VAr-Min Companion Software

User Guide v1.2

For use with Valquest System Inc.
VAr-Min series Capacitor Control

Valquest Systems, Inc.

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Caution

The information contained in this document covers tasks related to installation, testing and operation of specific equipment and is intended for qualified personnel who are trained to work with this specific type of equipment. Personnel performing these tasks must understand the hazards of the job. Information provided in this manual is not a substitute for training. Safety procedures must be followed at all times. Refer to your locally approved safety procedures and safety instructions when working with high voltage equipment.

Safety

This manual and the instructions within are not intended as a substitute for proper training. Only competent technicians who are familiar with this type of equipment should install, maintain and operate it.

Overview

Software Version

Version 7.09.01 is covered in this manual. Version can be determined by opening the VAr-Min Companion Software and selecting Help > About from the top toolbar.

Introduction

This manual provides install instructions, operation procedures and more for the VAr-Min Companion Software. The VAr-Min Companion Software is designed to work with the VAr-Min series controllers.

Compatible Part Numbers

- VAr-Min VX1
- VAr-Min SR2
- VAr-Min VT2
- VAr-Min ZV3
- VAr-Min DT1

Installation

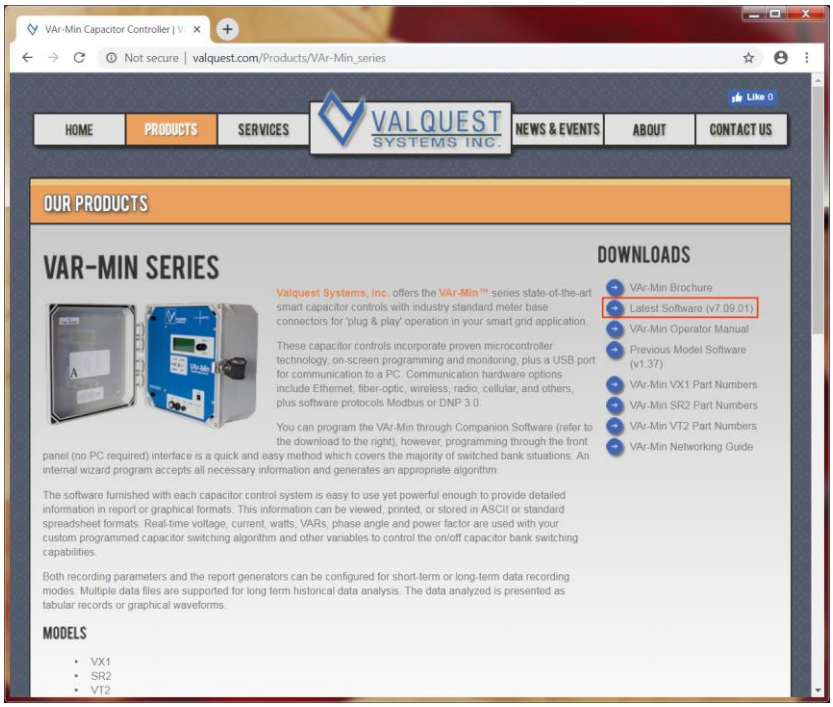
System Requirements

Processor Architecture: 32-bit or 64-bit
RAM: 1GB
Hard disk space: 500MB
Screen Resolution: 1280x1024 minimum
Operating System: Windows 7, 8.1, 10

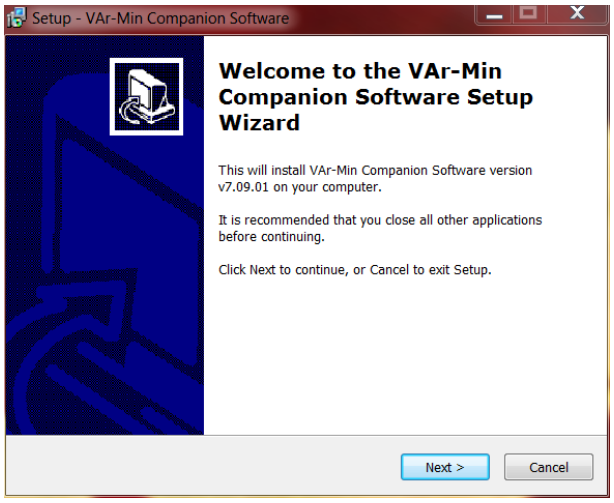
Install Software

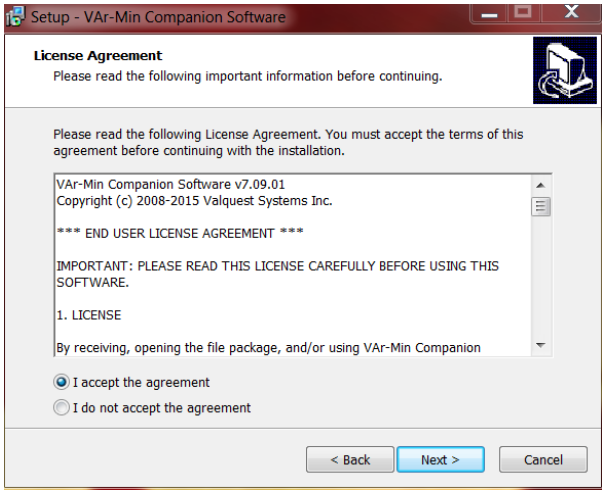
Installing the VAr-Min Companion Software requires a computer that meets the System Requirements0 above and the installation executable.

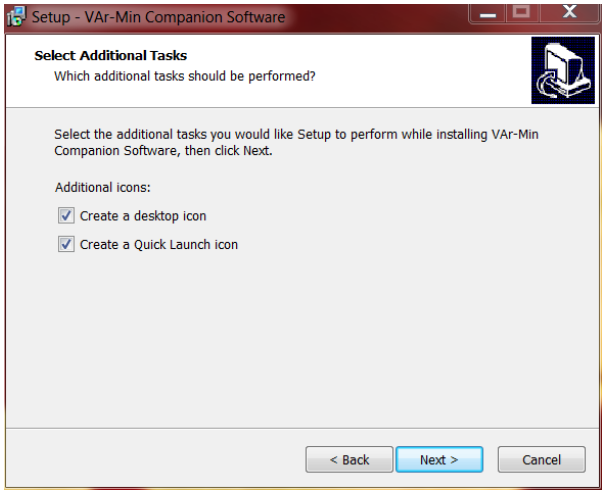
1. Go to http://valquest.com/Products/VAr-Min_series and select “Latest Software” on the right hand side of the screen to download the latest software version installer.

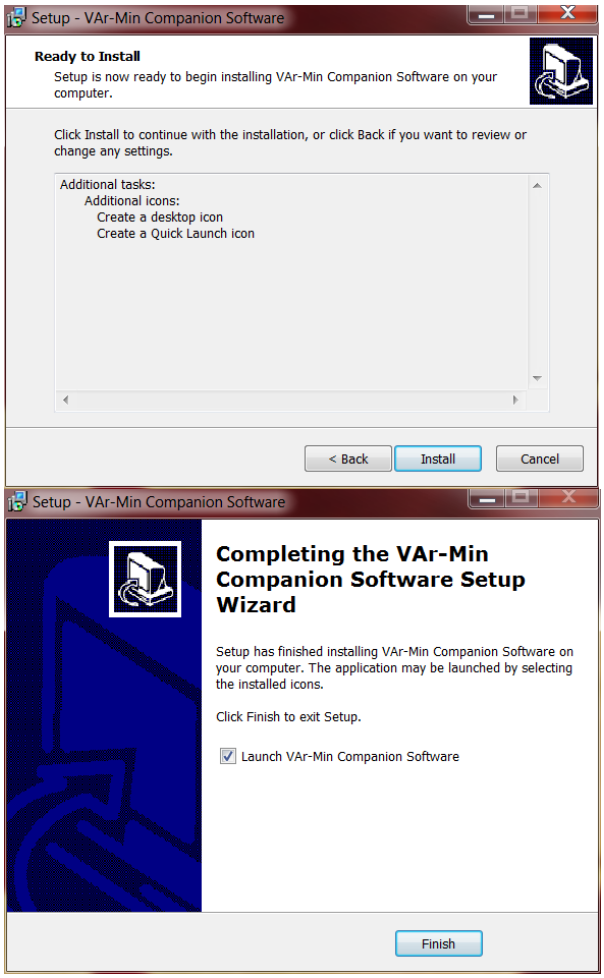


2. Open the software installer and follow the installer prompts shown below.


Setup - VAr-Min Companion Software
Welcome to the VAr-Min Companion Software Setup Wizard
This will install VAr-Min Companion Software version v7.09.01 on your computer.
It is recommended that you close all other applications before continuing.
Click Next to continue, or Cancel to exit Setup.
Next >
Cancel


Setup - VAr-Min Companion Software
License Agreement
Please read the following important information before continuing.
Please read the following License Agreement. You must accept the terms of this agreement before continuing with the installation.
VAr-Min Companion Software v7.09.01
Copyright (c) 2008-2015 Valquest Systems Inc.
*** END USER LICENSE AGREEMENT ***
IMPORTANT: PLEASE READ THIS LICENSE CAREFULLY BEFORE USING THIS SOFTWARE.
1. LICENSE
By receiving, opening the file package, and/or using VAr-Min Companion
I accept the agreement
I do not accept the agreement
< Back
Next >
Cancel


Setup - VAr-Min Companion Software
Select Additional Tasks
Which additional tasks should be performed?
Select the additional tasks you would like Setup to perform while installing VAr-Min Companion Software, then click Next.
Additional icons:
Create a desktop icon
Create a Quick Launch icon
< Back
Next >
Cancel



Connecting to the VAr-Min

Connecting over USB

The VAr-Min Companion Software allows for easy setup of the VAr-Min over the front panel USB port. The process below details the steps to connect the VAr-Min to the VAr-Min Companion Software.

1. Install the VAr-Min Companion Software. See (Installation).
2. Using the USB cable provided with your VAr-Min, plug one end into your VAr-Min (while powered) and the other end into your computer.
    a. Windows may attempt the scan for updated drivers. Allow this to finish.
3. Open the VAr-Min Companion Software.
    a. A label should appear at the bottom of the screen, indicating the status of the connected device. See (Connection Status page 10)
4. A window should pop-up automatically showing the device information. If this does not occur, select File > Read from the top toolbar.

User Interface

Connection Status

Communication status between the VAr-Min Companion Software and the VAr-Min is indicated on the bottom section of the software. These fields are updated automatically.

- **Model:** VAr-Min series
- **Serial Number:** Serial Number assigned at factory
- **Device ID:** ID that was selected by the end user
- **Firmware Version:** Version that is present on the connected VAr-Min

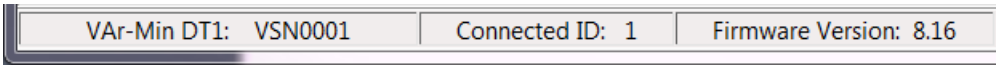


Figure 1: Connection Status (Example: VAr-Min Connection Good)

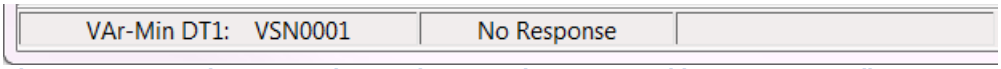


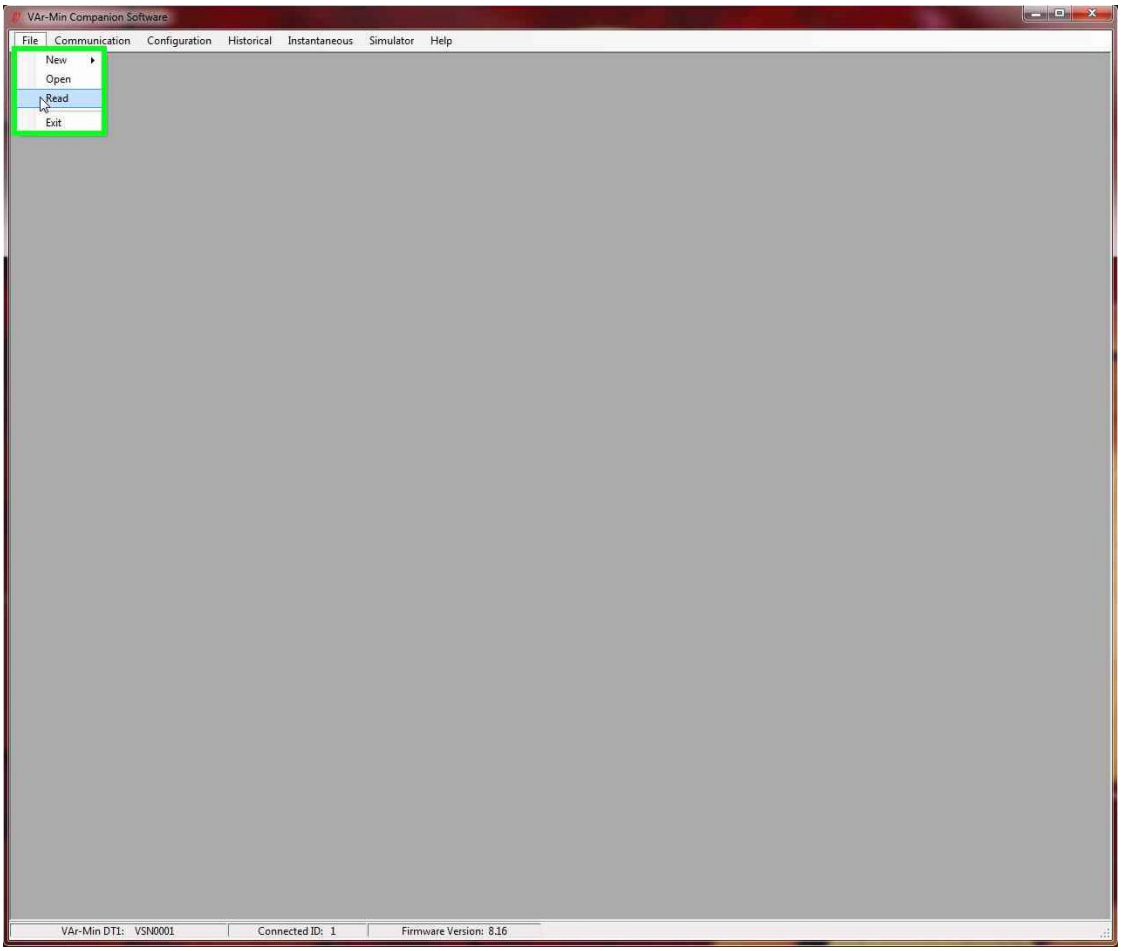
Figure 2: Connection Status (Example: VAr-Min Connected but not powered)

Figure 3: Connection Status (Example: No VAr-Min Recognized)

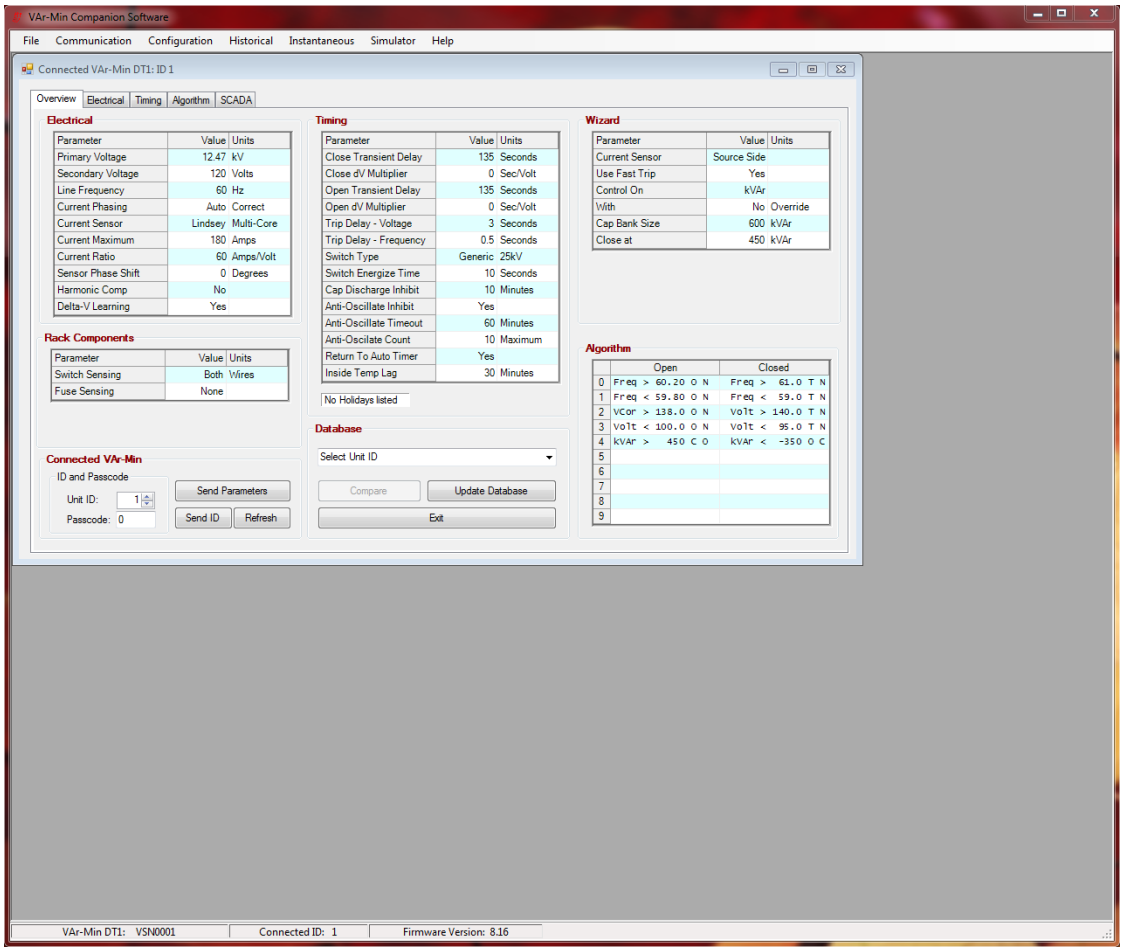
Program a VAr-Min

Change Single Control Configuration

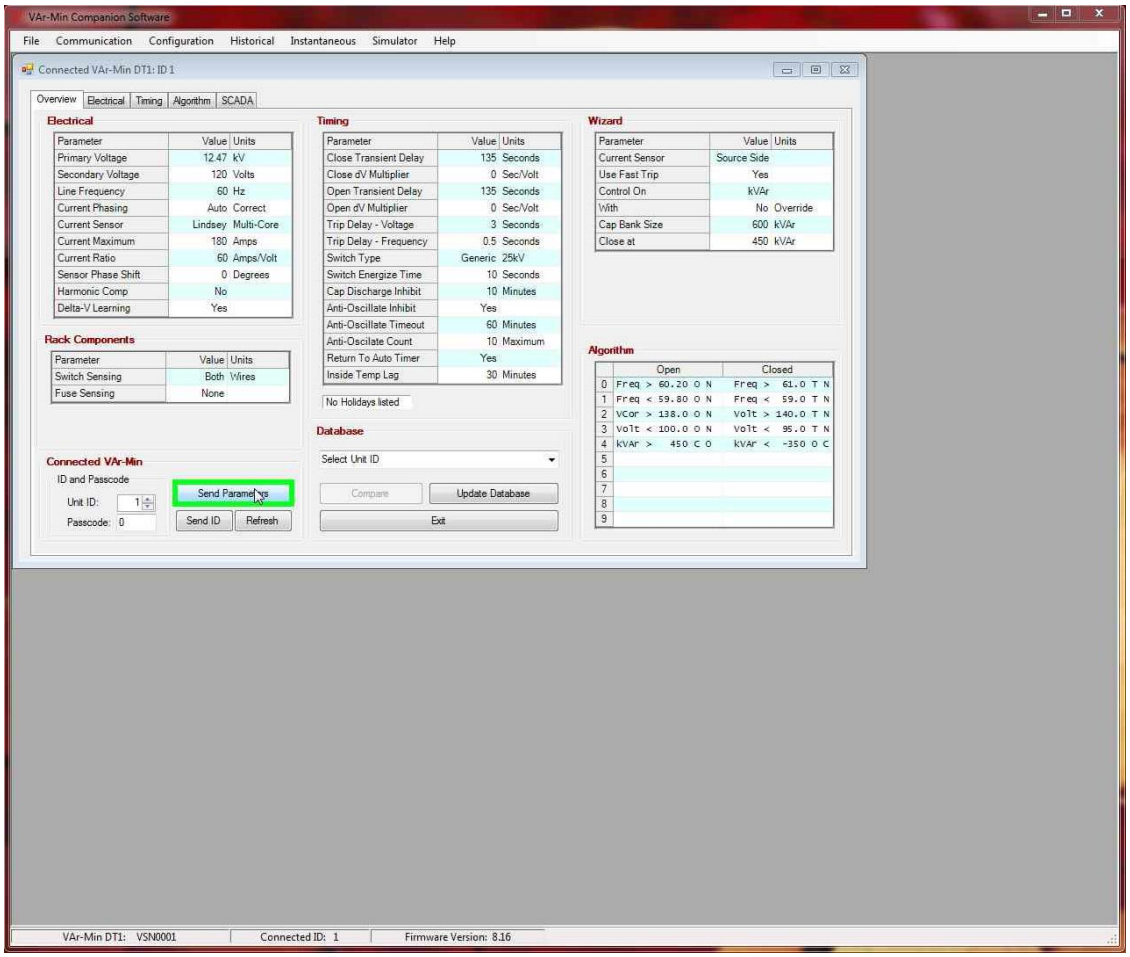
1. Verify VAr-Min is connected to the VAr-Min Companion Software, indicated in the Connection Status section at the bottom of the user interface.
2. Read current configuration from VAr-Min by selecting (File > Read) from the top menu bar.



3. You should see a new window pop up with the current information for the controller connected.



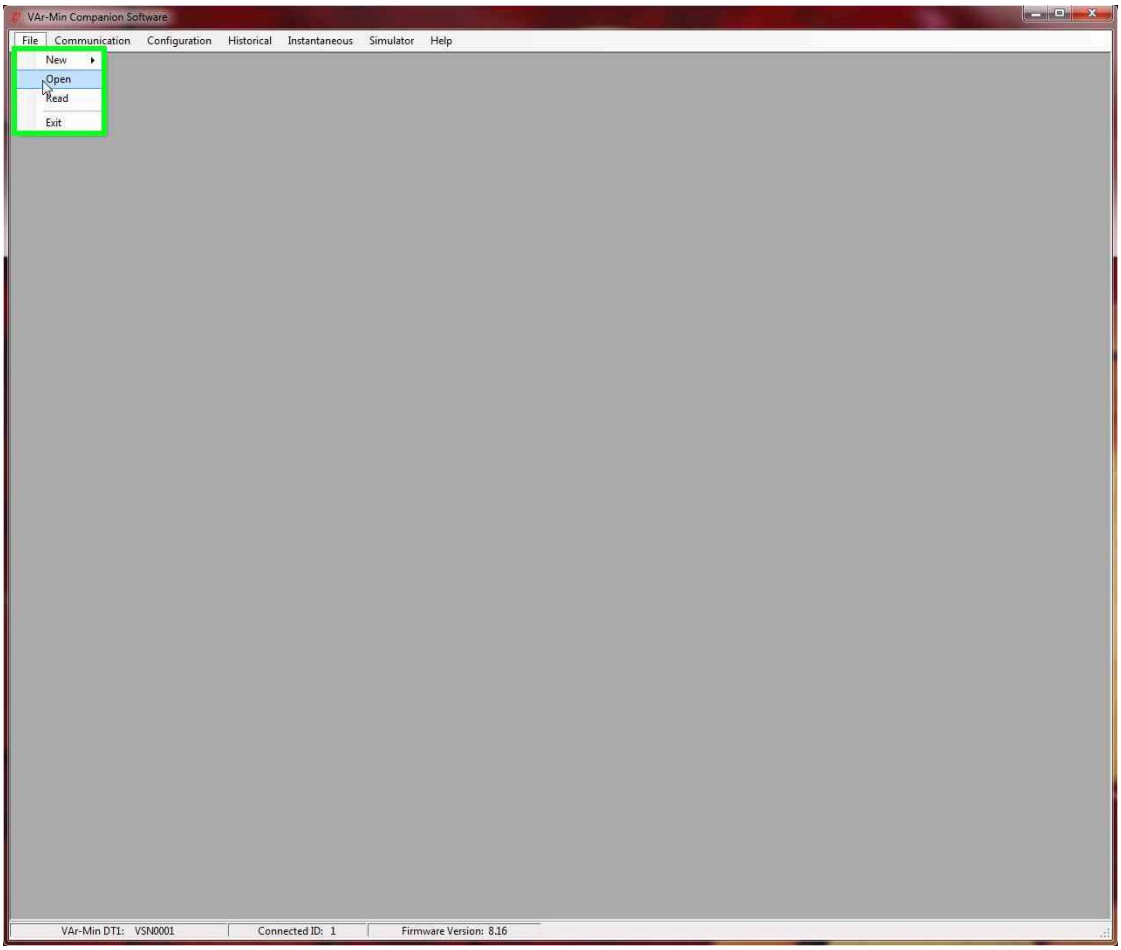
4. Use the Overview, Electrical, Timing, Algorithm and SCADA tabs to modify the entries you would like to change. Once changed, select “Send Parameters.”



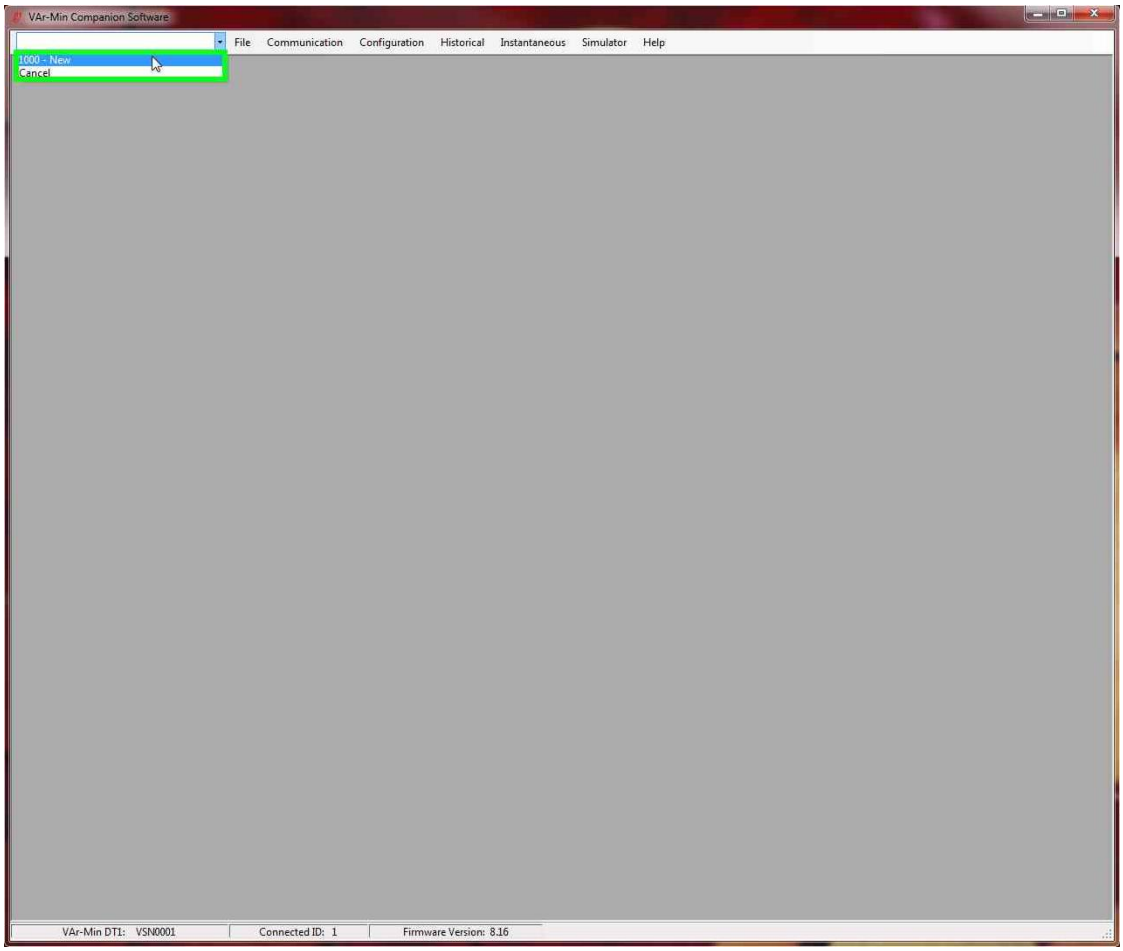
5. A confirmation pop up box will indicate the success of the transfer.

Use Configuration Saved Locally

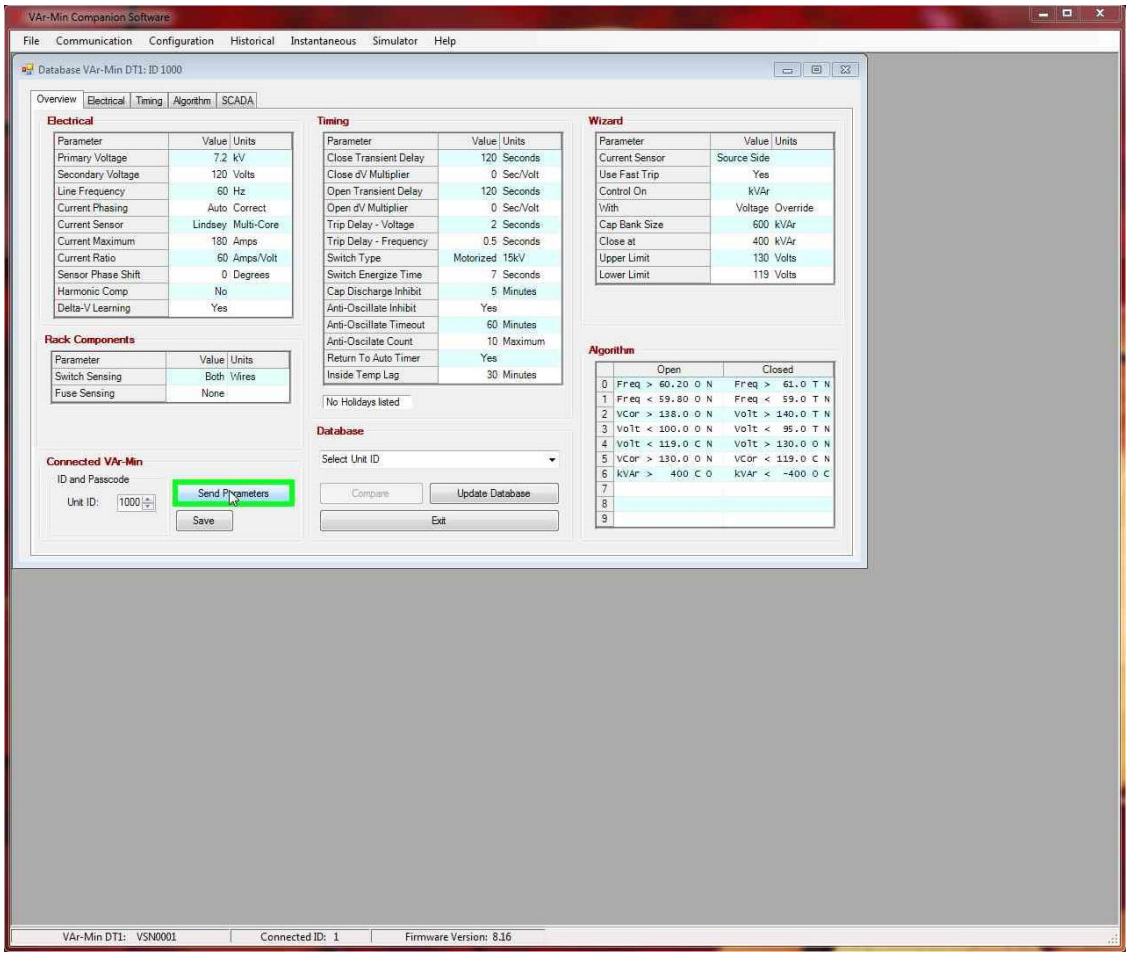
1. Verify VAr-Min is connected to the VAr-Min Companion Software, indicated in the Connection Status section at the bottom of the user interface.
2. Open the saved configuration you would like to program into the VAr-Min by selecting (File > Open).



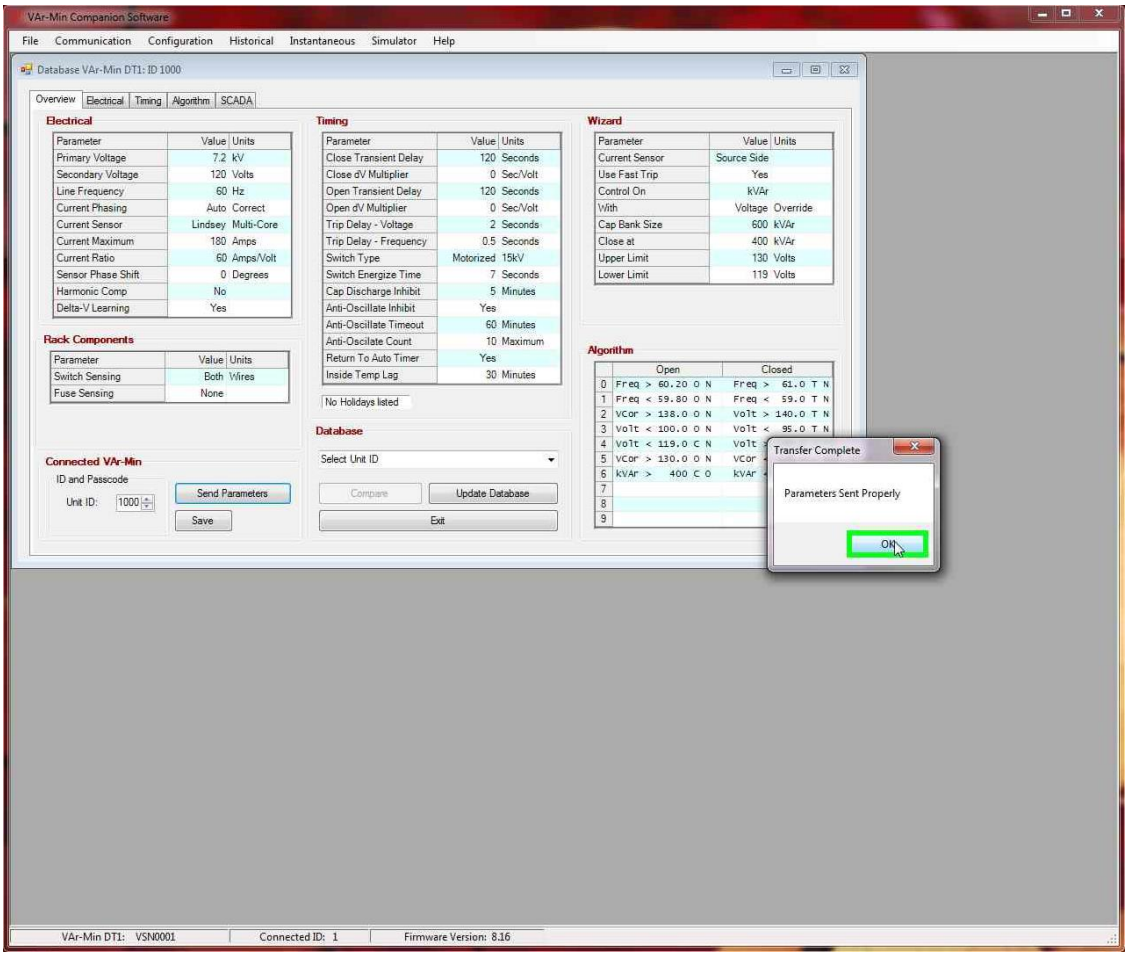
3. Select the configuration you would like to program into the VAr-Min from the list.



4. Select “Send Parameters.”



5. A confirmation pop up box will indicate the success of the transfer.



VAr-Min Configuration

The VAr-Min is programmed with a configuration that tells it the parameters of the system it will be installed in. This configuration can be viewed and changed through the VAr-Min Companion Software. The below sections cover the parameters that can be set in the control. Dependent upon the model being configured, some of these features may or may not be available. The program will indicate available features based on model.

Overview

The Overview screen provides an overview of the configuration for the VAr-Min. This includes parameters set in Electrical, Timing, Algorithm, Rack Components, and Database tabs. This is also where a Passcode and Unit ID can be viewed and set.

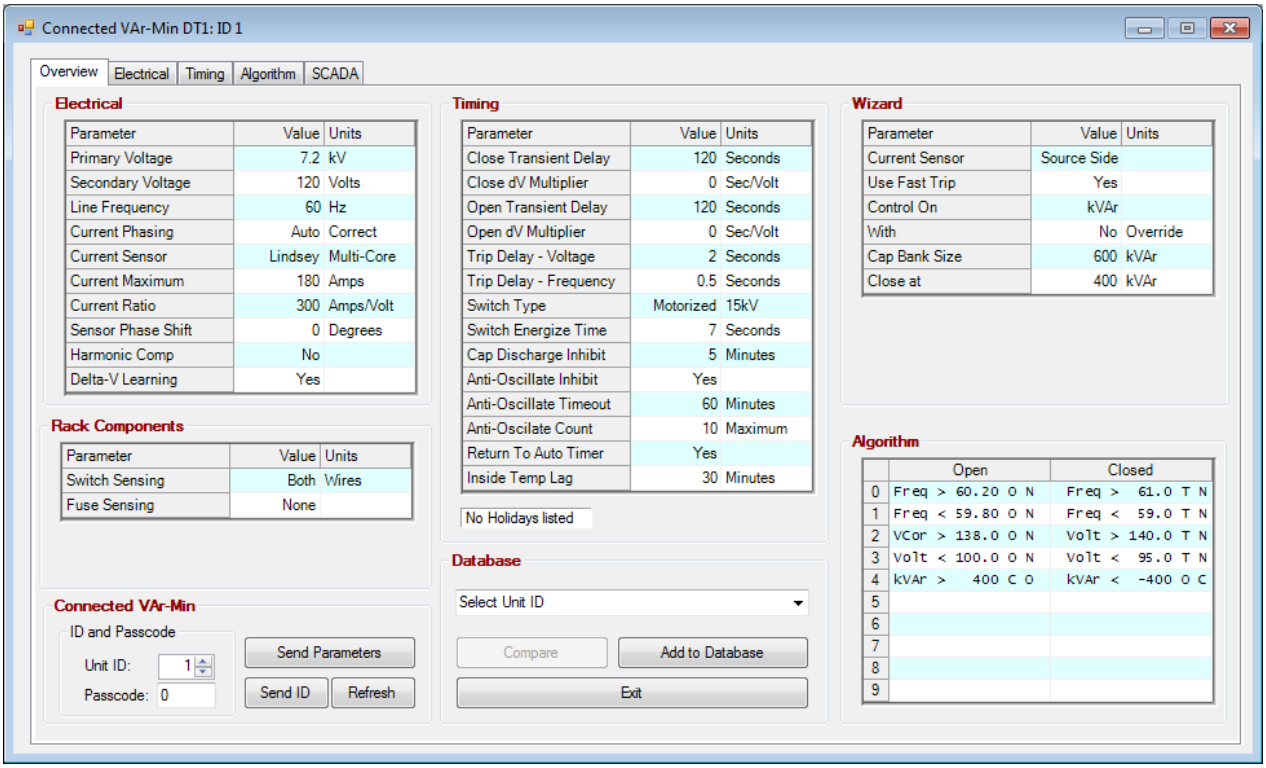


Figure 4: Configuration Overview

Electrical

The Electrical screen allows programming of electrical parameters and components located on the capacitor rack. These values affect both calculations and automatic control. After setting the desired parameters, the *Send Parameters* button may be used to write the new settings to the connected VAr-Min.
It would be helpful to have a thorough understanding of the information contained in sections 4, 5, 6 and 8 of the VAr-Min Control Manual.

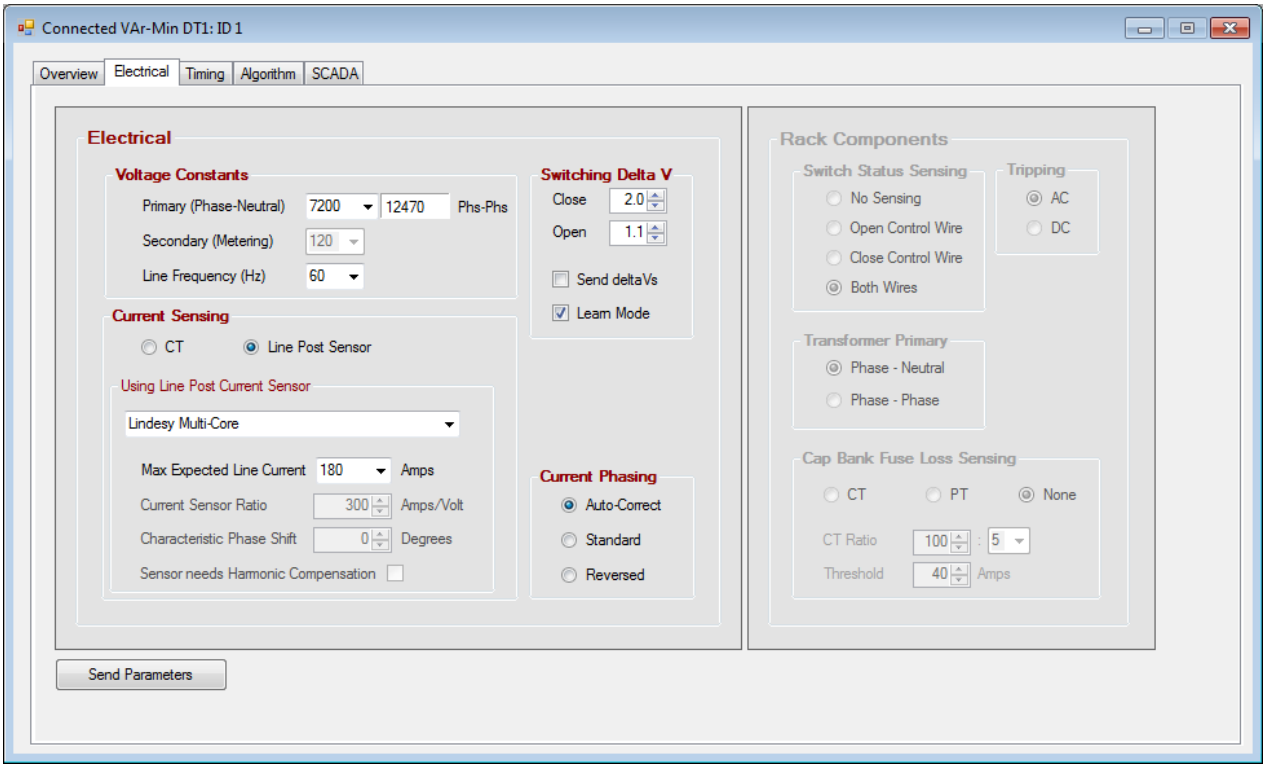


Figure 5: Configuration Electrical

Electrical (Voltage Constants)

The *Voltage Constants* division describes the nominal line voltage conditions for the capacitor control. Proper voltage constants are important for electrical parameter calculations and switching decisions.

- *Primary Voltage* – has the most common distribution line voltages in the pull-down menu. However, any reasonable phase to neutral voltage can be entered. As the phase to neutral voltage is changed the phase to phase value will change as a convenient reference.
- *Secondary Voltage* – has only two options: 120 and 240 VAC.
- *Line Frequency* – has only two options: 60 and 50 Hz.

Electrical (Current Sensing)

The *Current Sensing* division describes the current measuring equipment that will be used by the capacitor control. As with the voltage constants, these values are necessary for electrical parameter calculations and switching decisions.
Current accuracy is between 1% and 2% of full scale. It is normal to read some noise when current level is below 2%.

- *Line Post Current Sensor* – When this option is selected the following entries are presented:
  - *Line Post Sensor Type* – is a pull-down menu of several standard LPCSs. They include:

        - *Generic*
        - *Lindsey Multi-Core*
        - *Fisher-Pierce 1301 x7A*
        - *Fisher-Pierce 1301 x1A*
    - *Max Expected Line Current* – sets the front end gain on the current input amplifier. This is to avoid clipping of the current waveform. Higher values allow for more current but have less resolution.
    - *Current Sensor Ratio* – the current to voltage ratio of the LPCS. It is automatically populated with the ratio of the selected line post sensor and is only available for change by the user when the *Generic* type of sensor has been selected.
    - *Characteristic Phase Shift* – the inherent phase shift of the LPCS. It is automatically populated with the ratio of the selected line post sensor and is only available for change by the user when the *Generic* type of sensor has been selected.
- *CT* – When the CT option is selected the following entries are presented:
    - *CT Ratio* – the CT current ratio and can be expressed as xxx:5 or xxx:1
    - *Max Expected Line Current – for reference only and allows the user to see where current waveform may be clipped.*
    - *Phase difference* – normally zero however, it can be adjusted when the CT is not on the same phase with the voltage transformer. An engineering calculation based on the particular configuration will need to be made to determine the proper value for this.

Electrical (Switching Delta V)

The *Switching Delta V*oltage section allows the user to monitor and change the learned delta voltage values.

- The *Close* value represents the average secondary voltage increase that occurs when the capacitor bank is energized.
- The *Open* value represents the average secondary voltage decrease that occurs when the capacitor bank is de-energized.
- The *Send deltaVs* checkbox allows the user not to send the shown values when sending other updated electrical parameters. The default is not checked because these are learned values and are always being updated by the VAr-Min.
- The *Learn Mode* checkbox allows enabling or disabling Delta V learning.

More information is available in the VAr-Min Operator Manual section 8.4.

Electrical (Current Phasing)

The *Current Phasing* section is convenient for adjusting the polarity of the current sensor relative to the voltage sensor.

- *Auto-Correct* – will automatically adjust the current signal polarity such that the calculated kW is always positive.

- *Standard* – used when the current sensor is installed with polarity correctly phased with the voltage sensor and power direction is a necessary measurement. An example of this necessity might be when the possibility of a back feed condition exists.
- *Reversed* – used when the current sensor is installed with polarity opposite to that of the voltage sensor and power direction is a necessary measurement.

More information is available in the VAr-Min Operator Manual section 8.5.4.

Rack Components (Switch Status Sensing)

The *Switch Status Sensing* section allows selection of the method the VAr-Min will use to determine switch position. Options include:

- *No Sensing* – Position is determined strictly by assuming the switches are in the state last commanded by the control.
- *Open Control Wire* – Position is determined by observing impedance to neutral of the Open control wire.
- *Close Control Wire* – Position is determined by observing impedance to neutral of the Close control wire.
- *Both Wires* – Position is determined by observing impedance to neutral of both the Open and Close control wires. This option allows discovery of situations where the switches are not all in the same state or the control cable has a broken wire or wires.

More information is available in the VAr-Min Operator Manual section 8.5.10.

Rack Components (Tripping)

The *Tripping* section allows selection of either *AC* or *DC* tripping.

- AC tripping is required when using motor operated switches.
- DC tripping is only possible with solenoid operated switches and is required for fast relaying.

More information is available in the VAr-Min Operator Manual sections 2.6, 8.3 and 8.5.12.

Rack Components (Transformer Primary)

The Transformer Primary section is where the user will select whether the bank transformer primary is connected *Phase – Neutral* or *Phase – Phase*. Proper selection of the transformer primary connection is necessary for accurate electrical parameter calculations.
More information is available in the VAr-Min Operator Manual section 8.5.1.

Rack Components (Cap Bank Fuse Loss Sensing)

The *Cap Bank Fuse Loss Sensing* section is used when blown fuse detection is to be done. Fuse loss sensing is accomplished with a bank neutral CT in the case of

a grounded wye or a center to neutral PT in the case of an ungrounded wye. Options for this section are:

- *CT* – placed in the bank neutral conductor for a grounded wye configuration
  - *CT Ratio* – sets the CT current ratio
  - *Threshold* – sets the current level for determining a blown fuse
- *PT* – primary placed between the bank center and neutral for an ungrounded wye
  - *PT* secondary – sets the PT secondary nominal voltage
  - Threshold – sets the voltage for determining a blown fuse
- None – when selected, indicates that no blown fuse detection is to be done.

More information is available in the VAr-Min Operator Manual sections 8.5.8, 8.5.9 and 8.6.11.

Timing

The Timing screen allows programming id time and date parameters mostly used in the control scheme for the VAr-Min. These values affect both automatic control and protective control. After setting the desired parameters, the *Send Parameters* button may be used to write the new settings to the connected VAr-Min.
It would be helpful to have a thorough understanding of the information contained in the VAr-Min Control Manual sections 6 and 8.

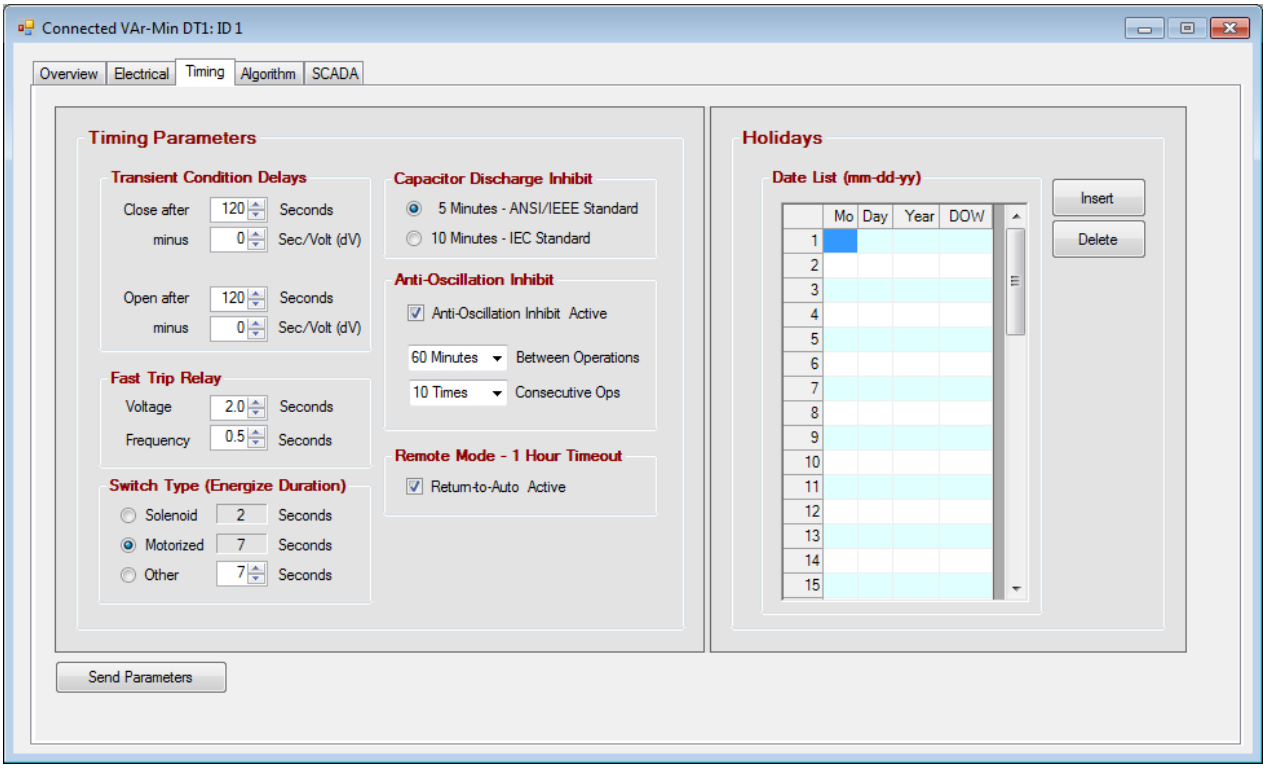


Figure 6: Configuration Timing

Timing Parameters (Transient Condition Delays)

The *Transient Condition Delays* section is for programming timings associated with normal conditions capacitor control. Normal conditions are conditions that occur periodically with load changes as opposed to abnormal conditions such as a power outage, a blink or a self-exciting condition that result in activation of Fast Tripping.
When these values are entered in the VAr-Min Companion Software, the Close and Open values can be different. The VAr-Min front panel wizard automatically assigns the entered value to both the Close and Open parameters.

- *Close after* and *Open after* – these entries are the Transient Delays
- *minus* – these entries are the Delta Voltage Multipliers

More information is available in the VAr-Min Operator Manual sections 8.6.9 and 8.6.10.

Timing Parameters (Fast Trip Relay)

The *Fast Trip Relay* section is for programming the Fast Voltage and Frequency Relay timings. These timings are much faster than the Transient Delays – from 0.1 to 5.0 seconds.

- *Voltage* – sets the Voltage Relaying Delay
- *Frequency* – sets the Frequency Relaying Delay

More information is available in the VAr-Min Operator Manual sections 2.6, 8.3 and 8.5.12

Timing Parameters (Switch Type (Energize Duration))

The *Switch Type (Energize Duration)* section allows for different types of switch control timings. It is self-explanatory.

Timing Parameters (Capacitor Discharge Inhibit)

The *Capacitor Discharge Inhibit* section selects the American (ANSI/IEEE) or European (IEC) standard for capacitor discharge time before allowing energization of the capacitor bank after it has been de-energized.

Timing Parameters (Anti-Oscillation Inhibit)

The *Anti-Oscillation Inhibit* is a protection scheme against the possibility of an inadvertent control algorithm that continuously cycles the bank on and off. It imposes limits on two things:

1. How often the bank switches can change states (normally – not including fast tripping)
2. How many times the switches can change states continuously with little or no delay before the control will be taken out of automatic mode.

The programmable parameters that control this are:

- *Anti-Oscillation Inhibit Active* check box – enables Anti-Oscillation Inhibit when checked.
- *Between Operations* entry – sets the minimum time between normal operations.
- *Consecutive Ops* entry – sets the number of consecutive operations before entering Remote (non-automatic) mode.

Timing Parameters (Remote Mode – 1 Hour Timeout)

The *Return to Auto* check box in the *Remote Mode* section, if checked, tells the VAr-Min to return to Automatic mode one hour after it was set to Remote mode by the SCADA system. This is to avoid inadvertently leaving the control in a non-automatic operating condition indefinitely.

Timing Parameters (Inside Temperature Calculation)

The *Temperature Lag* entry in the *Inside Temperature Calculation* section sets a time constant for simulation of in-door temperatures using the outside measured temperature. This facilitates estimation of load conditions when using temperature as part of the control algorithm.

Holidays (Date List (mm-dd-yy))

The Holidays *Date List* allows up to fifty holidays to be programmed into the VAr-Min for use with the control algorithm, when using Day of the Week as one of the control criteria. For each entry, Month, Day, Year and a day of week replacement are entered. When the VAr-Min determines that the current date matches one of the entries the entered DOW will be substituted for the actual day of the week for control purposes.
Any number from 0 to 9 can be entered in the DOW. The normal days of the week are consecutive with 1 for Monday and 7 for Sunday. 0, 8, and 9 as well as 1-7 can be entered into the Holiday Date List as DOW and the algorithm can treat them differently if so programmed.

Algorithm

The Algorithm screen allows programming of the control algorithm either directly or using the Algorithm Wizard. After building the desired algorithm, the *Send Parameters* button may be used to write the new settings to the connected VAr-Min
A thorough understanding of the information contained in the VAr-Min Control Manual section 8 and 8.4 in particular will be essential to understand the following discussions.

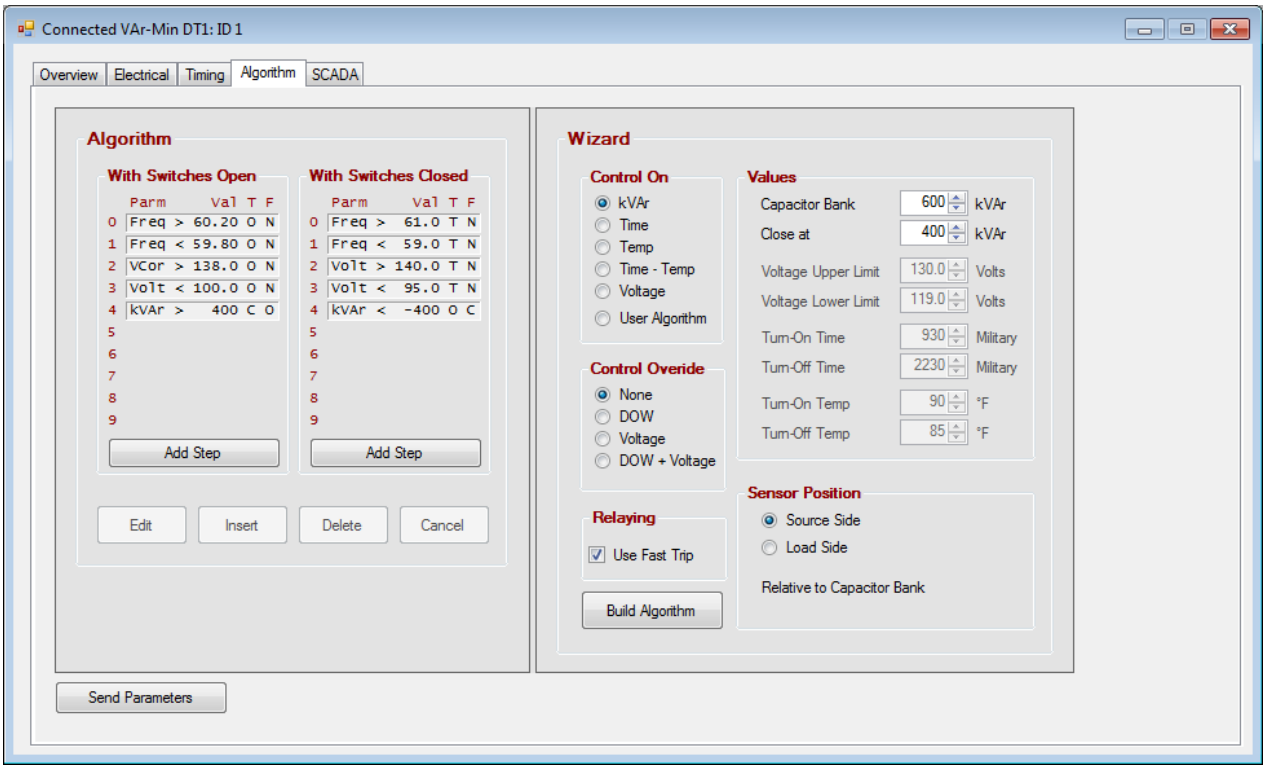


Figure 7: Configuration Algorithm

Algorithm (With Switches Open)

These are the Open Steps as described in the VAr-Min Operation Manual section 8.4. The interface allows steps to be added, deleted, inserted or edited. To Delete, Insert above or Edit the step must first be clicked. This will turn it red and enable the buttons.
Here is a description of each of the buttons located in the panel:

- *Add Step* – Opens the edit screen (see below) with an indication that the Open Step below the last existing Open Step is being edited.
- *Edit* – Opens the edit screen with an indication that the Open Step previously clicked on (and currently red) is being edited.
- *Insert* – Shifts Open steps down one step starting with the Open Step previously clicked on and opens the edit screen with an indication that the Open Step previously clicked on (and currently red) is being edited.
- *Delete* – Shifts Open Steps up one step starting with the Open Step previously clicked on, effectively deleting it.
- *Cancel* – Turns whatever step was previously clicked on from red back to black and greys out the edit buttons.

Algorithm (With Switches Closed)

These are the Closed Steps as described in the VAr-Min Operation Manual section 8.4. The interface allows steps to be added, deleted, inserted or edited.

To Delete, Insert above or Edit the step must first be clicked. This will turn it red and enable the buttons.
Here is a description of each of the buttons located in the panel:

- *Add Step* – Opens the edit screen (see below) with an indication that the Closed Step below the last existing Closed Step is being edited.
- *Edit* – Opens the edit screen with an indication that the Closed Step previously clicked on (and currently red) is being edited.
- *Insert* – Shifts Closed steps down one step starting with the Closed Step previously clicked on and opens the edit screen with an indication that the Closed Step previously clicked on (and currently red) is being edited.
- *Delete* – Shifts Closed Steps up one step starting with the Closed Step previously clicked on, effectively deleting it.
- *Cancel* – Turns whatever step was previously clicked on from red back to black and greys out the edit buttons.

Edit Open of Closed Step #X

This panel is displayed when a step edit is in progress. It is displayed as a result of any of the Add, Edit, or Insert buttons being clicked. The Edit panel has five sections which correspond to the five elements of the algorithm steps:

- Parameter – sets the parameter in the *Parm* column of the Steps table.
- Is – sets the operator in the evaluate column.
- Value – sets the value in the *Val* column.
- If True – sets the directive in the *T* column.
- If False – sets the directive in the *F* column.

Directives have the following meanings:

- Stay Open O used in Open steps to keep status quo
- Close C used in Open steps to close the switches
- Stay Closed C used in Closed steps to keep status quo
- Open O used in Closed steps to open the switches
- Next N used in any steps to move evaluation to next step
- Skip S used in any steps to move evaluation two steps
- Trip T used only in Closed steps for relay tripping of the switches

Buttons OK and Cancel will save the edited step or cancel the edit.

Wizard Panel

The Wizard panel enables the user to view and duplicate a Wizard algorithm built through the VAr-Min front panel. Each parameter is a duplicate of those available when operating a VAr-Min directly.
Please refer to the VAr-Min Operator Manual section 8.6 for a description of each of the parameters seen in the Wizard panel.
To build an algorithm from this panel, the desired selections should be made from each section and then the *Build Algorithm* button will be clicked. This will build the

proper steps into the Algorithm panel on the left. The algorithm is then ready to write to the VAr-Min using the *Send Parameters* button.

SCADA

The SCADA screen facilitates programming the VAr-Min for SCADA use. The VAr-Min supports two protocols through its communications ports:

- Modbus RTU Port 0
- DNP 3.0 Port 1

After setting the desired parameters, the *Send Parameters* button may be used to write the new settings to the connected VAr-Min. The *Save DNP Template* and *Load DNP Template* buttons are used to save and retrieve the DNP settings for use in other VAr-Mins.

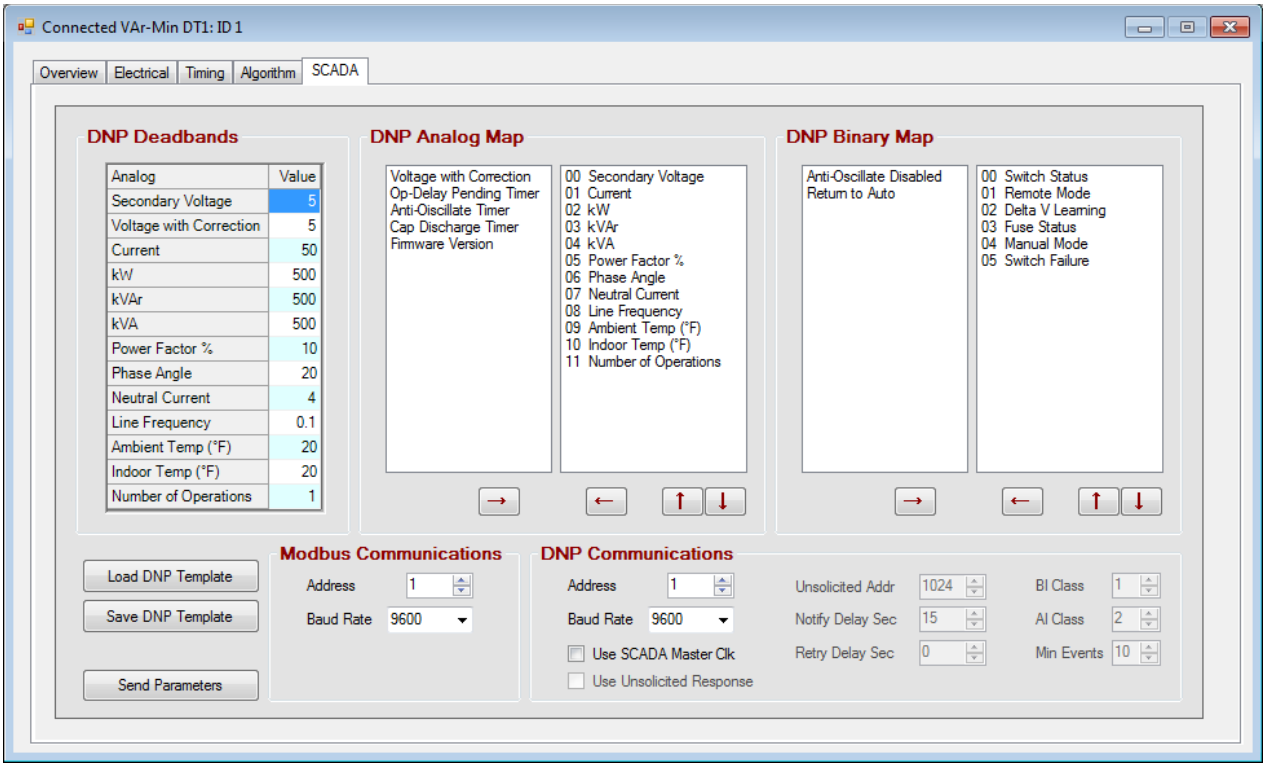


Figure 8: Configuration SCADA

Modbus Communication

This section allows entry of:

- *Address* 1 – 253
- *Baud Rate* 1200 – 115200

DNP Communication

This section allows entry of:

- *Address* 1 – 65533
- *Baud Rate* 1200 – 115200
- *SCADA Master Clk* VAr-Min uses the internal clock set periodically by SCADA rather than its own RTC
- *Unsolicited Resp* VAr-Min issues unsolicited report by exception responses
- *Unsolicited Addr* Unsolicited response destination address
- *Notify Delay Sec* Time till reporting change events if fewer than *Min Events*
- *Min Events* Minimum number of events to report before *Notify Delay*
- *Retry Delay Sec* Time to wait to retry URBE if no confirm from master
- *BI Class* Binary Input RBE Class (0 means none)
- *AI Class* Analog Input RBE Class (0 means none)

DNP Deadbands

This section allows entry of Analog Input report by exception Deadbands. Entries are in floating point format so they can use decimal places. For example: Secondary Voltage entered as 0.5 would give a one half volt deadband. An entry of zero (0) disables the RBE function for that Analog Input parameter.

DNP Analog Map

This section allows user customization of the Analog Inputs. Only the parameters listed in the *Not Mapped* panel of the DNP Analog Input Map will be available through DNP and in that order.
To customize the map use the right and left arrows to move marked items between the two panels. Use the up and down arrows to arrange the items in the *Mapped* panel in the desired order. The two digit number at the left of each parameter will be its DNP Analog Input index.

DNP Binary Map

This section allows user customization of the Binary Inputs. Only the parameters listed in the *Not Mapped* panel of the DNP Binary Input Map will be available through DNP and in that order.
To customize the map use the right and left arrows to move marked items between the two panels. Use the up and down arrows to arrange the items in the *Mapped* panel in the desired order. The two digit number at the left of each parameter will be its DNP Binary Input index.

Instantaneous

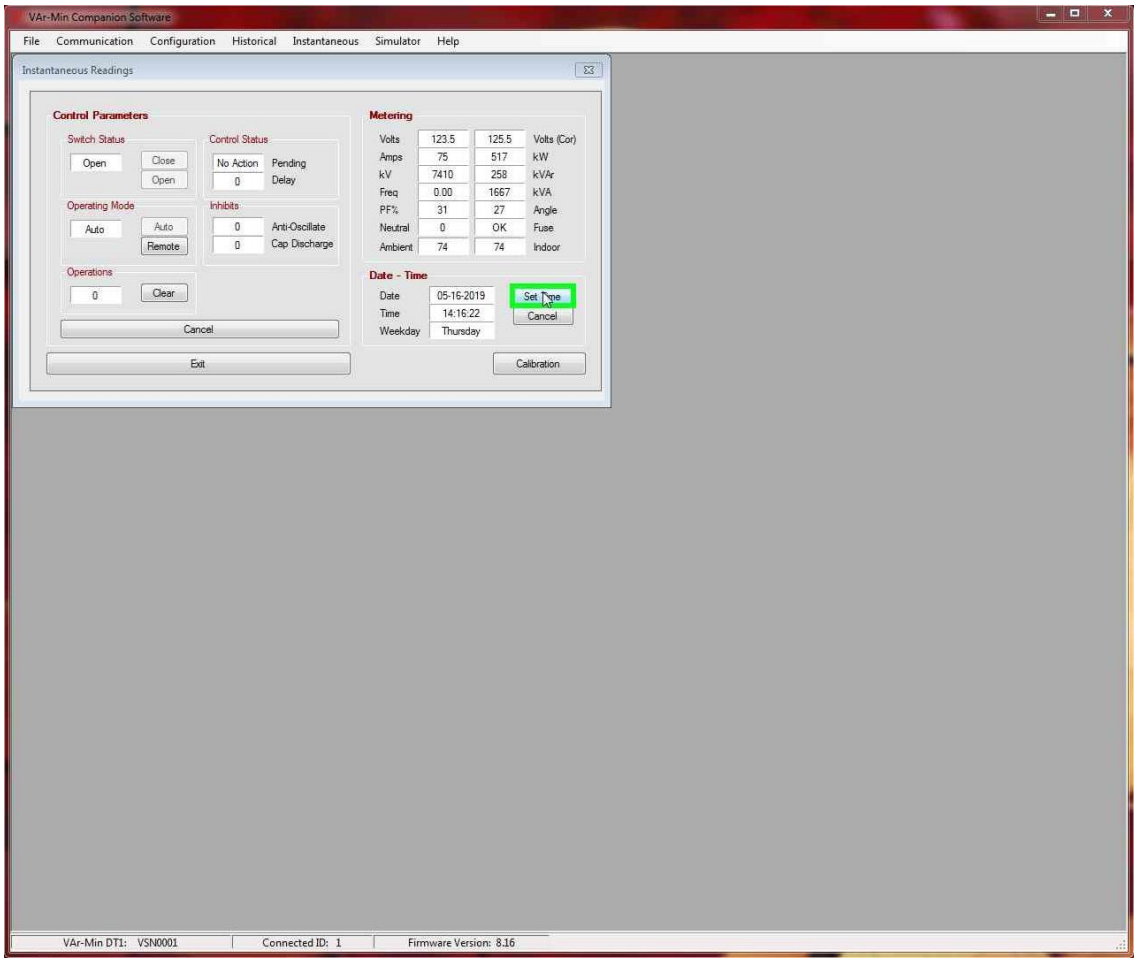
Displays the Instantaneous readings of either the currently connected VAr-Min or the simulator if open.

Setting Date and Time

Date and Time can be set using the Instantaneous window to the current computers time.

1. Verify VAr-Min is connect to the VAr-Min Companion Software indicated in the Connection Status section at the bottom of the user interface.
2. Select “Instantaneous” from the main toolbar.

3. Select “Set Time” once. The text will turn red and indicate it is ready to set the time and date. Select “Set Time” again and now the date and time on the VAr-Min is set to the current computer time.

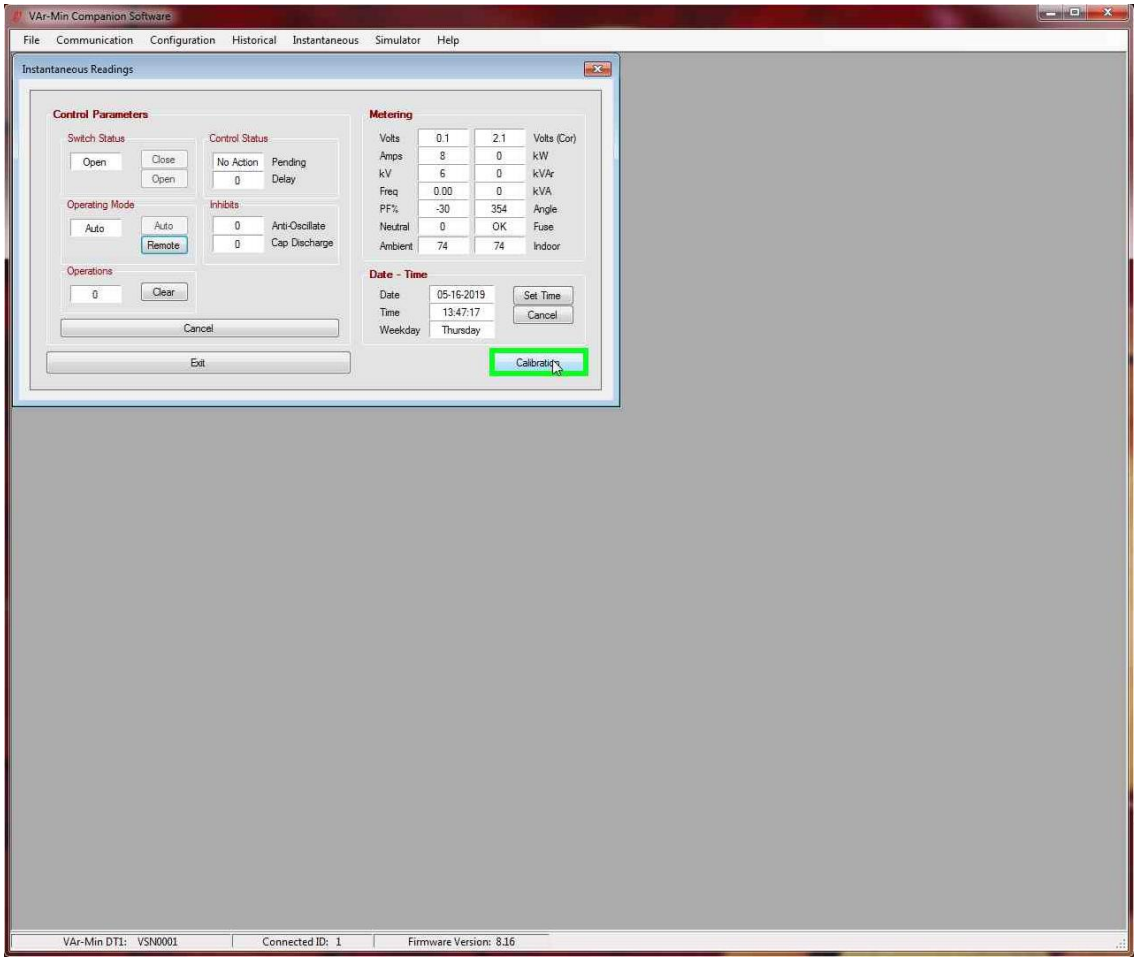


Calibrating Voltage and Current

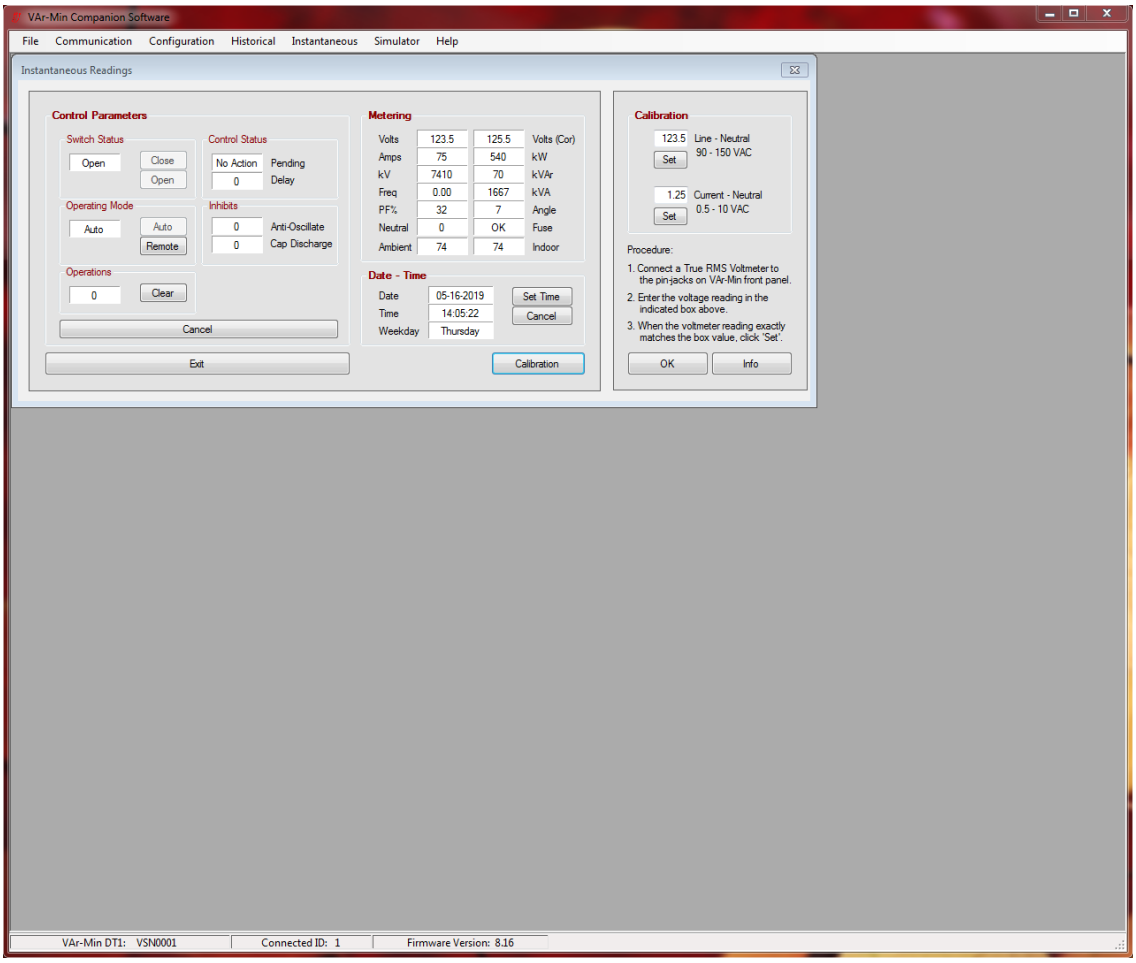
Calibration is performed at the factory but can be performed again to calibrate the Voltage and Current inputs to the VAr-Min Control.

4. Verify VAr-Min is connected to the VAr-Min Companion Software, indicated in the Connection Status section at the bottom of the user interface.
5. Select “Instantaneous” from the main toolbar.

6. Select “Calibration.”



7. Follow the Procedure in the Calibration section to perform a calibration.



Historical

Historical data can be downloaded from the VAr-Min and viewed or exported from the VAr-Min Companion Software.

Operations Log

Tracks the operations of the capacitor switches attached to the VAr-Min. Based on switch position sensing settings, this can track more than just the output of the VAr-Min.

Trending Records

Trending information can be downloaded from the VAr-Min and displayed graphically or exported. These records provide 15-minute interval data. Parameters recorded are:

- Voltage (Secondary Voltage)
- kV (Primary Voltage)
- Current

- kW
- kVAr
- kVA
- Power Factor
- Lead/Lag state
- Temperature
- Status (capacitor switch status)

Simulator

The VAr-Min Simulator simulates a VAr-Min Capacitor Control, three capacitor switches, a capacitor bank, and line conditions. This allows you to become familiar with the user interface of the VAr-Min Capacitor Control and simulate different line conditions. A user can simulate different line characteristics by changing the Voltage, Current, kW, kVAr, PF, dV, Temp, Bank kVAr, Switch Failure and more. Operators can be trained safely without having to interact with energized hardware.

Open the simulator by selecting “Simulator” on the main toolbar.

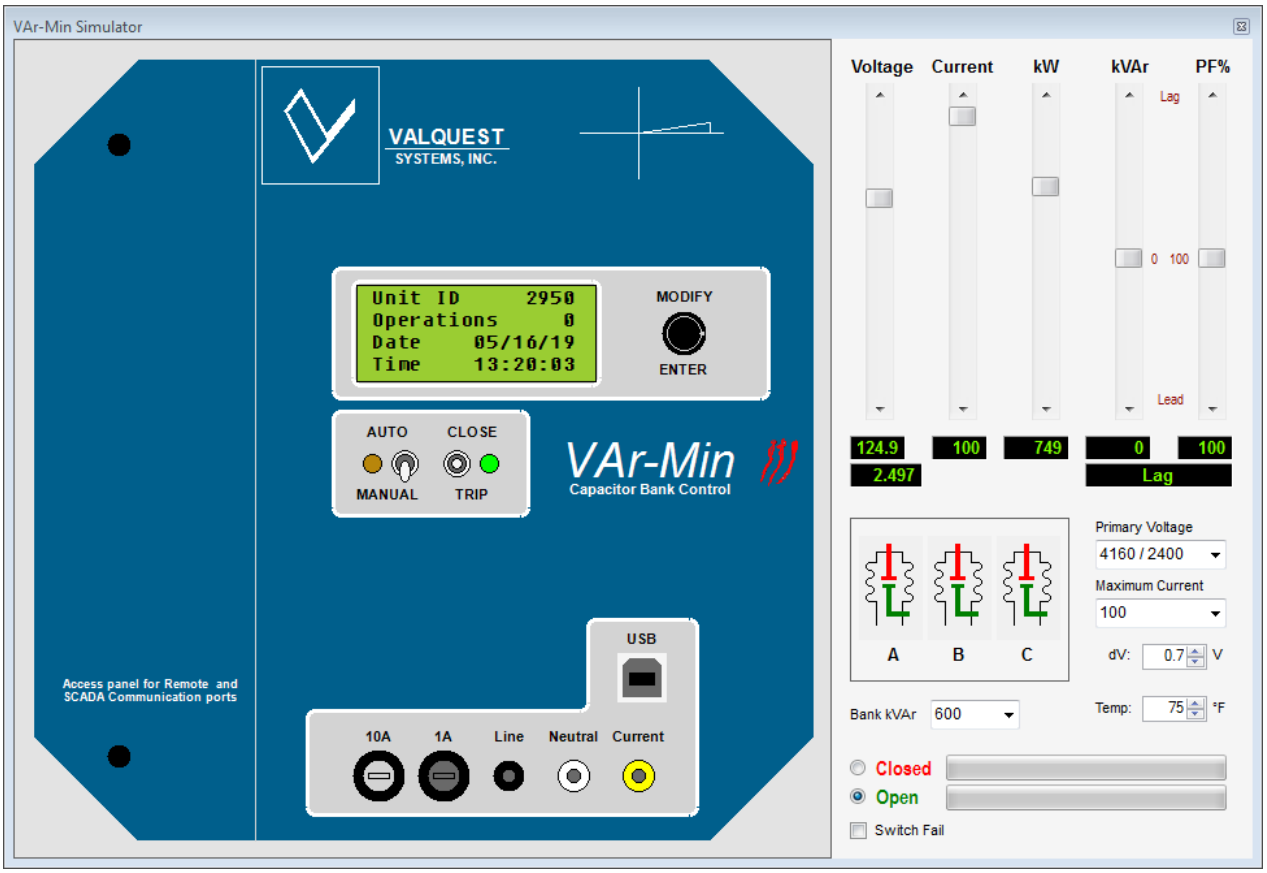


Figure 9: Simulator

Manual Changelog

V1.0

- Initial release

V1.1

- Revised formatting
- Added references to VAr-Min Manual

V1.2

- Added diagrams
- Revised DNP section