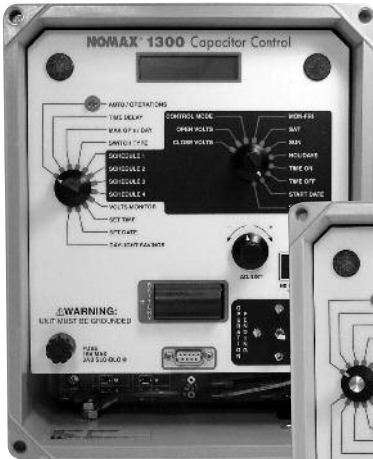


# NoMax<sup>®</sup>

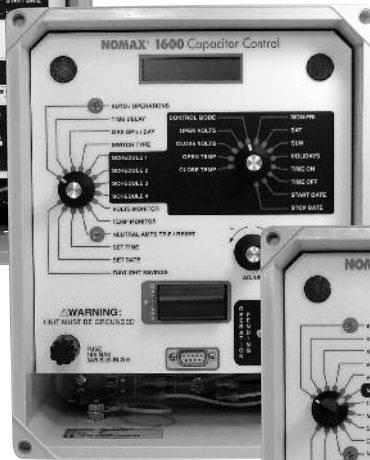
## CAPACITOR CONTROLS

### 1000 & 2000 SERIES

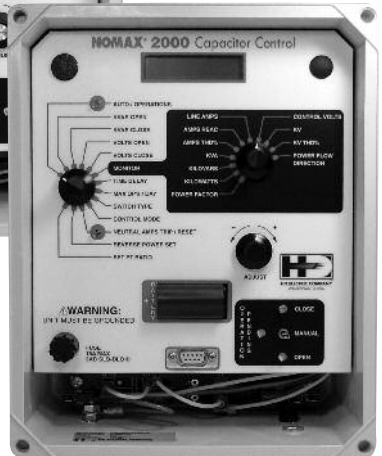
## Operating & Instruction Manual



NoMax<sup>®</sup> 1300



NoMax<sup>®</sup> 1600



NoMax<sup>®</sup> 2000



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# NoMax<sup>®</sup>

## CAPACITOR CONTROLS

### **1000 & 2000 SERIES**

## Operating & Instruction Manual

Overview .....	4
Installation .....	5
Current Sensor .....	6
Fusing .....	6
Manual Operation .....	6-7
Programming for Automatic Operation. ....	8-15
Settings Common to All Models .....	8
Setting the Control Mode .....	9
Schedule Settings (Models 1300 & 1600) .....	9-12
Other Settings .....	12-13
Voltage Settings - All Models. ....	12
Temperature Settings - Model 1600 .....	12
VAR Settings - Model 2000 .....	13
Reverse Power Set .....	13
System Monitoring .....	14
Neutral Current Monitoring. ....	15
Clock Back-up Battery .....	15
Troubleshooting .....	16-18
LED Indicators. ....	17
LCD Display .....	17-18
Specifications .....	18-19
NoMax Programming and Data Analysis Software. ....	20-29
Software Installation .....	21
Using the Software for the First Time .....	21
Create a Control Program .....	21-22
Upload a Setup Program to a NoMax Control. ....	23
Use Profile Data Logging .....	24
View and Graph Downloaded Profile Data .....	25-26
Modify Profile Graphs. ....	27-28
Real Time Monitoring of the NoMax Capacitor Control. ....	29
Limitation of Warranty and Liability .....	32

**WARNING:** Prior to installing, operating, maintaining or testing this equipment, read and understand the material in this manual. Failure to comply can result in death, severe injury and equipment damage. These instructions are intended to supplement, not replace, local safety practices and procedures.

NoMax Capacitor Controls set the standard for ease of use by providing sophisticated control and monitoring capabilities in an intuitive easy to use package. NoMax Windows™ compatible software extends these capabilities.

Please visit our website for the latest information on these and other quality HD Electric Company products.  
[www.HDElectricCompany.com](http://www.HDElectricCompany.com)

## OVERVIEW

The NoMax® 1000 and 2000 Series Capacitor Controls utilize user selectable functions and parameters to control switched capacitor banks. The NoMax 1300 controls with time and voltage, the NoMax 1600 controls with time, temperature and voltage and the NoMax 2000 controls with VAR and voltage.

**TIME** - The Control will close the capacitor bank when the user selected CLOSE TIME occurs. The Control will open the capacitor bank when the user selected OPEN TIME occurs. Both settings are subject to the weekend settings.

**VOLTAGE** - The Control will close the capacitor bank when the sensed line voltage drops below the user selected CLOSE VOLTS setting. The Control will open the capacitor bank when the sensed line voltage rises above the user selected OPEN VOLTS setting.

**TIME WITH VOLTAGE OVERRIDE** - The Control will function according to the time mode, except the time mode operating conditions will be overridden by voltage conditions according to the volt mode function.

**TEMPERATURE** - For Summer Schedule (defined by CLOSE TEMP greater than OPEN TEMP setting) - the Control will close the capacitor bank when the sensed ambient temperature rises above the user selected CLOSE TEMP setting. The Control will open the capacitor bank when the sensed ambient temperature drops below the user selected OPEN TEMP setting.

For Winter Schedule (defined by OPEN TEMP greater than CLOSE TEMP setting) - the Control will close the capacitor bank when the sensed ambient temperature drops below the user selected CLOSE TEMP setting. The Control will open the capacitor bank when the sensed ambient temperature rises above the user selected OPEN TEMP setting.

**TIME WITH TEMPERATURE OVERRIDE** - The Control will function according to the time mode, except the time mode operating conditions will be overridden by temperature conditions according to the temp mode function.

**TEMPERATURE WITH VOLTAGE OVERRIDE** - The Control will function according to the temp mode, except the temp mode operating conditions will be overridden by voltage conditions according to the volt mode function.

**TIME WITH VOLTAGE AND TEMPERATURE OVERRIDE** - The Control will function according to the time mode, except the time mode operating conditions will be overridden by temperature conditions according to the temp mode function and/or by voltage conditions according to the volt mode function. Voltage will override both time and temperature.

**VAR** - The Control will close the capacitor bank when the VAR settings drop below the user selected Amps Reactive setting. The Control will open the capacitor bank when the VAR setting rise above the user selected Amps Reactive setting.

**VAR WITH VOLTAGE OVERRIDE** - The Control will function according to the VAR settings, except the VAR setting operating conditions will be overridden by voltage conditions according to the volt mode function.

# INSTALLATION

All NoMax Controls are supplied ready for 4 or 6 jaw meter socket mounting or for mounting directly to a pole with a supplied mounting bracket. See the Specifications section (pg 19) for socket terminal assignments.



**WARNING:** Before plugging the Control into a live meter socket, rotate the main switch out of the **AUTO/OPERATIONS** position or remove the front panel fuse, and observe all safety procedures for working with exposed live circuits. Failure to comply can result in death, personal injury or equipment damage.

Socket mounted Controls are supplied ready for either ringed or ringless meter sockets. The two types of sockets are not interchangeable. Be sure that the correct type of Control is selected for the meter socket to be used.

## INSTALLING INTO A RINGED BASE

Align the terminals on the back of the Control and press firmly into the meter socket. Use the supplied ring to complete the installation. Attach a ground wire to the external ground lug. Seal or lock the ring only after the entire system has been verified.

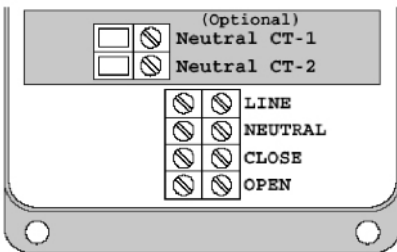
## INSTALLING INTO A RINGLESS BASE

Align the terminals on the back of the Control and press firmly into the meter socket. Tighten the 3 locking screws located on the meter base. Attach a ground wire to the external ground lug. Seal the three locking screws only after the entire system has been verified.

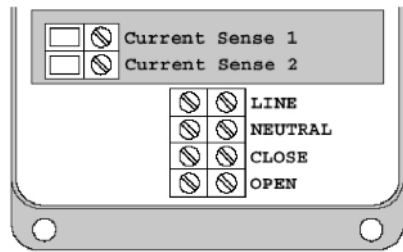
## INSTALLING POLE MOUNTED CONTROLS

Pole Mounted Controls are mounted with the included pole bracket and user supplied mounting straps or lag screws. After the Control is attached to the pole, attach a ground wire to the external ground lug. The Control should be wired by connecting the 6 wires **(must be deenergized during connection)** as per the diagrams below. The terminal blocks can accommodate wire sizes from #4 to #18.

### Series 1000 Time, Temperature, Voltage Controls



### Series 2000 VAR Controls



## CURRENT SENSOR

All NoMax VAR Controls are supplied ready to operate with Lindsey™ CVMI or Fisher Pierce™ 1301 overhead current sensors, which can be purchased separately. The sensor output must be 600A: 10V. If the current sensor is connected to a phase different than the Control supply voltage, refer to the software section of this manual (pg 22) to make phase adjustments. The meter socket pin assignments are shown in the Specifications section of this document (pg 19).

Voltage sensing for the VAR Control is pre-wired to use the supply voltage, typically 120 or 240V. Please consult the factory for other configurations.

## FUSING

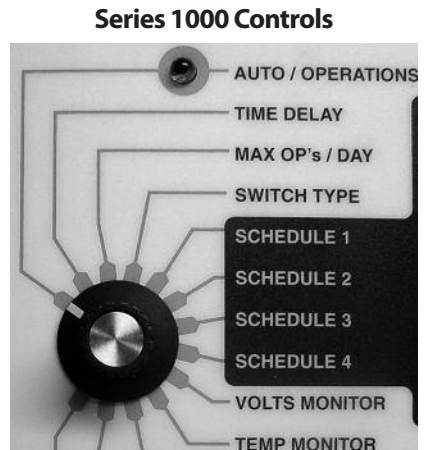
All NoMax Controls are supplied with a 15 Amp SLO-BLO® fuse, accessible from the front panel. This fuse protects the capacitor bank switches. If it was removed before installation, the fuse should be reinstalled after installation is complete.

An internal fuse that is not field replaceable protects the Control circuitry. All repairs should be referred to the factory.

## MANUAL OPERATION

All NoMax Controls can be used to operate the connected capacitor bank switches manually. To manually CLOSE or OPEN the capacitor bank using the Control front panel toggle switch:

- 1) Switch the Control out of the AUTO/ OPERATIONS mode, verify that the red lamp is off, and select TIME DELAY. Using the ADJUST knob, select the desired time delay, in seconds, from 3 to 600. This will delay both manual and automatic operations by the time selected. The OPERATION PENDING light flashes before every open or close operation during the time delay period.
- 2) Select SWITCH TYPE. Use the ADJUST knob to select the type of capacitor bank switch installed - MOTOR OP (for motor driven switches) or SOLENOID (for solenoid operated switches).

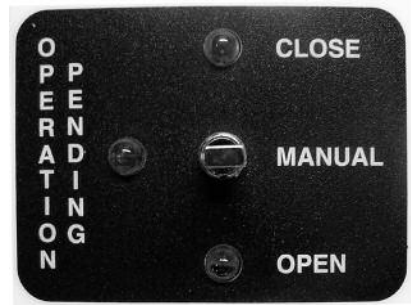
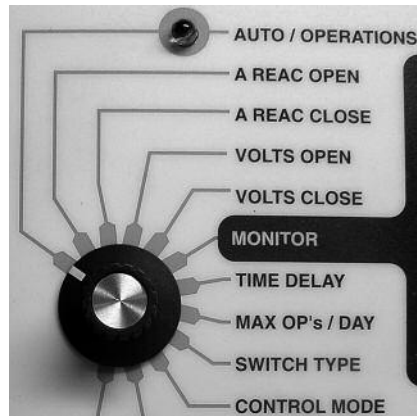


- 3) Use the MANUAL toggle switch to OPEN or CLOSE the capacitor bank switches. The OPERATION PENDING light will flash for the duration of the selected TIME DELAY. When the output is energized, the CLOSE or OPEN light will flash (100 msec. for SOLENOID or 15 sec. for MOTOR OP). Then, the output will de-energize and the light will remain on.

***The capacitor bank cannot perform a close operation less than 5 minutes after a trip operation to allow time for the capacitors to discharge. If a CLOSE operation is attempted during this 5 minute time period, the Control will display 5MIN DLY and the Control will not close the bank.***

**NOTE:** Manual operations are counted by the operations counter (close operations only), but manual operations do not count against the preset daily limit set by MAX OPS/DAY.

### Series 2000 Controls



After completing the required manual operations, return the Control to AUTO/ OPERATIONS for automatic operation. The AUTO/OPERATIONS light confirms Automatic operation. The display shows the total number of CLOSE operations.

**NOTE:** Pending manual operations can be canceled by turning the Control to AUTO/OPERATIONS. Similarly, pending automatic operations can be canceled by switching out of AUTO/OPERATIONS to any other switch position.

# PROGRAMMING FOR AUTOMATIC OPERATION

*Programming and set-up information for NoMax Controls.*

## Settings Common to all Models

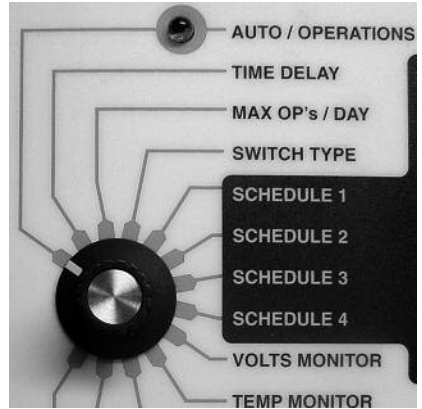
AUTO/OPERATIONS is the normal automatic operating mode for the Control. The display shows the operations counter, which cannot be reset. The operations counter counts all CLOSE operations.

**TIME DELAY** sets the time delay, in seconds, for both manual and automatic operations. The delay can be set from 3 to 600 seconds in 3 second increments using the ADJUST knob. The OPERATION PENDING light flashes before every open or close operation during the entire time delay period.

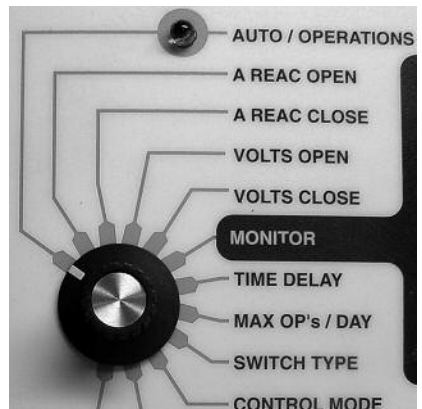
**MAX OP'S/DAY** sets the maximum number of automatic capacitor bank CLOSE operations per rolling 24-hour period. This can be set from 2 to 24 operations using the ADJUST knob. This setting overrides all other time, temperature, VAR or voltage settings. If the daily operations limit is reached, the display will alternately show the operations counter and OP LIMIT while the Control is in AUTO/OPERATIONS mode. When MAX OPS is reached, the last operation will be an OPEN. Manual operations do not count against the limit set by MAX OP'S/DAY.

**SWITCH TYPE** specifies the type of capacitor bank switch installed, MOTOR OP or SOLENOID. This setting determines the output relay ON time (100 msec. for a SOLENOID operated switch and 15 sec. for a MOTOR operated switch).

### Series 1000 Controls



### Series 2000 Controls

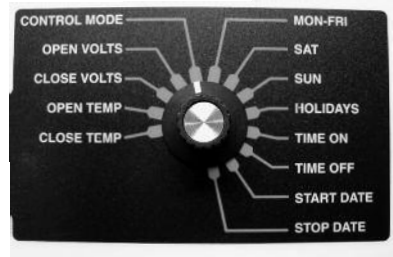


## SETTING THE CONTROL MODE

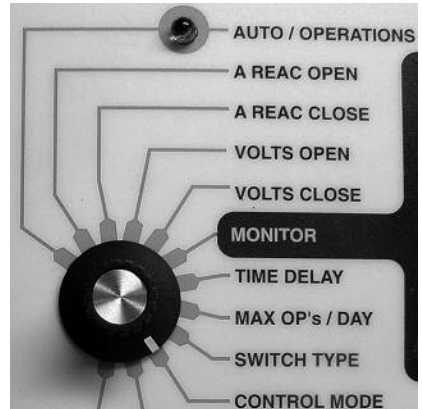
The Model 1300 Control allows voltage to override time settings. Override means that voltage and/or temperature will take precedence over time. The Model 1600 Control can allow voltage and/or temperature to override time settings. The Model 2000 Control can allow voltage to override VAR settings. Depending on the Model, the following Control Modes can be used:

<b>Control Mode</b>	<b>Display Shows</b>
Time only	TIME
Time with voltage override	VOLT/TIM
Voltage only	VOLT
Time with temperature override	TMP/TIME
Temperature only	TEMP
Temperature with voltage override	VOLT/TMP
Time with voltage and temperature override	V/TMP/TI
VAR only	VAR
VAR with voltage override	VOLT/VAR

### Series 1000 Controls



### Series 2000 Controls

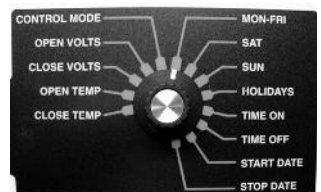
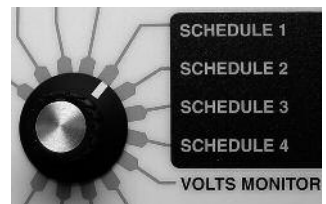


## SCHEDULE SETTINGS FOR MODELS 1300 AND 1600

Four independent time schedules are available - SCHEDULE 1 through SCHEDULE 4. Each time schedule allows one OPEN and one CLOSE operation per day. The four time schedules can be used to set multiple OPEN and CLOSE operations for each day or they can be used for seasonal changes to the time schedule, e.g. different OPEN and CLOSE times for summer and winter. For those units so equipped, the different time schedules can also be used for daily or seasonal variations in voltage or temperature override settings.

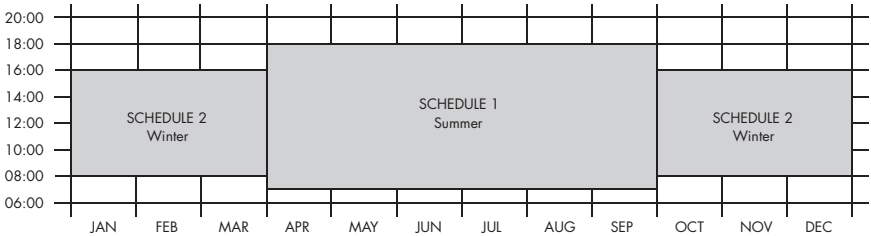
For each schedule selected, week days MON-FRI, weekend days SAT and SUN, and HOLIDAYS can be selected to be ACTIVE or OFF. ACTIVE days will follow the TIME ON and TIME OFF settings as well as any temperature or voltage override settings. OFF days will cause the capacitor bank to remain open.

The six standard holidays are New Years Day, Memorial Day, July 4th, Labor Day, Thanksgiving Day and Christmas Day. The NoMax 1600 allows a maximum of ten holidays to be programmed.



**EXAMPLE 1 - SEASONAL VARIATION** - Two time schedules are used for seasonal variation in the OPEN and CLOSE times and/or override settings (if any). TIME SCHEDULE 1 is a summer schedule with a START DATE of 4/1, a STOP DATE of 9/30, TIME ON at 07:00 and TIME OFF at 18:00 (all time settings are in 24 hour format). TIME SCHEDULE 2 is a winter schedule with a START DATE of 10/1, a STOP DATE of 3/31, TIME ON at 08:00 and TIME OFF at 16:00. For each time schedule, the days of the week, TIME ON, TIME OFF and override settings (if any) can be set independently.

### Example 1



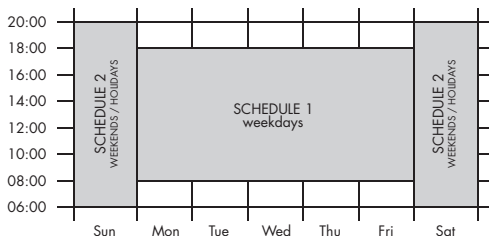
In this example, each schedule is ACTIVE for all days of the week and holidays and schedules 3 and 4 are not used. The CONTROL MODE is set for TIME, so voltage and temperature settings are not used.

To disable a time schedule, set the start date the same as the stop date. To make a schedule run year round, set the start date for 01/01 and the stop date for 12/31. In case of a conflict between time schedules, SCHEDULE 1 takes priority over SCHEDULE 2, SCHEDULE 2 over SCHEDULE 3, etc. In case of a conflict between temperature and voltage settings, voltage takes priority. To make a time schedule active for 24 hours, set TIME ON the same as TIME OFF.

**EXAMPLE 2 - TIME WITH VOLTAGE OVERRIDE** - Two time schedules are used for year-round time and voltage control. SCHEDULE 1 is a weekday schedule for time with voltage override. Set the CONTROL MODE for VOLT/TIME (time with voltage override). The TIME ON is 08:00 and the TIME OFF is 18:00. Set MON-FRI to ACTIVE and set SAT, SUN and HOLIDAYS to OFF. The START DATE is 1/1 and the STOP DATE is 12/31.

The Control will anticipate voltage changes caused by opening and closing the capacitor bank. This may cause scheduled open or close operations to be deferred or delayed. See the Voltage Settings section (pg 12) for more information about Adaptive Trip.

### Example 2



**IMPORTANT!** Time with voltage override means that voltage takes precedence. For these SCHEDULE 1 settings, the Control will close the bank at 08:00 only if the line voltage is below the OPEN VOLTS setting less the Adaptive Trip bias voltage. Conversely, the Control will open the bank at 18:00 only if the line voltage is above the CLOSE VOLTS setting plus the Adaptive Trip bias voltage. If the Control does not close the bank at the TIME ON setting or open the bank at the TIME OFF setting due to voltage conditions, it will open or close the bank later if the line voltage changes. The Control will also close the bank before the scheduled time of 08:00 if the line voltage drops below the CLOSE VOLTS setting.

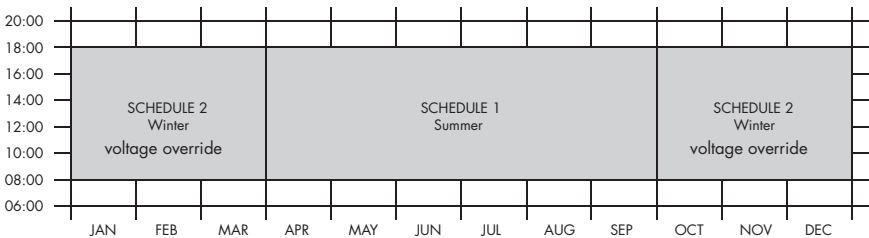
SCHEDULE 2 is a weekend schedule for voltage control only. Set the CONTROL MODE for VOLT (voltage control). For 24-hour control, set the TIME ON and TIME OFF to the same time. Set MON-FRI to OFF and SAT, SUN and HOLIDAYS to ACTIVE. Set the START DATE to 1/1 and the STOP DATE to 12/31. The Control will change from a weekday to a weekend schedule at midnight.

If 24-hour voltage control is not desired, the TIME ON and TIME OFF settings can be set as needed. The Control will close the bank at TIME ON only if the line voltage is below the OPEN VOLTS setting less the Adaptive Trip bias voltage. The Control will open the bank at TIME OFF independent of voltage.

**EXAMPLE 3 - TIME WITH TEMPERATURE AND VOLTAGE OVERRIDE** - Two time schedules are used for seasonal variations in temperature and voltage override settings.

SCHEDULE 1 is set for TEMP/TIME (time with temperature override) using the CONTROL MODE setting. This is a daily summer schedule so the START DATE is 4/1 and the STOP DATE is 9/30. The TIME ON is 08:00 and the TIME OFF is 18:00. The OPEN TEMP is 60°F and the CLOSE TEMP is 80°F. MON-FRI SAT, SUN and HOLIDAYS are all set to ACTIVE.

### Example 3



**IMPORTANT!** Time with temperature override means that temperature takes precedence. For these SCHEDULE 1 settings, the Control will close the bank at 08:00 only if the temperature is above the OPEN TEMP setting of 60°F. Conversely, the Control will open the bank at 18:00 only if the temperature is below the CLOSE TEMP setting of 80°F. If the Control does not close the bank at the TIME ON setting or open the bank at the TIME OFF setting due to temperature conditions, it will open or close the bank when the temperature changes. The Control will also close the bank before the scheduled time of 08:00 if the temperature increases above the CLOSE TEMP setting.

SCHEDULE 2 is set for VOLT/TIME using the CONTROL MODE setting. This is the winter schedule so the START DATE is 10/1 and the STOP DATE is 3/31. The TIME ON is 08:00 and the TIME OFF is 18:00 MON-FRI, SAT, SUN and HOLIDAYS are all set to ACTIVE. Voltage settings are set as needed.

## OTHER SETTINGS

Besides the four independent time schedules, there are three other time settings to be entered. **DAYLIGHT SAVINGS** can be set to ACTIVE or OFF. Selecting ACTIVE automatically adjusts the internal clock and all time settings for daylight savings time in the spring and fall. Selecting OFF causes the Control to ignore daylight savings time changes.

**SET TIME** and **SET DATE** are used only for initial set-up of the Control, or after the battery has been replaced. The time is entered in 24 hr. format and manually adjusted in 5-minute increments. The date is entered as mm-dd-yy. [The first day in the year 2000 will be displayed as 1/1/00]. Reference the software for setting the date and time.

### **Voltage Settings - All Models**

OPEN VOLTS must be at least 3 volts above CLOSE VOLTS and cannot be set to any voltage difference less than 3 volts. The control voltage is measured and averaged over a 5-minute period to reject momentary spikes or sags. The Control will not respond to short-term voltage changes such as those caused by a sudden line voltage change or adjusting the control voltage with a variable transformer.

Voltage Controls also incorporate **Adaptive Trip**; the Controls are sensitive to the voltage rise caused by closing the capacitor bank. The voltage rise caused by closing the capacitor bank is averaged over the last 4 close operations and is used to anticipate the voltage change for the next close or open operation. This voltage change is used as a bias, and if the next close operation would cause the Control voltage to be above the open voltage set-point, the close operation is not performed until the voltage falls below the open voltage set point less the bias voltage. Similarly, if the next open operation would cause the Control voltage to be below the close voltage set point, the operation is not performed until the voltage rises above the close voltage set point plus the bias voltage. The initial factory default bias setting is 2 volts.

### **Temperature Settings - Model 1600**

OPEN TEMP cannot be set closer than 5°F above or below CLOSE TEMP. OPEN TEMP can be either higher or lower than CLOSE TEMP for summer or winter peaking loads. Temperature is measured and averaged over a 30 minute period so the Control will better respond to temperature sensitive VAR loading. The Control will not respond to short-term temperature changes such as those caused by spraying cold water on the temperature sensor.

## VAR SETTINGS - MODEL 2000

To simplify settings, voltage has been factored out of the VAR settings leaving only Amps Reactive - **A REAC** - on the front panel. When setting Amps Reactive open or close, the display will also show **LD** for Leading or **LG** for Lagging. Amps Reactive Open may be set up to 100 Amps Leading. Amps Reactive Close can only be set lagging and must be at least 2 amps more lagging than Amps Reactive Open. Amps Reactive Close Range is LG 600 to LD 0.5.

The Amps Reactive are measured and averaged over a 5-minute period to reject momentary transients. The VAR settings also incorporate **Adaptive Trip**; the Controls are sensitive to the change in reactive amps caused by closing and opening the capacitor bank. The change in reactive amps caused by closing the capacitor bank is averaged over the last 4 close operations and is used to anticipate the change in reactive amps caused by the next close or open operation. This change is used as a bias. If the next close or open operation will place the Control beyond the next reactive amps set point, that operation is not performed until the reactive amps changes beyond the set reactive amps plus the bias. The initial factory default bias setting is 10 amps reactive.

**REVERSE POWER SET** sets the action of the Control when reverse power flow is detected. Options are: IGNORE - to do nothing and leave the capacitor bank in its present state, VOLT - to revert to voltage control, or OPEN - to open the capacitor bank until normal power flow is restored.

**EXAMPLE - VAR WITH VOLTAGE OVERRIDE** - The VAR Control does not use time schedules so all settings are active at all times. The CONTROL MODE is set to VOLT/VAR, for VAR with voltage override. That is, the Control will follow the VAR settings unless the voltage is outside of the voltage set points. The VAR settings are set as follows: A REAC OPEN (Amps Reactive Open) is LD 5.0 (5 Amps leading). A REAC CLOSE (Amps Reactive Close) is LG 50.0 (50 Amps lagging). Voltage Override settings are set to VOLTS OPEN 128.5 and VOLTS CLOSE 122.0. The Control will open the bank, regardless of VARs, if the control voltage exceeds 128.5V. The Control will close the bank, regardless of VARs, if the control voltage falls below 122.0V.

**IMPORTANT!** The Control may not operate exactly at the above set points due to the Adaptive Trip feature described earlier. For example, the Control may not close at the A REAC CLOSE set point of LG 50.0 if doing so would raise the control voltage above the VOLTS OPEN set point of 128.5V. Similarly, the Control may not open the bank at the A REAC OPEN set point of LD 5.0 if doing so would lower the control voltage below the VOLTS CLOSE set point of 122.0V. Any operation that is deferred due to Adaptive Trip will take place as VAR or voltage conditions change.

## SYSTEM MONITORING

Depending on the Model, the actual line voltage, ambient temperature or VARs can be monitored using the MONITOR settings. This can be helpful for setting up and checking Control operation. All parameters are measured and displayed real-time without any time delay or averaging.

*Voltage, temperature and VARs can also be monitored with the Control set for AUTO/OPERATIONS simply by rotating the ADJUST knob. After displaying the desired readings for 5 seconds, the display will automatically revert to the operations counter.*

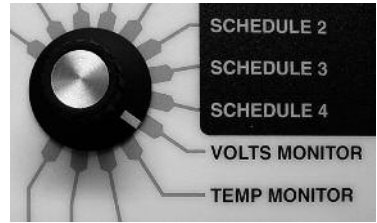
The Model 2000 VAR Control can monitor many system parameters from the primary feeder. All of these parameters can be displayed by selecting MONITOR from the mode switch.

**LINE AMPS** is the total current on the line, both real and reactive. **AMPS REAC** is the reactive component of the total line current. Reactive amps will be displayed along with LD for leading, LG for lagging, RV for reverse, and UN for unity power factor. Both **LINE AMPS** and **AMPS REAC** will show **LOW AMPS** in the display if less than 3 amps are measured. The **AMPS REAC** setting can be particularly helpful when adjusting the Amps Reactive set points for VAR Control. The effect of the capacitor bank on feeder VARs can also be seen by monitoring this setting while manually opening and closing the capacitor bank. **AMPS THD%** is the Total Harmonic Distortion in the line current. **KVA** is Kilo Volt Amperes.

**KILOWATTS** are the real component of the **KVA**. **POWER FACTOR** is displayed as a percentage of unity, e.g. 90% for a 0.9 power factor. To properly display **KVA**, **KVAR** and **KW**; the **PT RATIO** must be set. This is the ratio of the transformer supplying power to the Control. For example, the ratio for a 7200V line to ground connected transformer supplying 120V to the Control would be 60 ( $7200 / 120 = 60$ ).

**CONTROL VOLTS** is the voltage used to power the Control, typically 120 or 240V. **KV** is the primary voltage in kilovolts and is derived from **CONTROL VOLTS** x **PT RATIO**. **KV THD%** is the Total Harmonic Distortion in the line voltage. **POWER FLOW DIRECTION** shows in the display as **FORWARD** or **REVERSE**. This will indicate a current sensor that is wired backwards.

*Line Amps, Amps Reactive and Voltage can also be monitored with the Control set for AUTO/OPERATIONS simply by rotating the ADJUST knob. After displaying the desired readings for 5 seconds, the display will automatically revert to the operations counter.*



## NEUTRAL CURRENT MONITORING

On units equipped with optional Neutral Current monitoring, the capacitor bank neutral line is monitored. A neutral current sensor is mounted around the capacitor bank neutral lead and is connected to the Control. High neutral current is indicative of unbalanced VAR loading and can be used to trip the capacitor bank off line and keep it off line until the Control is manually reset. The neutral amps are averaged over five minutes when in AUTO mode. This average is used for comparison to the set point.

The NEUTRAL SENSE OPTION works in the following manner:

1. In MANUAL MODE, monitoring of neutral amps is accomplished by selecting VOLTS MONITOR, then rotating the ADJUST knob one position in either direction.
2. In AUTO MODE, monitoring of neutral amps is accomplished by rotating the ADJUST knob slowly until the display reads iA (Instantaneous Neutral Amps), and aA (5-minute Averaged Neutral Amps).
3. The neutral amps trip set point can be set from 3 to 100 amps. The setting below 3 amps will disable the neutral amp trip function. The display will read disabled.
4. In AUTO mode, if the neutral amps rise above the set point, the Control will open the capacitor bank, light the neutral trip LED, and hold the bank locked out until manually reset. Resetting the Control from neutral amp lockout is accomplished by rotating the MODE switch to the NEUTRAL AMPS, TRIP / RESET position.

The internal wiring connections for the neutral current sensor are shown in the diagrams on page 5.

## CLOCK BACK-UP BATTERY

All Capacitor Controls use a back-up battery for maintaining the internal clock settings when Control power is interrupted (The NoMax 2000 VAR Control uses the clock for data logging only). The lithium battery has a 10-year life and can be replaced through the battery access port in the front panel. If power is interrupted to a Control with a dead battery, all time settings will be lost. When this happens, the Control will alternately display TIME ERR when in the AUTO/ OPERATIONS mode.

*Only the internal clock, which is used for data logging, is dependent on the battery. All other previously logged data, front panel settings and Control programming is stored in non-volatile memory, which retains its contents indefinitely without power.*

## TROUBLESHOOTING

NoMax Capacitor Controls are sophisticated microprocessor based systems. There are no user serviceable parts inside. Any disassembly of a Control may damage components and expose lethal voltages. All servicing should be referred to the factory.

When the Control is first powered up, a self-test sequence is performed that tests all of the front panel lights. All of the LED's flash on and off in sequence and the LCD displays the Control firmware revision.

If the Control is exhibiting problems, the following test procedure may be helpful for troubleshooting. For additional assistance, contact the factory.

1. **POWER ON** Verify that the LCD display is showing characters and/or numbers thus indicating power to the controller. If the display is blank, measure the input voltage across terminals Line 1 (L1) and Neutral (N) just below the front panel. If the correct input voltage is available and the display is still blank, contact the factory for assistance.
2. **VOLTS MONITOR** Rotate the MODE switch to the VOLTS MONITOR position. Compare the value on the display to a calibrated digital voltmeter (DVM) reading across terminals L1 and N. The two values should be within +/- 2 VAC. This value takes into account the tolerances of the Control and a typical DVM.
3. **TEMPERATURE MONITOR** Rotate the MODE switch to the TEMP MONITOR position. Compare the temperature on the display to a calibrated digital temperature meter (DTM). Place the temperature sensor of the DTM tight against the Control temperature sensor; this is the gold button on the bottom of the enclosure. The measured value should be within +/- 3 degrees Fahrenheit (°F). This value takes into account the tolerances of the Control and a typical DTM.
4. **MANUAL CLOSE AND OPEN** Place the Control in manual mode by rotating the MODE switch to any position other than Auto/Operations. Use the manual toggle switch to perform a close or open operation. The Operation Pending light will flash for the length of time selected by the TIME DELAY setting. Once the delay time has elapsed, the Control output will energize and the appropriate LED will flash open or closed. If the open or closed LED is on but the capacitor bank switch failed to operate, check the 15-amp front panel fuse. If the fuse is bad, replace it with a 15-amp Slo-Blo® fuse. Note: If operating from open to close, a 5-minute close inhibit will be active if 5 minutes has not elapsed since the last open operation. Also, the Control cannot sense the position of the capacitor bank switches. A newly installed Control may not show the correct switch position. Similarly, a blown fuse or a bad capacitor bank switch can cause the Control to indicate the wrong switch position.
5. **SET TIME** To verify the correct time setting, rotate the MODE switch to SET TIME. Compare the displayed time to an accurate time source. The displayed time should be within +/- 5 min. If the two are different, reset the Control time and check the front panel battery. Remove the battery cover and pry up one end of the battery with a small screwdriver to remove. Replace the battery with a size 2/3A, 3V Lithium or equivalent. Note the proper polarity when installing. Reset the Capacitor Control to the current time and date with either the front panel switches or the software. Note: The time is set in 5-minute increments via the front panel. Follow the same procedure for the date. If the time or date cannot be set or continue to be lost when power is interrupted, contact the factory for assistance.

6. **OPERATION SET POINTS** To verify proper operation of the set points, the recommended procedure is to download both the profile and setup data and examine the data with respect to the set points. The profile data will show the Time On/Off, Close/Open Volts or VARs and Start/Stop Dates as well as collected system data. This also checks the relay outputs, (noting the rise and fall voltage values of the bank at the sampled times) Control sensors and profile memory.
7. **COMMUNICATIONS PORT** Place the Control in Manual mode by rotating the MODE switch to any position other than the Auto/Operations or Set Time. Using a computer with installed NoMax software, download the profile and setup data. While downloading the data, the Control display should show COM BUSY indicating that the RS-232 communications link is working properly. Note any messages displayed on the computer screen during the download procedure. Follow the instructions given on the screen. If the Control is unable to communicate with the computer, contact the factory for assistance.

The following information regarding the front panel displays may prove helpful in diagnosing a Control that appears to be functioning improperly.

## LED INDICATORS

- **AUTO/OPERATIONS** - Indicates the Control is in automatic mode. The Control will open and close the bank only per the programmed settings and the toggle switch is disabled. The display indicates the total number of CLOSE operations. When the LED is off, the Control is in manual mode and the toggle switch is enabled.
- **OPERATION PENDING** - Flashes during the number of seconds selected by TIME DELAY for every pending OPEN or CLOSE operation.
- **CLOSE** - Shows the bank status as closed. A flashing LED indicates the CLOSE output is energized.
- **OPEN** - Shows the bank status as open. A flashing LED indicates the OPEN output is energized.
- **NEUTRAL AMPS TRIP / RESET** - (Optional) The capacitor bank neutral current has exceeded the preset threshold and the bank is locked OPEN. To reset this condition, rotate the MODE switch to the NEUTRAL AMPS TRIP/RESET position.

## LCD DISPLAY

- **AMP ERR** - The current sensor is not operating properly. If this is a transient condition, the Control will automatically reset the current sensor input and continue to operate properly. A permanent current sensor failure can be verified with the MONITOR - LINE AMPS setting which will show LOW AMPS. If this condition is permanent, the Control will not perform any VAR related operations but will otherwise operate normally.

- **COM BUSY** - The Control is communicating via the RS-232 communications port.
- **LOW LINE** - The supply voltage has dropped below its operating threshold (92V for a 120V unit and 180V for a 240V unit). The Control will go into a standby mode until the voltage recovers and will then perform a power up self-check.
- **OP LIMIT** - The Control has reached its daily limit of automatic close operations as set by MAX OP'S/DAY. The Control will not CLOSE automatically again during the present 24 hour period. Manual CLOSE and OPEN operations can still be performed.
- **REVERSE** - The Control has detected current flowing in the reverse direction. If this message is displayed upon initial installation, the current sensor may be connected backwards or to a different phase than the supply or sense voltage.
- **SYS ERR** - The Control has detected a memory defect. The Control will stop operating and must be returned to the factory for repair.
- **TIME ERR** - The Control has detected a timing error, most likely due to a dead clock back-up battery. This condition can be reset temporarily by resetting the Control's time and date via the front panel or via the NoMax software. Permanent repair requires battery replacement.
- **VOLT ERR** - The voltage sensor is not operating properly or the voltage being measured has fallen either below 100V or above 150V. If this display is due to a short-term voltage change, the Control will reset automatically. While this condition persists, the Control will not perform any voltage related operations but will otherwise operate normally.
- **5MIN DLY** - Will be displayed for 5 minutes following any OPEN operation. The Control will not perform a CLOSE operation this period.

## SPECIFICATIONS: ALL MODELS

### ELECTRICAL

**POWER REQUIREMENT** 100-140 or 200-260 VAC, 10W

**MOUNTING** 4 or 6 Jaw Meter Socket or Pole Brackets. Internal terminal block electrical connections for pole mounted unit. Optional Amphenol connector for pole mounted units.

**OUTPUT CONTACTOR** 30A, 120/240 VAC. 15 second "on" duration for MOTOR OP switches. 100 millisecond "on" duration for SOLENOID switches.

**FUSE** 15A Slo-Blo®

**SURGE / LIGHTNING PROTECTION** ANSI C37.90.1 1989

**VOLTAGE ACCURACY**  $\pm 0.5\text{VAC}$ , 0.1VAC Resolution

**TEMPERATURE ACCURACY**  $\pm 1^\circ\text{F}$  Resolution

**CURRENT ACCURACY**  $\pm 1\%$  + sensor accuracy, 0.5Amp Resolution.

**COMPATIBLE SENSORS:** Lindsey™ CVMI and Fisher Pierce™ 1301

**PHASE ANGLE ACCURACY**  $\pm 1^\circ$  lead or lag

**TIME ACCURACY** Temperature compensated oscillator with back-up battery,  $\pm 0.001\%$

**BATTERY** Lithium cell, 10-year life, size 2/3A, 3V

**DISPLAY** Liquid Crystal, backlit

**RS-232** DB-9 female on front panel, 2400 baud; 3-5 minutes to download 5,000 data points.

## MECHANICAL

**MOUNTING** Meter socket, 4 or 6 jaw ringed or ringless (must be specified) or pole bracket with conduit hub hole (specify size and location) or Amphenol connector.

**ENCLOSURE-METER SOCKET MOUNTING** NEMA 4X weather tight fiberglass; 8.75 x 10.75 x 5.5 in. Weight 7.5 lb., 3.3 kg, hinged left, lock hasp on right side.

**ENCLOSURE-POLE MOUNTING (W/AMPENOL CONNECTOR)** NEMA 4X weather tight fiberglass; 10.75 x 12.75 x 5.6 in. Weight 7.9 lb., 3.6 kg, hinged left, lock hasp on right size.

## ENVIRONMENTAL

**TEMPERATURE** -22°F to +185°F (-30 to +85° C)

**HUMIDITY** 5-95% non-condensing

## SETTINGS

**VOLTAGE CLOSE:** 105-127 / 210-257 VAC; Max. Setting = Open Volts - 3VAC.

Open: 108-130 / 213-260 VAC; Min. Setting = Close Volts + 3VAC.

5-minute time averaged voltage response. Settings in 0.1 volt increments.

**TEMPERATURE CLOSE:** 0-120°F (°C display optional).

Open: 0-120°F, no closer than 5°F to Close temp.

30-minute time averaged temperature response. Settings in 1°F increments.

**AMPS REACTIVE** Open: 100A Leading to 598A Lagging; Max Setting = Close Amps - 2A.

Close: 0.5A Leading to 600A Lagging; Min Setting = Open Amps + 2A.

5-minute time averaged current response. Settings in 0.5 Amp increments.

**TIME DELAY** 3-600 seconds, 3 second increments.

**MAX OPERATIONS/DAY** Configurable from 2-24

**MANUAL TRIP** Center-off, momentary Open or Close, Close and Open operations delayed by selected Time Delay, 5-minute delay following Open before re-close.

**NEUTRAL AMPS TRIP** 3-100 Amps, harmonic filtered, 5-minute time averaged response, manual reset, 5-minute minimum tripped time.

**PT RATIO SET** 1-300

### CONTROL MODELS:

NoMax 1300: Time | Voltage | Time with Voltage Override

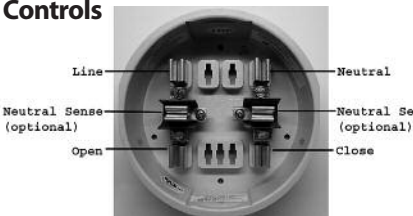
NoMax 1600: Time | Voltage | Temperature | Time with Voltage Override

Temperature with Voltage Override

Time with Voltage and Temperature Override

NoMax 2000: VAR | VAR with Voltage Override | Voltage

### Series 1000 Controls



### Series 2000 Controls



# NOMAX PROGRAMMING AND DATA ANALYSIS SOFTWARE

## Features

Version 5 NoMax software aids in programming a NoMax Capacitor Control for capacitor bank switching and power system monitoring via a computer. The software includes the following features:

- Design capacitor bank control strategies in the office for future uploading to the Control.
- Create and save different control strategies for different model Controls all with the same software.
- View and analyze data downloaded from Capacitor Controls. Examine Control switching operations, power outages and system parameters such as voltage or VARs.
- Graph stored voltage, temperature or load current data. Zoom in on areas of interest.
- Connect to a Control for real time monitoring of the Control parameters such as voltage, temperature or VARs.
- Download stored programs to update a control strategy or download a control program from a control back to a computer.
- Set up the Control for data logging. Program the Control to store control and system parameters such as switching operations, voltage, temperature or VARs.

## PRECAUTIONS

Precautions must be taken before connecting a computer to an installed capacitor bank control.



**CAUTION!** Before connecting a computer to an installed capacitor bank take the following steps:

1. Ensure the Capacitor Control is properly grounded.
2. Set the Control so it is **not** at **AUTO / OPERATIONS** or **SET TIME**.

Failure to follow these precautions may result in damage to the computer, unexpected capacitor bank operation or personal injury.

## SOFTWARE INSTALLATION

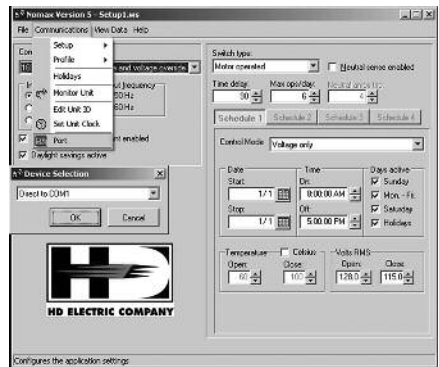
**HARDWARE REQUIREMENTS:** NoMax software runs on Windows™ 95 or higher.

The proper installation and use of this software requires a 386 or better computer with at least 32 MB RAM and at least 20 MB of free hard disk space. The software will communicate with the Capacitor Control through an open serial port - either COM1 or COM2. A DB-9 connection is required. The cable connecting a computer to the Control should be a straight through serial cable. The NoMax Capacitor Control is equipped with a DB-9 female connector.

Before beginning the software installation process, close or exit all other programs. The NoMax software is provided on CD. Installation will begin automatically provided that auto-insert notification is not disabled on the computer being used. If installation does not begin automatically, double click the CD ROM drive in "My Computer" and run Setup.exe from the CD.

### Using the Software for the first time

Start the NoMax software via the **NoMax** icon or use the Windows™ Start button to navigate to the NoMax folder. Before connecting the computer to a NoMax Control, verify that the computer is set up for communications on the correct COM port. COM1 is the default port in the software. If necessary, change the port as shown in the graphic, starting with the **Communications** drop-down menu.



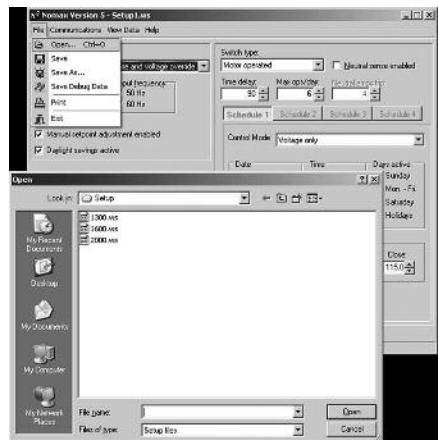
**IMPORTANT!** If the COM port is changed, the NoMax software must be restarted for the change to take effect.

### Create a Control program

To program a NoMax Capacitor Control with a computer and NoMax software, a Control program must be created as shown here.

Select **File**, then **Open**. If this is the first time for setting up a program, select one of the default programs for the Control model that is to be programmed. For example, select 1600.ws for a Model 1600 Control. A previously created file may also be selected. All setup files will have a **.wss** extension.

After the file is opened, the name of the file will be shown on the title bar of the main window.



Note that the NoMax Control front panel ADJUST knob can be disabled in the main window by un-checking **Manual setpoint adjustment enabled**. This provides a level of security and prevents unwanted changes to the control program in the field.

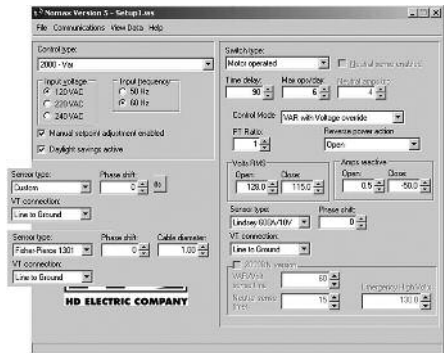
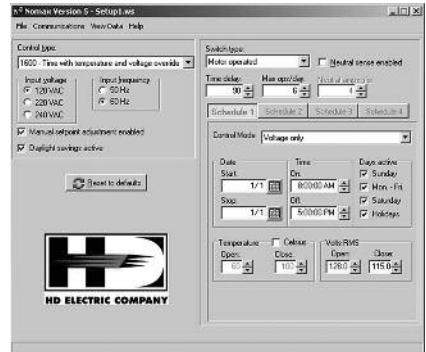
Select a Schedule. Each time schedule must be programmed individually. To disable a schedule, set the start date the same as the stop date. To make a schedule active 24 hours per day for around the clock voltage control, set the start time the same as the stop time. The schedules in black lettering are active schedules, orange lettering refers to inactive schedules.

Note that negative Amp settings are used to indicate lagging amps. Positive Amps indicate leading Amps.

When programming a **Model 2000 VAR** Control, select the **Sensor type** that will be used. For either Fisher Pierce™ or Lindsey™ sensors, the sensor phase shift is automatically set in the software (to +90°). Both have a ratio of 600A/10V. If the current sensor is on a different phase from the control voltage, add or subtract 120° as required. For example, if the current sensor is on A-phase, and the Control is powered from B-phase, enter 120° in the **Phase shift** box. Because settings must be entered in the range of -180° to +180°, settings greater than 180° must be entered with a reciprocal. For example, 210° is entered as -150° ( $210^\circ - 360^\circ = -150^\circ$ ). Consult the manufacturer's technical literature for additional information regarding the current sensor. The Fisher Pierce™ sensor also requires the additional **Cable diameter** setting shown.

After entering all the desired settings, save the new file. Enter a file name and select **File**, then **Save**. The NoMax software automatically adds the **.ws** extension. If an existing setup file was modified, **Save As** must be selected so the original file is not overwritten.

To print the Active setup file, select **File**, then **Print**. To print another setup file, select **File**, then **Open**, then **Print**.



## UPLOAD A SETUP PROGRAM TO A NOMAX CONTROL

To upload a setup program to a NoMax Control, **follow the precautions shown at the beginning of the software section of this manual** (page 20) and connect a computer to the Control with a straight through RS-232 cable. Make sure the selected COM port matches the DB-9 connector on the back of the computer.

Select **Communications**, then **Setup**, then **Upload Setup Data** from the main menu.

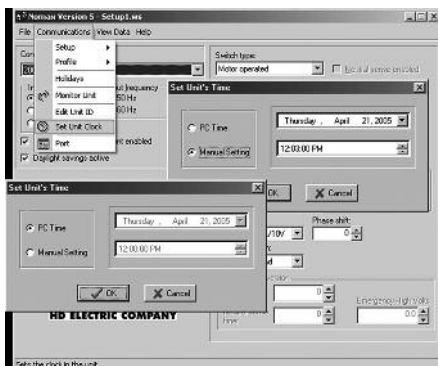
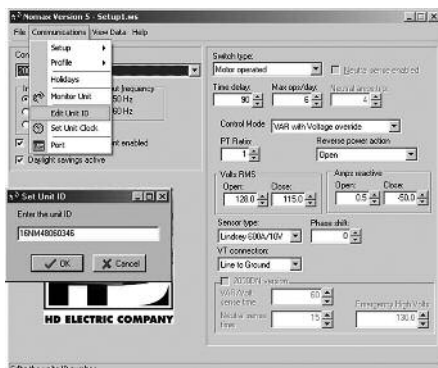
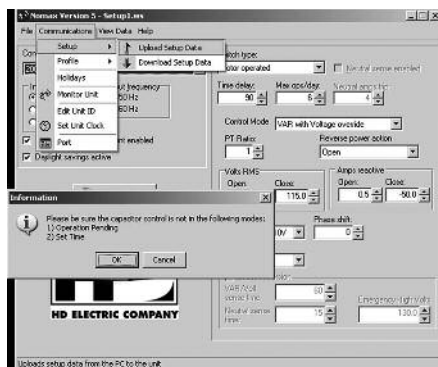
Note that the name of the active setup file that will be uploaded to the NoMax Control is shown in the upper left corner of the main title bar.

At this time, the current setup program can be downloaded from a NoMax Control to a computer by selecting **Communications**, then **Setup**, then **Download Setup Data**.

Any time communications are initiated with a NoMax Control, a warning will appear asking the user to verify that the Control is not in **Auto/Operations** or **Set Time**. While the setup data is being transferred, the LCD display on the NoMax Control will display **COM BUSY**.

**Edit Unit ID** will give each Control a unique identification. The factory default ID is the serial number of the Control. This number is used in the header of all downloaded data and is also be the default file name for the data file.

To set the clock on the Control, select **Communications**, then **Set Unit Clock**. The clock can be set according to the clock on the computer that is connected to the NoMax Control. Alternately, the clock can be set manually with the front panel knobs (this feature is not available on the Model 2000 VAR Control).

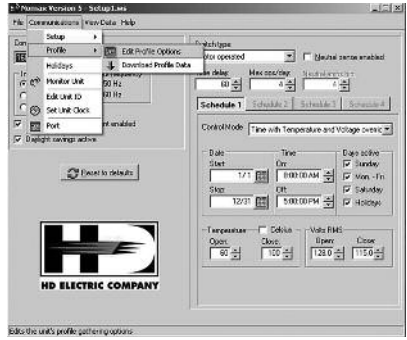


# USE PROFILE DATA LOGGING

Set up and use of the internal data logging features in a NoMax Capacitor Control and download the stored data.

## Initialize the Profile Data Collection Options

From the main menu, select **Communication** then **Profile**, then **Edit profile options**:



**SAMPLE PERIOD** sets the sample frequency for voltage, temperature, current, or VAR (depending on the Control model) data. All collected data are instantaneous readings and are not averaged or delayed.

**CIRCULAR OVERWRITE ENABLED** will overwrite the oldest data when memory is full.

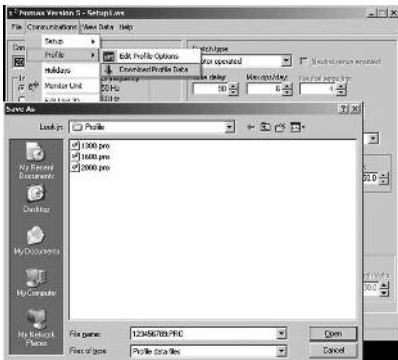
**RECORD TEMPERATURE** enables temperature data recording (Model 1600 Control only).

**RECORD NEUTRAL CURRENT** enables neutral current data recording. This option is only available if the Control has the neutral sense feature enabled.

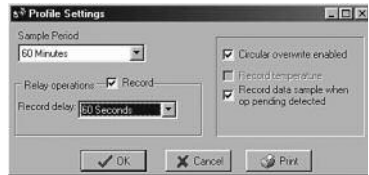
Select **Relay operations** to record data after an open or close operation. If selected, select a **Record delay** frequency from the drop-down box. A time delay is recommended to allow switching transients to settle.

When all desired options have been selected, select OK to update the Control. **Updating Profile options erases any previously stored data in the Control.**

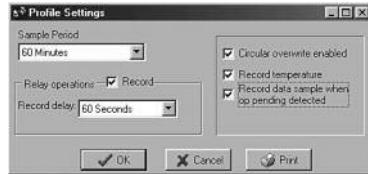
To download stored data, select **Communications**, then **Profile**, then Download **profile data**. The default file name is the Control ID# selected earlier (a **.pro** filename extension will be automatically added.) A different filename can also be entered at this time.



## Model 1300 Controls



## Model 1600 Controls



## Model 2000 Controls



# VIEW AND GRAPH DOWNLOADED PROFILE DATA

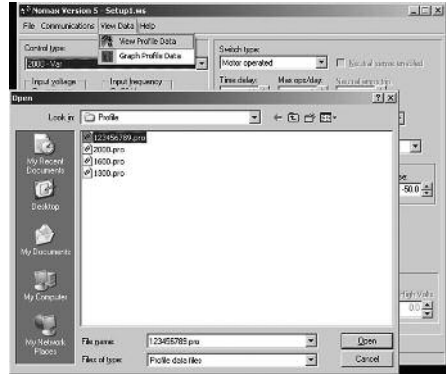
Review NoMax Capacitor Control switching operations and system power outages, or graph collected system data such as voltage, temperature, real amps, reactive amps, etc.

## View Profile Data Files

Select **View Data** from the main menu, then **View Profile Data**.

Select from the available profile files shown.

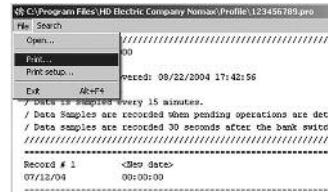
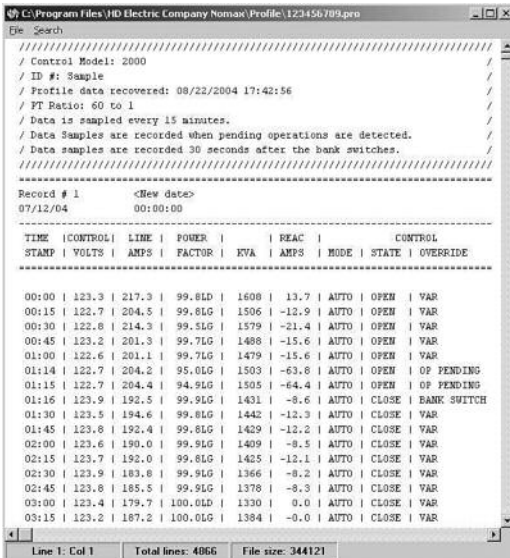
The stored data will be shown as a file of data points. A new header with a record number is generated every time power is restored, every day just after midnight, following a manual adjustment of the time clock, or whenever the Control performs a switching operation.



Power outage duration can be determined by the time difference between the last recorded data point and the time that power is restored.

The data file also displays the status of the Control, the MODE (AUTO or MANUAL), the STATE of the bank (OPEN or CLOSED), the OPERATION occurring, or the reason for the last Control operation (TIME, VOLTAGE, TEMPERATURE, VAR, etc.).

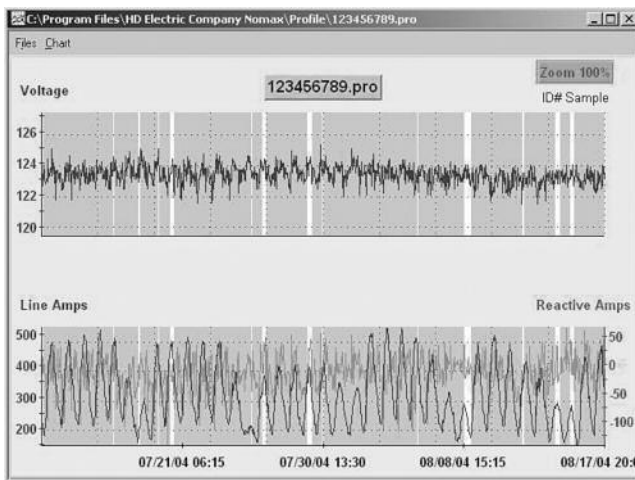
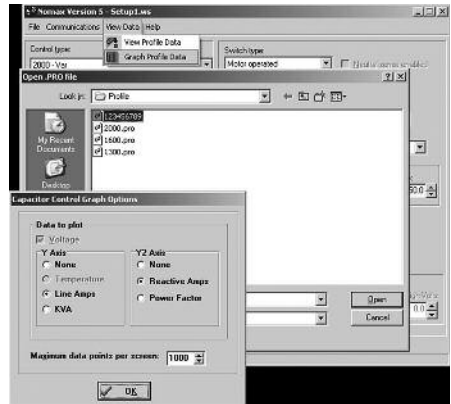
To print a copy of this file, select **File**, then **Print**.



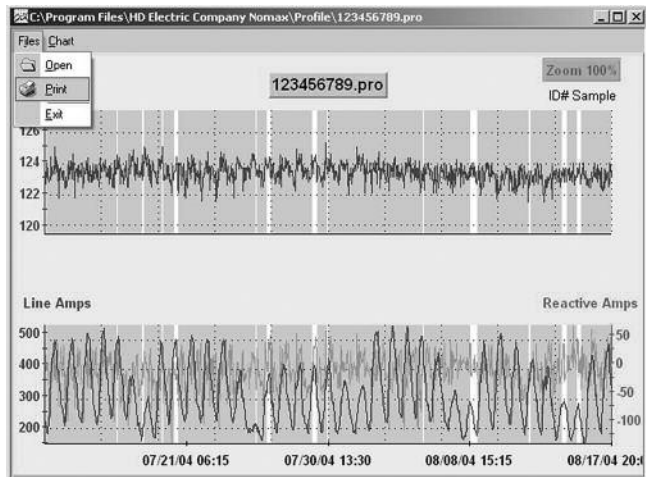
## GRAPH PROFILE DATA FILES

Any stored system parameter such as voltage, temperature or Amps can be graphed. Select **View Data**, then **Graph Profile Data** and choose the desired data file.

Select the data to be shown on the graph. The proper graphing options will be enabled for the appropriate NoMax model.



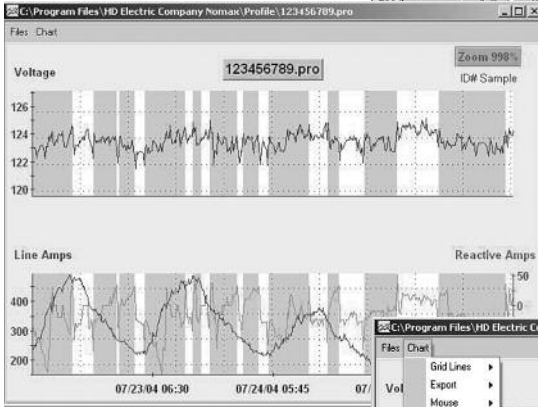
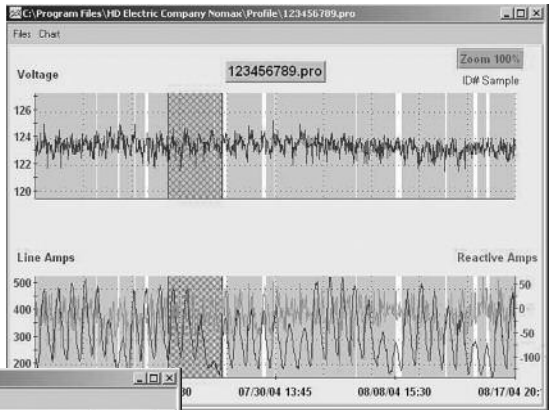
To print a graph, select **Files**, then **Print**.



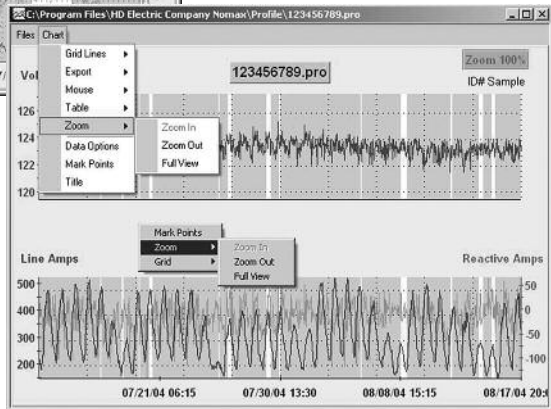
## MODIFY PROFILE GRAPHS

To zoom in on a particular set of data points, click and drag the mouse around the area to be zoomed. Release to complete the selection.

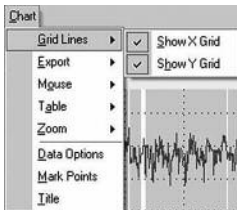
Zooming can also be accomplished by selecting **Chart**, then **Zoom**. Select the appropriate zoom function.



Clicking the right mouse button anywhere on the graph will also access the zoom function via a pop-up menu.

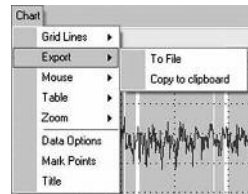


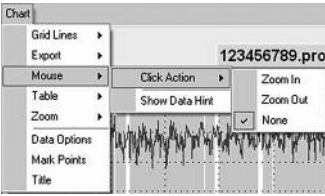
Using the **Zoom In** or **Zoom Out** functions will zoom in or out referenced from the center of the graph. **Full View** displays the entire graph.



**GRID LINES:** Toggles the display of grid lines on and off.

**EXPORT:** Allows the graph to be exported to a specified file or copied to the Windows™ clipboard.

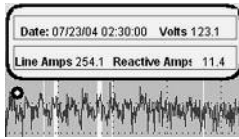




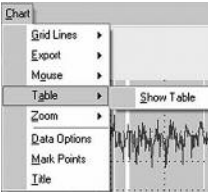
**CLICK ACTION, ZOOM IN:** With this option enabled, double clicking on the graph area will zoom in.

**CLICK ACTION, ZOOM OUT:** With this option enabled, double clicking on the graph area will zoom out.

**CLICK ACTION, NONE:** With this option enabled, double clicking will have no effect.



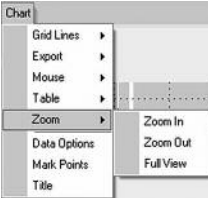
**SHOW DATA HINT:** Displays a popup window with details of the closest data point.



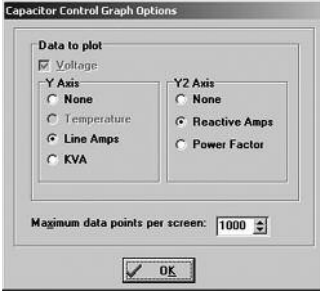
	07/21/04 06:15	07/30/04 13:30	08/08/04 15:15	08/17/04 20:00
Voltage	122.6	124.1	123.5	122.7
Line Amps	248.2	398.3	285.3	326.3
Reactive Amps	-42.8	17.8	28.5	0.0

**SHOW TABLE:** Displays a data table at the bottom of the graph window.

**ZOOM:** Same functions as described on pages 27 & 28.



**DATA OPTIONS:** Changes the data that is displayed on the graph.



**MARK POINTS:** Places a point at each data point on the graph.

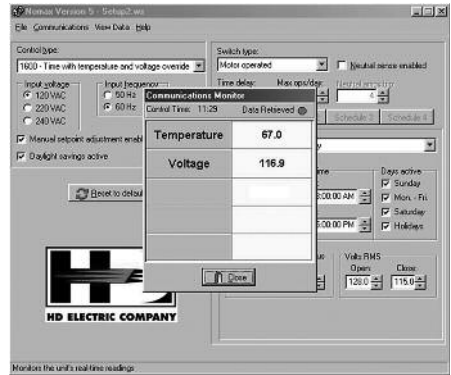


**TITLE:** Changes the title of the current graph.

## REAL TIME MONITORING OF THE NOMAX CAPACITOR CONTROL

Connect a computer to the Control for real time monitoring of the Control.

**Follow the precautions shown at the beginning of the software section of this manual** (page 20) and connect a computer to the Control with a straight through RS-232 cable. Verify that the selected COM port matches the DB-9 connector on the back of the computer (See page 21 to change the COM port). Then, select **Communications**, then **Monitor Unit** from the main menu.



Information will be displayed depending on the Control model currently connected. All displayed values will be updated continuously until the Communications Monitor window is closed.





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This warranty applies to all products sold by HD Electric Company (the "Products"); provided, however, that the term Products does not include any third party products purchased through HD Electric Company, for which no warranties are made (the "Third Party Products"). Third Party Products may be subject to a separate manufacturer's warranty; [should you have any question regarding whether a separate warranty applies, please contact HD Electric Company].

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