Time Stamp
2C - AT Time Stamp
B2 - AT Time Stamp
DE - AT Time Stamp
93 - AT Time Stamp
A8 - AT Time Stamp
00 - Point Value
00 - Point Value
00 - Point Value
00 - Point Value
01 - AT Time Stamp
2C - AT Time Stamp
B2 - AT Time Stamp
DF - AT Time Stamp
7E - AT Time Stamp
09 - AT Time Stamp
00 - Point Value
00 - Point Value
00 - Point Value
00 - Point Value
01 - AT Time Stamp
2C - AT Time Stamp
B2 - AT Time Stamp
E0 - AT Time Stamp
68 - AT Time Stamp
64 - AT Time Stamp
00 - Point Value
00 - Point Value
00 - Point Value
00 - Point Value
01 - AT Time Stamp
2C - AT Time Stamp

B2 - AT Time Stamp
E1 - AT Time Stamp
52 - AT Time Stamp
D6 - AT Time Stamp
00 - Point Value
00 - Point Value
00 - Point Value
00 - Point Value
01 - AT Time Stamp
2C - AT Time Stamp
B2 - AT Time Stamp
E2 - AT Time Stamp
3D - AT Time Stamp
30 - AT Time Stamp
00 - Point Value
00 - Point Value
00 - Point Value
00 - Point Value
01 - AT Time Stamp
2C - AT Time Stamp
B2 - AT Time Stamp
E3 - AT Time Stamp
27 - AT Time Stamp
82 - AT Time Stamp
00 - Point Value
00 - Point Value
00 - Point Value
00 - Point Value
01 - AT Time Stamp
2C - AT Time Stamp
B2 - AT Time Stamp
E4 - AT Time Stamp
11 - AT Time Stamp
E5 - AT Time Stamp
00 - Point Value
00 - Point Value
00 - Point Value
00 - Point Value
01 - AT Time Stamp
2C - AT Time Stamp
B2 - AT Time Stamp
E4 - AT Time Stamp
FC - AT Time Stamp
47 - AT Time Stamp
00 - Point Value
00 - Point Value

00 - Point Value
00 - Point Value
01 - AT Time Stamp
2C - AT Time Stamp
B2 - AT Time Stamp
E5 - AT Time Stamp
E6 - AT Time Stamp
AA - AT Time Stamp
00 - Point Value
00 - Point Value
00 - Point Value
00 - Point Value
01 - AT Time Stamp
2C - AT Time Stamp
B2 - AT Time Stamp
E6 - AT Time Stamp
D1 - AT Time Stamp
0C - AT Time Stamp
00 - Point Value
00 - Point Value
00 - Point Value
00 - Point Value
01 - AT Time Stamp
2C - AT Time Stamp
B2 - AT Time Stamp
E7 - AT Time Stamp
BB - AT Time Stamp
6F - AT Time Stamp
00 - Point Value
00 - Point Value
00 - Point Value
00 - Point Value
40 - CRC
47 - CRC

Control Point Operation

Control point operation via Modbus can be done in one of two ways:

1. Using a single function 16 message, as shown in the table below (example in Modbus RTU flavor):

Byte (hex value)	Interpretation
11	Unit address (in this example address = 17)
10	Modbus Function (16)
CT – Hi	Hi byte of value of CT (from base register map)

CT – Lo	Lo byte of value of CT (from base register map)
00	Hi byte for Number of registers
02	Lo byte for number of registers
04	Byte count (this value = 8 for Enron flavors of Modbus)
00	Hi byte of control point address (in this example address = 2)
02	Lo byte of control point address (in this example address = 2)
TT	Hi byte – point state parameters (see below)
OP	Lo byte – point state parameters (see below)
CRC – Hi	Hi byte – CRC
CRC – Lo	Lo byte – CRC

One can choose the following TT and OP values from the table below:

OP	Meaning	Supported TT Values
00	Latched Operation	TT > 0 for ON, TT = 0 for OFF
01	Timed Operation	TT > 0 (in minutes) for OFF, TT = 0 for ON
02	Timed Operation	TT > 0 (in minutes) for ON, TT = 0 for OFF
03	Momentary Op.	TT > 0 (in milliseconds) for ON, TT = 0 for OFF
04	Momentary Op.	TT > 0 (in milliseconds) for OFF, TT = 0 for ON

2. Using two messages. First, Modbus function 6 message writes time (pulse duration) to a register as shown below (example in Modbus RTU flavor):

Byte (hex value)	Interpretation
11	Unit address (in this example address = 17)
06	Modbus Function (6)
CT – Hi	Hi byte of value of CT (from base register map)
CT – Lo	Lo byte of value of CT (from base register map)
00	Hi byte of duration (in this example 15 milliseconds)
0F	Lo byte of duration (in this example 15 milliseconds)
CRC – Hi	Hi byte – CRC
CRC – Lo	Lo byte – CRC

Second, Modbus function 5 message sets a ‘coil’ to activate the command.

Byte (hex value)	Interpretation
11	Unit address (in this example address = 17)
05	Modbus Function (5)

00	Hi byte of control point address (in this example address = 2)
02	Lo byte of control point address (in this example address = 2)
OP	Hi byte – point state parameters (see below)
00	Lo byte – point state parameters (always 00)
CRC – Hi	Hi byte – CRC
CRC – Lo	Lo byte – CRC

Above, OP = FF for ON, 00 for OFF.

Data Sampling

CCDC scans all analog, counter, and status inputs, as well as control outputs on attached I/O board, and records the readings once every 100 milliseconds (default). This period is parameterized and can be changed. At the time of each scan, all computed values (Min., Max., and Ave.) are also updated.

Data Events

Sampled data is analyzed; events are generated if so configured. Globally, event generation must be enabled. On a point by point basis, an I/O point generates an event if the following conditions are satisfied:

- The point is enabled,
- The point's event generation is enabled,
- The point's chatter filter is not active (see below),
- The point class is 1, 2, or 3 (but not 0),
- The point event triggering condition has occurred.

Event triggering conditions vary by point type:

- Analog points must cross value region (high, OK, low) thresholds
- Counters must change by more than pre-configured amount
- Status points must change state
- Control points must change state

I/O point chatter filter is active when point inactivity period is defined, and previous event occurred less than that amount of time ago. Chatter filtering can be turned off on a point by point basis.

Events are reported quiescently (if so configured) or by polling. Unsolicited reports can be of two types, depending on configuration:

- Notification Only – report notifies the master that there is event data. It is up to the master to poll for event data when convenient.

- All Data – all event data is reported to the master station.

Default DNP objects used by CCDC to report event data quiescently are as follows:

- Analog Points – Group 31, Variation 03
- Counters – Group 21, Variation 05
- Status Points – Group 02, Variation 02
- Control Points – Group 10, Variation 02

Except for control points, above objects are used because they contain event date and time information.

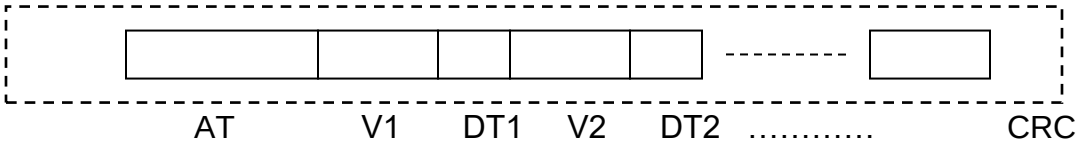
Data Recording

Data recording can be configured by NTMC, or NGC (RTU database upload). Every I/O point can be individually configured to record data. The following conditions need to be satisfied for I/O point data to be recorded:

- Data recording must be enabled globally
- Data recording interval must be defined (one interval for all I/O points)
- I/O point must be enabled
- Data recording must be enabled locally (I/O Point)

In addition,

- Data recording cannot be enabled until TSB is set to TRUE. This is to make sure that RTC has been set. – see time-keeping above.
- Data recording parameters (record schema, sampling frequency, etc) are defined in station configuration record.
- To minimize the number of writes onto serial flash disk, every sampling period all readings are stored as one record. Record structure is indicated below.



Above:

- AT = Absolute Time when measurement of all quantities in the record began.
- V1 = Value of the first measured item (number of bytes depends on item)
- DT1 = Number of milliseconds after AT when V1 was measured (1 byte)

- V2 = Value of the second measured item (number of bytes depends on item)
- DT2 = Number of milliseconds after AT when V2 was measured (1 byte)
- CRC = Checksum of the record

Each record lists values in the following order:

- Analog values (enabled I/O points only, if any) (4 bytes each)
- Counters (enabled I/O points only, if any) (4 bytes each),
- Status values (enabled I/O points only, if any) (1 byte each)
- Control point Boolean values (enabled I/O points only, if any) (TRUE / FALSE) (1 byte each).

Data Recording Startup Sequence

At startup, once data recording has been initialized and enabled, CCDC goes through the following steps to start data recording:

- Serialized record structure is constructed from data recording record schema in station's configuration database.
- The latest (newest) record in data recording database is tested for integrity and verified to be the latest record on file by using indexes stored in battery backed up RAM (BBRAM). If this fails (failure may occur after firmware update, battery replacement, etc), serial flash disk pages are scanned to find the last (newest) record in data recording database.
- Wait until after TSB is set to TRUE.
- Schedule the next data recording

Error Events

CCDC reports errors via DNP event mechanism when CCDC_ERROR_EVENT_PRINTOUTS is not defined. When an error occurs, a pair of 32 bit unsigned integer values is generated. Both values are reported as DNP class 1 events associated with a pair of analog points with respective addresses 0xFFE (4094) and 0xFFF (4095). The first value register (reported as analog value at address 0xFFE) is partitioned as follows:

- Event Identifier (bits – 0 – 7, bit 0 = lsb)
- Source file id (bits 8 – 15)
- Source file line number (bits 16 – 29)
- Event log entry value type (bits 30 – 31)

The second value register (reported as analog value at address 0xFFF) is filled with entry value, if any. The tables below list the various identifiers in the first register.

Error Event Identifiers – System Resources

0	System restart
1	Memory allocation failure
2	Serial port open failure
3	Failed to send data via RS232 port
4	Failed to initialize serial flash disk
5	Serial flash disk page read failed
6	Serial flash disk RAM read failed
7	Serial flash disk RAM write failed
8	Serial flash disk page write failed
9	System restart requested

Error Event Identifiers – System Miscellaneous

50	Copy from root to xtended memory (root2xmem) failure
51	Copy from xtended memory to root(xmem2root) failure
52	Destination buffer too short
53	General assertion failure
54	Index out of bounds condition has occurred
55	Sorting of an array failed
56	This station database version mismatch
57	Serial Flash Disk page too short
58	This station database CRC mismatch
59	Failed to set this station time
60	Failed to sample data
61	Data recording record larger than SFD page
62	Data recorder failed to locate oldest record on SFD
63	Failed to record data
64	Failed to generate a data event
65	Master station does not generate events
66	Data manager received request for unrecognized I/O point type
67	Data recording ON/OFF operation failed
68	Data manager failed to record data recording period
69	Timer reporting PT to AT conversion failed
70	Timer reporting AT to PT conversion failed
71	Timer reporting PT of last Top Of Hour failed
72	Timer reporting failed time computation
73	Data manager was asked to set recording period too high - max limit enforced
74	Data manager was asked to set recording period too low - min limit enforced
75	Data manager failed to schedule the next data recording cycle

76	Invalid (null) buffer address
77	Analog input out of specified range (overflow)

Error Event Identifiers – DNP Data Link

100	Incoming message too long
101	Incoming message too short
102	DNP data link frame de-serialization failed
103	DNP data link frame contains incorrect number of blocks
104	DNP data link frame integrity bad
105	DNP data link frame header block has incorrect length
106	DNP data link frame header block first byte bad
107	DNP data link frame header block second byte bad
108	DNP data link frame block CRC bad
109	DNP data link frame block length bad
110	DNP data link source and destination addresses equal
111	DNP data link frame had insufficient data
112	DNP data link frame serialization failed
113	DNP data link response function (ACK, NACK, LINK_STATUS) received illegal function argument
114	DNP data link ACK not sent
115	DNP data link NACK not sent
116	DNP data link LINK_STATUS not sent
117	DNP data link RESET LINK STATE not sent
118	DNP data link RESET USER PROCESS not sent
119	DNP data link USER DATA not sent
120	DNP data link TEST REMOTE LINK not sent
121	DNP data link USER DATA WITH COMFIRM not sent
122	DNP data link function received unsupported function code request
123	DNP data link function received user data which is too long
124	DNP data link failed to receive response from a station
125	DNP data link reporting route table full

Error Event Identifiers – DNP Transport Layer

150	DNP transport layer missing a specific segment, message incomplete
151	DNP transport layer missing segment(s), message incomplete
152	DNP transport layer failed to send message to specified station address

Error Event Identifiers – DNP Application Layer

200	DNP application layer fragment too short
201	DNP application layer received bad range specifier code
202	DNP application layer received a non-first fragment while no message was accumulating, fragment discarded
203	DNP application layer missing a specific fragment, message incomplete
204	DNP application layer missing fragment(s), message incomplete
205	DNP application layer failed to send message to outstation

206	DNP application layer received bad range (start & stop) values
207	DNP application layer fragment contains insufficient data to deserialize an object
208	DNP application layer failed to deserialize object group
209	DNP application layer received bad offset value
210	DNP application layer received bad index size value
211	DNP application layer received bad object type value
212	DNP application layer received bad function code value
213	DNP application layer failed to save object group data to this station
214	DNP application layer received message from station reporting restart
215	DNP application layer failed to arm (select) control point(s)
216	DNP application layer failed to operate control point(s)
217	DNP application layer source object size undefined
218	DNP application layer private registration object contains unknown vendor id
219	DNP application layer received bad private object registration number
220	DNP application layer object contains insufficient data
221	DNP application layer failed to execute routing management command

Source File Identifiers

0	IOBoard.lib
1	BigDig.lib
2	Timer.lib
3	Buffer.lib
4	SerialFlqashDisk.lib
5	Array.lib
6	SerialPort.lib
7	Ethernet.lib
8	CommChannel.lib
9	IOPoint.lib
10	ControlPoint.lib
11	StatusPoint.lib
12	CounterPoint.lib
13	AnalogPoint.lib
14	Config.lib
15	DataManager.lib
16	OutMsgQueItem.lib
17	OutMsgQue.lib
18	DnpCfg.lib
19	DnpStation.lib
20	DnpFrame.lib
21	DnpDataLink.lib
22	DnpSegment.lib

23	DnpTspLayer.lib
24	DnpObject.lib
25	DnpObjectGroup.lib
26	DnpFragment.lib
27	DnpAppLayer.lib
28	DnpClient.lib
29	DnpServer.lib
30	DnpI.lib
31	ThisStation.lib
32	ModbusI
33	ModbusCfg

Event Log Entry Value Types

0	None (No entry)
1	Signed 16 bit integer
2	Unsigned 16 bit integer
3	Unsigned 32 bit integer

Message Routing (Store and Forward)

Routes must be used when the master station cannot directly communicate with one or more units in the field. This can be because those units are too far, or they may be obstructed so direct line of communication is not possible, etc.

Routing is implemented in the Data Link layer over standard DNP in such a way as to remain fully compatible with DNP. DNP messages contain routing information in the N most significant bits of their destination address as part of standard DNP addressing, where N is a number between 0 (no routing) and 8. In addition, route users (see definition below) need not be units running CCDC, i.e. they can communicate with the master station via above described network using standard DNP. In other words, route users can be built by any vendor, running standard DNP, as long as they are addressed between 1 and 2**(16-N) - 1.

When so configured, DNP slave can store and forward messages to the local DNP master, and vice versa. This capability makes NeXGen units running CCDC capable of storing and forwarding messages to neighboring units, thus forming a DNP network. This network has the following properties:

- It contains one, centrally located master station (star topology)
- Each unit can be configured as store and forward message repeater (router)
- There can be up to (2**N)-1 routes in the network, i.e. each unit can be a member of up to (2**N) -1 routes.
- Routes can cross, i.e. they can share arbitrary number of units.

- Units doing the routing (repeaters) need to have equal DNP master and slave addresses.

A distinction needs to be made between *route members* (store and forward repeaters), and *route users* (units communicating with the master station via above described network, but not themselves forwarding DNP messages). As far as firmware is concerned, there can be

1. Up to (2**N) -1 routes in a network,
2. Up to 2**(16-N) - 1route members per route
3. Up to 2**(16-N) - 1route users.

Practical limitations, such as timing, reduce these numbers to lower values.

APPENDIX A

Troubleshooting

Problem	Potential Cause	Suggestion	Caution Status
Screen not active	No line power to PCB	Power down the NeXVar. Remove the front panel. Check the AC-IN wires in the power input terminal block at J6. Confirm AC Neutral and Hot inputs are connected	
Screen not active	Resettable input power fuse may be tripped.	Power down the instrument. Unplug the main power. Allow the NeXVar to rest for approximately 20 minutes. Power-up the instrument and observe LEDs	
Screen is active, but CLOSE and TRIP relays do not cause capacitor switch to operate	Load Fuse may be blown, or missing	Check the load fuse and replace is blown or missing	

CLOSE and TRIP relays are operating in the absence of a remote or local command	Voltage override may be enabled	Confirm the Voltage Override program setting	ATTENTION
CLOSE/TRIP relays are not operating with remote commands	Instrument is improperly addressed.	Check the instrument address.	ATTENTION
Address is correct, but CLOSE/TRIP relays are not operating with remote commands	Instrument cannot communicate through wireless transceiver	Power down the NeXVar. Remove the front panel. Repower the NeXVar and check the instrument Rx / Tx LEDs at the transceiver connection point on the PCB. Confirm both the Rx and Tx lights are active.	ATTENTION

Screen is not active, or Wireless transceiver does not work, or Control serial communication does not work.	One or more of the instrument power supplies may be inoperable	Power down the NeXVar. Remove the front panel. Repower the NeXVar and check the instrument 5V, 13.8V and 3.3V LEDs at TP2, TP3 and TP4	DANGER