

# AutoCap™ Adaptive Capacitor Controller And Recorder



## POWERFLEX® SERIES

The Fisher Pierce 4400 Series AutoCap Adaptive Capacitor Controller takes the complexity out of switched capacitor bank control.

Plug in the factory programmed AutoCap controller and it adapts itself to the installation. No more hassles with sensor wiring or set point calculations. The 4400 Series can be installed without ever opening the enclosure!

The Adaptive VAR™ control mode automatically measures the size of the bank and establishes VAR set points for maximum energy loss reduction.

The PhaseFind™ function of the controller locates current signal source and compensates for phase rotation and reversed wiring.

The Voltage Guard™ function measures the voltage change caused by capacitor switching and applies this value to the present line voltage. If Voltage Guard predicts that bank switching will cause the line to exceed preset voltage limits, switching is inhibited, preventing both out of range line voltage conditions and capacitor bank cycling.

The controller automatically corrects for installation errors such as sensing voltage and current from different phases, reversed current signal wiring, reversed Trip/Close wiring and calibration errors. The AutoCap can adjust to abnormal operating conditions including reverse

power flow, bank hunting, low switching voltage, capacitor can failure (neutral current lockout), and excessive bank switching.

The 4400 Series AutoCap is a one-to-four season programmable controller. It can operate on the basis of VAR, voltage, current, temperature, time and combinations of these inputs. Programming is accomplished using SmartSet™ application software, Windows based and menu driven for ease of use. In addition, AutoCap includes complete load data/event recording and report generation supported in SmartSet.

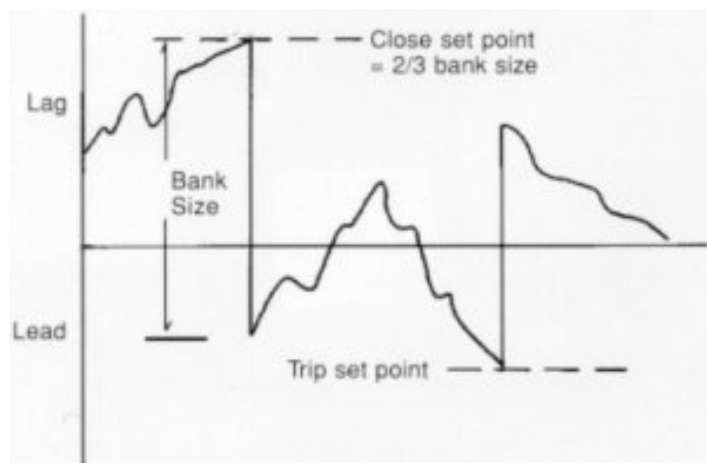
### Features

- Adaptive VAR control
- Voltage Guard (adaptive voltage restraint)
- PhaseFind
- Reverse power functions
- True RMS voltage and current sensing
- Total harmonic distortion recording
- Reverse Trip/Close wiring detection
- Anti-hunt function
- Under voltage inhibit feature
- Plug-to-Plug compatible with existing controllers
- Windows-based SmartSet application software
- Graphs and reports directly from SmartSet
- Expanded load data and event recording
- Compact package

## Exclusive AutoCap Advantages

The Series 4400 AutoCap controller includes many new and innovative functions which eliminate the traditional struggle associated with setting optimum VAR setpoints (Fig. 1 - Adaptive VAR); finding the voltage change caused by bank switching (Fig. 2 - Adaptive Voltage Guard); and field wiring (Fig. 3 - PhaseFind).

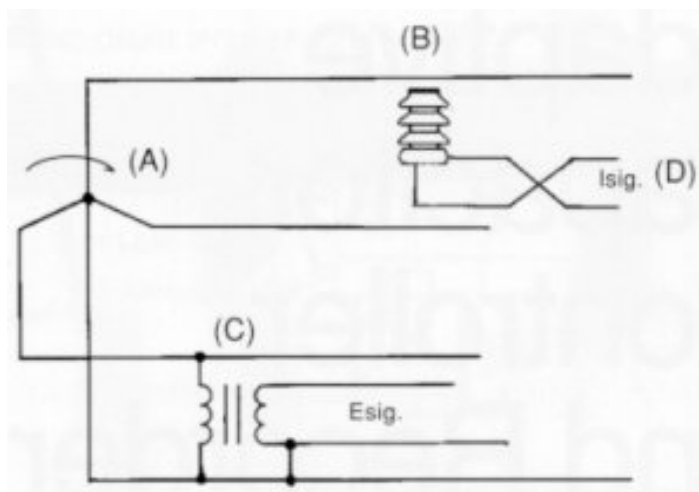
- **Reverse power functions** calculate proper VAR setpoints to compensate for altered VAR measurement during this condition. Four other control mode options are also available for use during reverse power conditions. An LED on the controller panel indicates reverse power condition.



### Adaptive Var™ (Fig. 1)

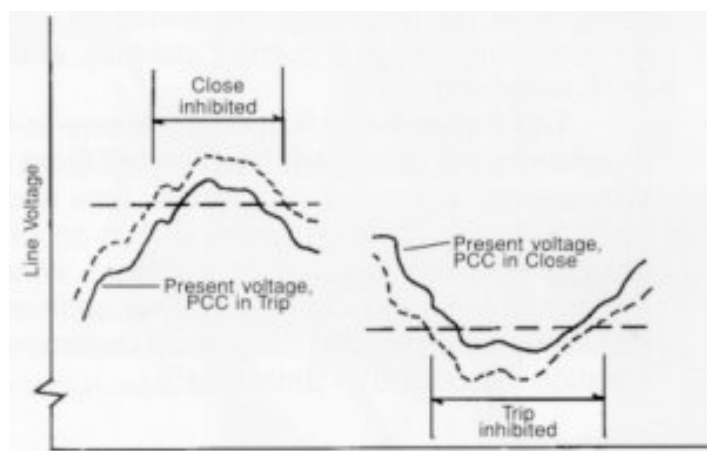
Identifies size of the capacitor bank and sets the Var switching points for maximum loss reduction.

- **Reverse Trip/Close detection** automatically senses reverse wiring of the Close and Trip drive circuits to the capacitor switch; inhibits all switching, except manual, and indicates error by flashing LED on front panel.
- **Anti-hunt function** automatically compensates for rapid bank tripping due to cycling loads or interaction from other switched banks on the feeder.
- **Undervoltage inhibit** feature protects the capacitor bank switch from damage caused by low voltage.



### PhaseFind™ (Fig. 3)

Compensates for phase rotation (A), finds current signal phase (B) with respect to voltage phase (C), and compensates for reversed wiring (D).



### Adaptive Voltage Guard™ (Fig. 2)

Identifies voltage change from bank switching; inhibits Close operation if Voltage Guard™ plus present line voltage exceeds high voltage limit. Reverse conditions inhibit Trip.

## Additional AutoCap Features

The AutoCap controller builds on more than 30 years of Fisher Pierce experience in the design, manufacture, and application of electronic capacitor controls.

- Standard meter socket mounting, pole or wall mounting available.
- Single phase line current signal input: Line post sensor or CT input for VAr and current control and data recording.
- Capacitor bank neutral current signal input: Fisher Pierce split lamination sensor (AT929) or CT neutral current input.
- Neutral current lockout lamp; reset by manual button or command through RS-232.
- Shielded ambient temperature sensor.
- 9 Pin, RS-232 communications port.
- Optical communication port available.
- 365/366 day time clock includes next century.
- Programmable momentary output relays.
- Nonvolatile memory.
- Independent watchdog timer.
- Electromechanical operations counter available.
- Internal LCD read-only display available.
- Operational status LED'S.
- Manual Close/Trip operation and Auto/Manual switches.

## SmartSet™ Application Software

The Series 4400 AutoCap controller is programmed using Windows-based SmartSet software created by Fisher Pierce for greater programming ease.

[Click to see sample set-up screen](#)

Using SmartSet software, the AutoCap is a multifunction microprocessor based controller which can be programmed for up to four seasons. Each season can have its own primary and override functions as listed in the Control Modes table below. The PCC is programmed via a standard RS-232 or optional optical communications port using any Windows-based PC.

### Control Modes

Basic Functions	Override Functions	Voltage Bias	Reverse Power
● Adaptive VAr™	● Voltage	● Time	● Ignore
● Var	● Time	● High Temp	● Voltage
● Voltage	● High Temp	● Low Temp	● VAr
● Current	● Low Temp		● Trip and Inhibit
● Time			● Close and Inhibit
● High Temp			
● Low Temp			

### The following additional functions are also provided

- Real-time monitoring of data readings and controller status through local RS-232 or optical port.
- Traditional holiday calendar - 10 year predefined, can be user edited.
- Individual and block holidays - 10 year user programmable.
- Daylight Saving Time calendar - 10 year predefined, can be edited.
- Daily close count limit - User programmable.
- Switching time delays/inhibits - For automatic and manual modes with LED indication on controller panel.
- Neutral current lockout - Trips bank and prevents further capacitor operation, and flashes external lamp in the event of a capacitor can failure. Reset by external button or RS-232 command.

[Click to see sample season configuration screen](#)

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### Extensive Data Recording

The Series 4400 AutoCap PCC provides a full spectrum of user defined load data and controller operations recording capability. Three-phase load data are derived from single phase measurements and assume balanced load. All recorded data are easily uploaded via RS-232 or optional optical port. Memory of 32K standard; expanded 128K is available.

### Data Recording Parameters

#### Load Data Recording

(1 min. to 4 hour averaging period)

Date/Time Stamp  
Voltage (Sec. or Line)  
Current (Sec. or Line)  
kvar (3 $\emptyset$ )  
kVA (3 $\emptyset$ )  
kW (3 $\emptyset$ )  
Power Factor  
Total Harmonics  
Temperature  
Trip/Close Status

#### Daily Summary Recording

Date Stamp  
Time of Max/Min Value  
Daily Max/Min Voltage  
Daily Max/Min Current  
Daily Max/Min (3 $\emptyset$ ) kVAr  
Daily Max/Min Temp  
Daily Close Operations  
Daily Close Hours  
Close Ops Running Total

#### Operations Recording

Date/Time  
Basic Operations  
Override Operations  
Manual Operations  
Power up/Power down  
Voltage Before/Delta  
kVAr Before and After  
kW Before and After  
Reverse Power

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## Report Generation Capability

[Click to see sample graph screen](#)

The SmartSet™ report generation feature provides spreadsheet format and visual presentation of recorded data as well as many editing features. This capability is integrated into SmartSet- no additional software is required. The ability to graph all load study data, specify time period, and superimpose Close/Trip operations is included.

## Load Data Reports

- Spread sheet format
- Graphing of all load data
- Edit graph time period
- Scale of graph
- Title of graph
- Trip/Close status
- Report printing

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## Specifications:

### ELECTRICAL

#### Operating Voltage Ranges:

- 95 - 150V, 60 Hz
- 190 - 280V, 60 Hz
- 95 - 125V, 50 Hz
- 190 - 250V, 50 Hz

**Surge Withstand:** ANSI C62.41 - 1987

#### Electrostatic Discharge Test:

IEC 801-2, 15 kV applied to all accessible areas

#### Output Relay:

**Number:** Two

**Type:** Momentary closure

**Maximum continuous load:** 10A

**Maximum inrush:** 50A, 50% PF, 6 cycles, make only

**Contact closure period:** Programmable 1 - 1000 seconds, in 1sec increments

**Fuse Rating: Controller input:** 2A

**Output to capacitor switch:** 10A FNM Slo-Blo®

**RS 232 Communications Port:** DB9 female connector

**Optical Communications Port:** Type 2

### MECHANICAL

**Enclosure:** Lexan or Aluminum, NEMA 3R

**Mounting:** 4 or 6 jaw meter base

Wall or Pole bracket (Alum only)

#### Dimensions:

8.5"h x 6.5w x 4.75"d (Lexan)

11.5"h x 7.0"w x 4.0"d (Alum)

### ENVIRONMENTAL

#### Operating Temperature:

-40°C to +80°C (-40°F to + 176°F)

**Humidity Range:** 0 to 95% (non-condensing)

### MEASUREMENT PERFORMANCE

#### Voltage

### CURRENT

#### Resolution:

Fisher Pierce 1301 sensor: 0.1A

Lindsey line post sensor: 0.1A

Current Transformer: 0.01A (secondary)

**Accuracy:** ±1% of reading, ±0.2% range, ±sensor error

#### Range:

Fisher Pierce 1301 sensor: 4 to 800A, true rms

Lindsey line post sensor: 4 to 800A, true rms

Current Transformer: 0.1 to 20A (secondary), true rms

Current Transformer Ratio: 5.5 to 2000:5, in 1:5 increments

#### Reactive Power (VAr)

**Resolution:** 1 kVAr

**Range:** ±99,999 kVAr

#### Temperature

**Resolution:** 1°F (1°C) **Accuracy:** ±2°F (°1C)

**Range:** -40°C to +60°C (-40°F to 140°F)

#### Time Clock

**Resolution:** 1 second

**Accuracy:** ±10 minutes per year

**Range:** 24 hour clock

**Settings:** 1 minute increments

#### Phase Angle

**Resolution:** 0.1°

**Accuracy:** ±1°

**Range:** 0° - 359°

**Neutral Current Resolution:** Fisher Pierce

AT929 sensor: 0.1A

**Current Transformer:** 0.01A (secondary)

**Accuracy:** ±1% of reading, ±0.2% range, ±sensor error

**Range:** Fisher Pierce AT929 sensor: 1 to 60A

**Current Transformer:** 0.1 to 20A (secondary)

**Current Transformer Ratio:** 5:5 to 2000:5, in 1:5 increments

**Secondary**

**Resolution:** 0.1 Vac

**Accuracy:**  $\pm 0.5\%$  of reading over temperature

**Range:** Same as operating range, true rms

**Primary**

**Ratio range:** 1:1 to 1000:1 in 0.1:1 increments

**CONTROLLER PROCESSOR**

**Memory Size:** 32 kB (standard), 128 kB (option)

**Memory Type:** EPROM, NVRAM, and battery backed RAM

**SERIES 1301 LINE POST SENSOR**

**Calibration Accuracy at 120A:**  $\pm 1\%$

**Linearity Error:** 3-1200A,  $\pm 1\%$

**Angle Error:** 3-600A,  $\pm 0.5^\circ$

**Temperature Error:**  $\pm 0.02\%/^\circ\text{C}$

**7th Harmonic Response:** 82%

See Fisher Pierce Series 1301 bulletin FP054 for complete specifications.

For more information about Capacitor Controls and/or Relays contact Dave Donovan at 1.800.969.9797  
Or contact [Dave Donovan](#) via E-Mail

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**FISHER PIERCE - SmartSet (TM) Ver. 1.0 :VIEW SETUP**

VIEW SETUP	SAVE SETUP	SEND TO PCC	PRINT SETUP	CONTROL CONFIG
SITE/LIMITS	HOLIDAYS	DATA LOG	ERASE	MAIN MENU

PCC ID  Setup  16:39 Aug. 09 1995

Control Config (season)	Start MM/DD	End MM/DD	Primary Function	Voltage Bias	Override	Reverse Power	Config Status
1	<input type="text" value="03/10"/>	<input type="text" value="06/15"/>	<input type="text" value="ADAP VAR"/>	<input type="text" value="N/A"/>	<input type="text" value="VOLT"/>	<input type="text" value="MOD VAR"/>	<input type="text" value="Complete"/>
2	<input type="text" value="06/16"/>	<input type="text" value="09/01"/>	<input type="text" value="TIME"/>	<input type="text" value="N/A"/>	<input type="text" value="VOLT"/>	<input type="text" value="IGNORE"/>	<input type="text" value="Complete"/>
3	<input type="text" value="09/02"/>	<input type="text" value="12/06"/>	<input type="text" value="VOLT"/>	<input type="text" value="TIME"/>	<input type="text" value="NO"/>	<input type="text" value="TR-INH"/>	<input type="text" value="Complete"/>
4	<input type="text" value="12/07"/>	<input type="text" value="03/09"/>	<input type="text" value="TEMP"/>	<input type="text" value="N/A"/>	<input type="text" value="VOLT"/>	<input type="text" value="IGNORE"/>	<input type="text" value="Complete"/>

Summary of Site/Limits

Cur Sensor : <input type="text" value="HI 1301"/>	Ratio : <input type="text" value="60"/>	Status : <input type="text" value="Complete"/>
Line : <input type="text" value="WYE"/>	Rot : <input type="text" value="ADAP"/>	Current Ph : <input type="text" value="ADAP"/>
Fwd/Rvs <input type="text" value="ADAP"/>	Volt Trans Ratio : <input type="text" value="63.5"/>	
Volt Guard (V) : <input type="text" value="ADAP"/>	Hi (V) : <input type="text" value="128"/>	Lo (V) : <input type="text" value="110"/>
Undervolt Switch Inhibit (V) : <input type="text" value="105"/>		
Neutral Current Lockout (A) : <input type="text" value="15"/>	Maximum Close Per Day : <input type="text" value="5"/>	
Anti-Hunt <input type="text" value="YES"/>	Min Cl-Tr Time (min) : <input type="text" value="120"/>	Increase delay by (min) : <input type="text" value="30"/>

**FISHER PIERCE - SmartSet (TM) Ver. 1.0 :SEASON CONFIG**

Season 1  All Temperatures in : Deg F

Start Date : 03/10 End Date : 06/15 Primary Function VAR

Close Set Point : ADAP VAR Adaptive Mode Yes

Trip Set Point : ADAP VAR Current Sensor Ratio : 60 A/V

Switching Delay : 120 S Voltage Trans Ratio : 63.5 :1

Note : +VARs are lagging, -VARs are leading Backup Voltage Enabled

Close (V) : 115.0

Trip (V) : 125.0

Switching Delay (S) : 60

Override Voltage

Reverse Power Mod VAR

Trip Override (V) : 125.0 Min Reverse Power : -30 PU

High Release (V) : 122.0 Delay (S) : 60

Low Release (V) : 118.0

Close Override (V) : 115.0

Switching Delay (S) : 60