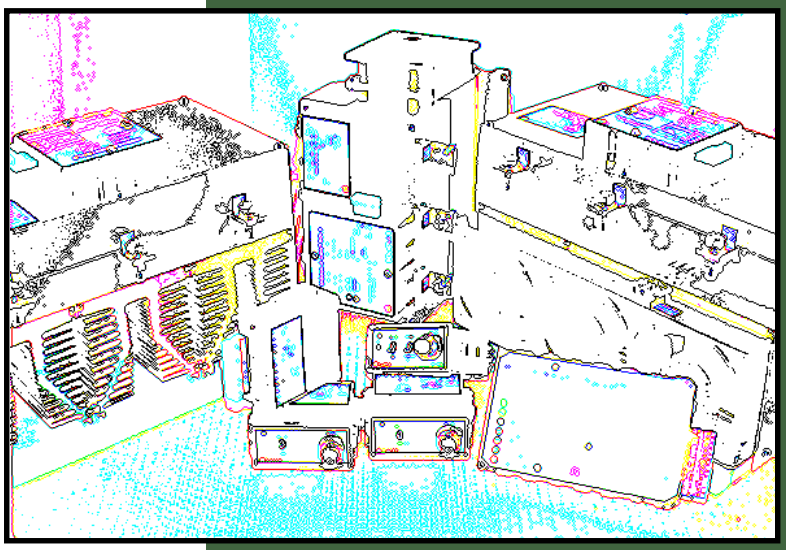
Varix

You Can Trust

bulletin **102BE**

Power Controllers



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Controladores de Potência

SOLIDVAR

The Varix Power Controllers are available in two versions: With incorporate protections (Plus) and without protections (Normal).

Power Controller is an equipment destined to control the level of energy in a load, for processes in general, involving resistive and inductive loads (1- Phase, 2-Phase or 3-Phases). It could be used in general temperature control, illumination, industrial ovens, stoves, injection machines, extruders, primary of transformer, etc. The controller receives analogical imput sign, coming from a process controller (example: temperature controller) or potentiometer or PLC, and in function of the sign, it modulates the time of conduction of the tyiristors. This way the load receives energy, whose medium value is proportional at the level of control signal. With this system we can get excellent stability in the controlled temperature, when compared with "ON/OFF" systems.

Three control types are offered: “Train of pulses (or PWM), “Angle of Phase” or "Mixed".

In the control type "Train of Pulses” it modulates the width of the pulses (trully the number of cicles sensed to load in a half of second that is the control period, proporcionaly to the imput signal, being also associated to the system “Zero Crossing”, that synchronizes the shot of the tyristors with the passage of the zero volts of the sinusoidal wave off the line voltage, avoiding this way, the appearance of undesirable transients in the circuit. It is indicated for resistive loads. In the system “Angle of Phase” the control of the power is executed in each semi-cycle of the line voltage. The shot of the tyristors occurs when the wave form reaches the certain phase angle proportional to the control signal, given power to the load in each semi-cycle. It is indicated for resistive or inductive loads resistivas.

In the system “Mixed”, it is basically a system “Train of Pulses” or “PWM” in which, during the first few semi-cicles, they are modulated obeying a growing ramp, and it is a normal “PWM” or "Train of pulses" during the remaining of the cycle. This allows soft magnetization of very inductive loads as primary of transformers.

the model "Plus" can be operated in “Opem Loop" or “Constant Current closed Loop". In the mode "closed Loop" the controller tries to maintain constant current in the load, even with variations of line voltage and impedance of the load.

The system “Train of Pulses” doesn't provoke noises and generation of harmonics in the line. It should not be used in illumination systems that need continuous supply of energy, since the controller supplies packages of energy to the load, in interval of time, whose duration (Duty Cicle) depends on the imput signal. It is the preferable system for heating. Besides the control by voltage (0 to 5V / 0 to 10V) and current (4 to 20mA / 0 to 20mA), it can also be used with a simple potentiometer to control the power level in the load, since the module possesses auxiliary output of 5V or 10V.

Controllers with incorporate protections (Model Plus): In this version besides the functions described above, the controller (which includes some protections and functions incorporated.

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• Types: 3-Phases, 2-Phases and 1-Phases.

• Construction: compact.

• Voltage: 220, 380 and 440 VAC

• Power Supply: 110/220 VAC.

• Control Modules:plug-in, encapsulated, for the whole range.

• Tyristors Firing Circuits: optically insulated / encapsulated.

• Ambient: It supports aggressive atmospheres.

• Modes: "Train of Pulses", "Phase Angle" or "Mixed".

• Controls: Open Loop" or "Constant Current closed loop".

• Insulation: (between control and power): >2500V.

• Protections (model Plus): Short circuit, Phase loss/Load break-in,Overtemperature, Control signal loss, Current Limitating.

• Signalizing: All fails, Power Supply On, Power On, Limiting current, Operation Mode.

• Output: Fail Relay (SPDT), 0 to 5 V.

• Control signals: Potentiometer, 4 to 20 MA, 0 to 5 V, 0 to 10 V.

Power Controllers are used basically for temperature control, even so they can be applied in another processes.

You can opt by tree control modes: "Angle of Phase" (type Dimer), "Train of Pulses" (PWM) or "Mixed".

All can be used in Opem Loop or Closed Loop, with constant current.

They are supplied in two Models: Without protections or with some incorporated protections (Plus).

With the use of a temperature controller, the process is operated at constant temperature.

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Main Advantages

The Solid State Power controllers made by VARIX present countless advantages in relation to controls type "ON/OFF":
• High Precision and high durability. Clean and compact assemblage, propitiating easy maintenance.
• Doesn't present bounces.
• Doesn't present mobile parts, but for the fans, that gets on automatically above 50º C.
• Doesn't present vibrations, avoiding ungriping of screws and sound noises.
• Allows linear control of the power.
• Possesses incorporated protections: (phase loss in the imput and in the output, short circuit, control signal loss, adjustable limit of current and overtemperature (Model Plus).
• Admits two operation modes: Opem Loop and Constant current closed loop (Model Plus).
• Possesses output signal for CLP or current indicator, proportional to the current. (0 - 5VCC) (model Plus).
• Possesses output signal for faill indication (SPDT relay) (Model Plus)

General characteristics of the "Normal" model.

•Types: 3-Phases, 2-Phases and 1-Phases.
• Construction: compact.
• Maximum Line voltage: 500VCA (750VCA under consultation).
• Power Supply: 110/220 VCA.
• Nominal Current: 10 to 2000A.
• Ambient Temperature: 0 to 45ºC (up to 65ºC also possible with “derating”).
• Control Module: plug-in, encapsulated. (One type for the whole range - modules up to 25A are totally encapsulated).
• Tyristors Firing Circuits: Optically insulated / encapsulated.
• Environment: They support aggressive atmospheres.
• Modes: "Train of Pulses", "Phase Angle" or "Mixed".
• Signalizations: Powe supply On and Power Output active.

General characteristics of the Model “Plus”.

• **Tipes:** 3-Phases, 2-Phases and 1-Phase.
• **Construction:** compact.
• Maximum Line Voltage: 500VCA (750VCA under consultation).
• **Power Supply:** 110/220 VCA.
• **Nominal Current:** 30 to 2000A.
• **Ambient Temperature:** 0 to 45ºC (up to 65ºC also possible with derating).
• **Control Modules:** only one for eache model, encapsulated, for the whole range.
• **Tyristors Firing modules:** Optically Insulated / encapsulated.
• **Environment:** They support aggressive atmospheres.
• **Modes:** "Train of Pulses", "Angle of phase" or "Mixed".
• **Controls:** "Open Loop" or "Constant Current Closed Loop".
• **Insulation:** (between control and power): >2500V.
• **Protections:** Short circuit, Loss of Phase / load Break-in, Overtemperature, control signal loss, current Limit.
• **Signalizations:** All fails, Power supply on, Power output active, Limiting current, operation mode.
• **Outputs:** Fail (SPDT relay), 0 to 5 V.
• **Control Signals:** Potentiometer, 4 to 20 mA, 0 a 5 V,0 a 10 V.

Types Selection

To select an appropriate model to yor application it is enough to follow some simple rules:
• Case your load is purely resistive one of the two types can be used: Angle of Phase or Train of Pulses. This last one is preferable in most of the cases, because it doesn't generate harmonic neither noises in the line and improve the power factor when fed by transformer.

• If your load include lamps, the type Angle of Phase should be used, so that the lamps don't work blinking.

• In case the controller is applied in the primary of a transformer, the type Angle of Phase or mixed should be preferred, to avoid the “Inrush Current” in each pulse, due to magnetization current of the transformer.

• should be considered the following: In the case of the type Train of Pulses noises are not generated neither harmonic in the linet, because the interruption is always in the zero of the sinusoidal wave. In this case it will only be possible to read the average current of the load through the proportional tension of an optional integrator (the model Plus already possesses it incorporated). In the case of the Normal model Varix can supply the integrator separately. With the model "Angle of Phase" can be used an ammeter or current transformer directly in series with the load.

• If the process is important, in which the detection of break-in of the load, for example, should be detected or for controllers of high current, for which the additional cost will be negligible, prefer the model with incorporated protections (Plus).

• once defined the type, choose the controller by the nominal current of load. See the tables.

DIMENSIONING

Once chosen the type to be used, "Angle of Phase" or "Train of Pulses", you must choose the controller´s rate, with the aid of the tables, or by the nominal current of the load.

· With the power of the load in KW and the voltage is enough to enter in the table of corresponding electric specification to get the controller's nominal current.

· Observes that the table supplies besides the medium current (that defines the controller's code), also the maximum current and the surge current.

· The current maximum should not be surpassed and is due in this case to consider the resistance of the cold load, that is the worst case and to verify that the current in this in case be compatible.

· The surge current, (10 mS) is the current that should not be surpassed in case of short circuit in the load. In general the impedance of the line and the ultra-fast fuses protect the equipment appropriately. The manual that accompanies the equipment possesses detailed information, as I2T and fuse tables.

MECHANICS

In the tables of mechanical characteristics can be observed which models are refrigerated naturally or which possess refrigeration by forced air, with incorporated fans. The drawings are without scale, should be observed the quotas and tables to obtain the dimensions of the equipment.

• In the tables can be obtained the controllers' dimensions.

• Is important to observe that the control module is Plug-in, being inserted in the controller's superior part, being of easy access, substitution and verification, and control module, for certain chosen type, is the same for all range of currents, up to 2000 Ampers, being enough a control module as spare part, to cover all the controllers of the same type (The models up to 25 ampers are totally encapsulated).

• The tyristors modules are easily replaceable, opening the superior cover, without removing the controller of the panel.

• The firing modules, are encapsulated, being one for each phase, having optically insulation, what provides high reliability and high insulation between control an power circuit. These modules still include dv/dt protection (snubber).

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OPERATION PRINCIPLE

In the two control types, a signal, that can be manual (potentiometer) or coming from a temperature process controller, establishes the operation point and the amount of energy given to the load. In the controller's with open loop mode, the signal establishes the level of tension given to load and in the case of Closed Loop mode, the control signal establishes the current level in the load, (maintaining the current constant with reasonable variations of line tension and impedance of the load. The model Plus can operate in the two manners.

The interruption of energy is made in the zero current. This way as the energy stored in an inductor that is LI2/2, and as the current is at this time zero, then the energy stored in the inductor is zero, in the moment of the interruption, not provoking transients or sparks, as the electromechanical contactors.

TYPE "TRAIN OF PULSES"

In this type of operation, the commutation is always made in the tension zero, in the turn on, and in the current zero, for the turn off. In the diagram the curves are represented for a resitive load, in which the current and tension are in phase.

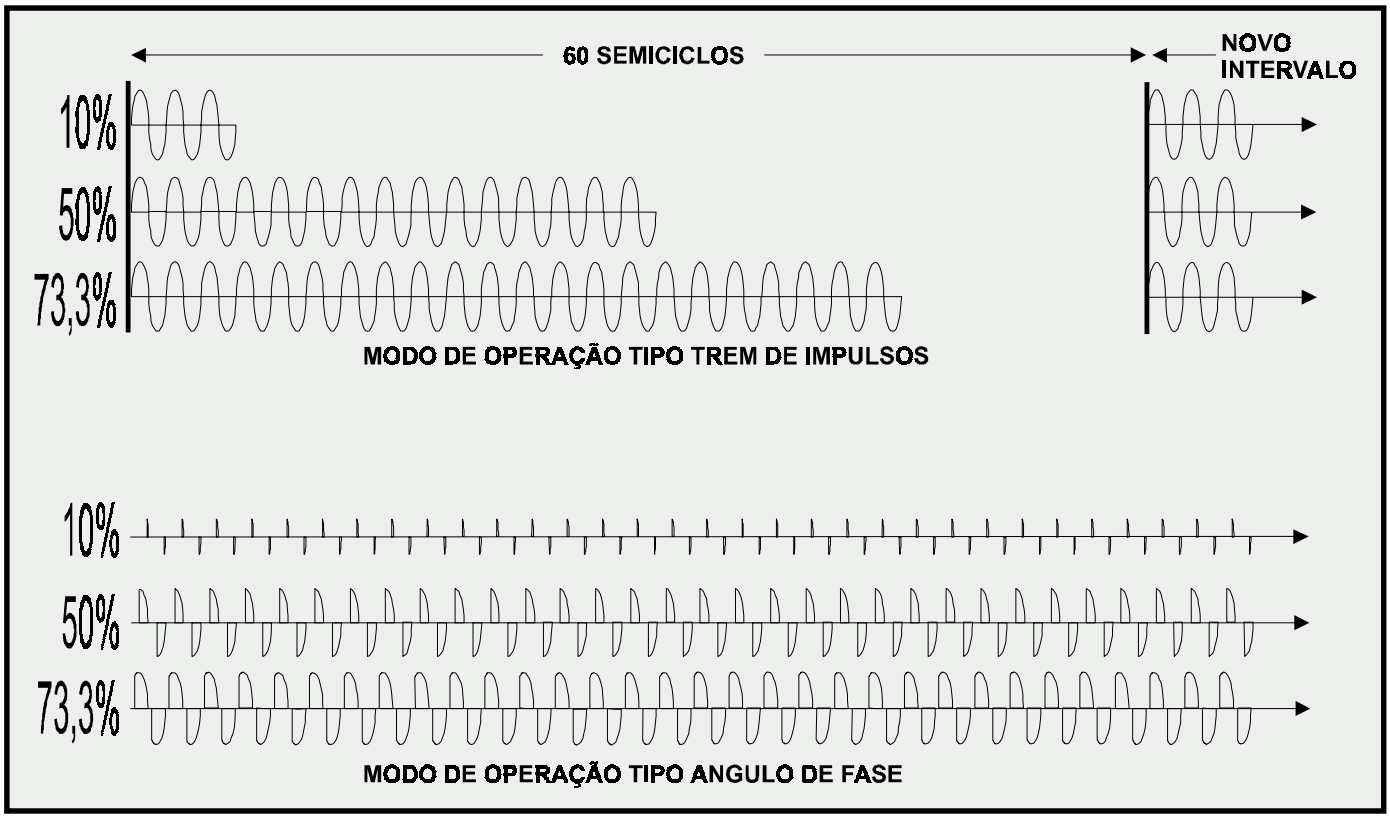
SOLIDVAR Controllers possess a period of cycle of 0,5 second, in which the load can receive 60 semi-cycles of the line, and this way the controller can modulate the supplied power to the load, with resolution of 1/60, that is to say, with steps of 1,66% of the available total power, being gotten a linear control of the power, in relation to the control signal. See examples of some control levels in the curves below.

TYPE “ANGLE OF PHASE”

In this operation mode, the commutation is made cycle by cycle of the line, being modulated the angle of firing of the tyiristors. The turn-on happens in the shot angle established by the control signal and the turn off always happens in the current zero, not provoking transients.

In this case is also gotten a linear control of the power in relation to the control signal, when it is closed loop controller at constant constant.

This is the operation type more adapted to be used in primary of transformers. (Important: The transformer should have at least 30% of the load, always connected, so that doesn't happen instabilities due to the fact that the power factor is very low with transformers without load).



Model Plus controller's details

Functions
• Operation Modes “Normal” and “Constant Current”
• Current Integrador for ammeter or PLC.
• Adjustable current Limiting (for the Open Loop mode).

Protections:
• phase loss in the input and in output / detection of load break in.
• Short circuit in the load.
• Overtemperature in the controller.
• Control signal loss.
• Adjustable Current Limit.

Sinalizations:
• Power supply On.
• Power output active.
• Limiting current / Constant Current.
• Phase Loss.
• Short-circuit.
• Control signal loss.
• Overtemperature.

Description of Sinalizations:
Control On: Green Led. It indicates a energized module.
Power On: Green Led. It indicates load energized.
Limit of current active: Yellow Led. In the mode “normal”, it lights when reached the limit of average pré programmed limit (in front trimpot). In the mode “constant current” it is the whole time lit.
Phase loss: Red Led. It indicates loss off at least 1-phase in the imput or in the output, or opening of the load in one of the phases.
Short-circuit: Red Led. It indicates one instantaneous overcurrent of 4 times or more the nominal value.
Control signal Loss: Red Led. It indicates break in of the cables of the control signal.
Overtemperature: Red Led. It indicates that the temperature in the heat exchangers surpassed 85º C.

Descriptions of the functions:

Mode **“Normal”** with adjustable limiting of current: In this mode the controller works in open loop, not receiving signal of feedback of the current, and the control signal, simply alters the angle of conduction of the tyiristors or the duration of the pulses. The controller possesses, in the control module, a trimpot, where can adjust the value of maximum work current, inside of the range of 10% to 100% of the nominal current of the equipment. During the operation, if the current rises until the value corresponding to the setpoint, the current becomes limited, even if the signal requests larger current. In this point lights the yellow led, (Constant Current/Limiting Current). When the current goes down, the controller returns to the normal mode, without limitation and the led fades.

Mode **“Constant Current”** with closed loop: The Constant current mode is advantageous in manual operation, and this way the power in the load doesn't vary with the eventual variation of the line tension. The controller possesses incorporated three mini CTs (current transfomers), that are good for reading of the medium current in the phases. In this mode, selected connecting the terminals B8 and B9, the output current is maintained constant in the value corresponding to the control signal. The led “Constant Current/Limiting current”, stays lit. The trimpot of adjustment of the current limit is without function. The Power range that in this mode is gotten with the variation of the control signal, is from 10% to 100%. The current in the load stays constant, for moderate variations of line voltage or impedance of the load. (Regulation of 5% for variation of 50% of the load or ± 20% of the line, since still inside of the control range).
A process controller or temperature controller can be used, to supply the control signal, being obtained this way the second control loop.

Current Integrador for ammeter or PLC: An incorporated integrador, integrates the current of the three phases, generating an analogical signal from 0 to 5VCC, for mensuration for instrument or PLC. Zero volts indicate minimum current and 5VCC indicates that the controller is with its nominal current. The signal 0 to 5VCC is fixed in factory in agreement with the controller's nominal current (Example: in a controller of 200A, when the analogical signal goes to 5VCC, it indicates that the equipment is with its maximum current, of 200A).

Description of the protections:

Phase Loss and load break-in: it detects the current loss in one of the phases and in the load, when the other phases are in conduction. This allows to notice, burns of the load resistance of one of the phases, fails in the controller and phase loss in the controller's input. When actuated, lights the corresponding red led and commutes the fail relay. In 3-Phases systems with load in star connection, in case it is tied up star's closing in the neutral, the loss of two phases at the same time can be detected. In the other cases, if happen the loss of two phases simultaneously, the system doesn't detect the flaw for current loss in the three phases. This doesn't cause any problem, since the currents are going the zero any way. This protection doesn't inhibit the firing of the tyristors (it only signals), to avoid stops important processes, for resistance break-in, which can be changed opportunely, since the resistances of the other phases can compensate, eventually, the defective.

Short circuit: this fail is actuated, in case it happens an instantaneous current of value over 4 times the nominal of the controller. (Time of actuation: 5 mSeg). In this case lights the corresponding led, Tyristors firing are inhibited and the fail relay is commuted. Important: This protection doesn't release the fuses use, which should be ultra-fast type, for tyristor protection, since the short circuit conditions vary, depending on the impedance of the line, could reach elevated values of currents, of the order of several kiloamperes. In this case the fuses can act first, protecting the tyristors more appropriately.

Overtemperature: the controller possesses a thermal sensor in the heat exchengers. In case it happens elevation of the temperature above 85ºC, will happen the indication of the fail in the corresponding red led, the controller's inhibition, and the commutation of the fail relay (contact SPDT).

Control signal Loss: if there is the break-in of the control signal cable will happen the indication of the fail, in the corresponding red led, the controller's inhibition and commutation of the fail relay.

CONTROLLER MODEL "NORMAL" MODE "TRAIN OF PULSES" WITHOUT PROTECTIONS.

The controllers with mode "Train of Pulses" are appropriate for conecting of resitive loads. Its selection is very simple:
• Selects the table adapted to the side and in the Power columns, for its tension, the number of KWs of its resistance group, locate the model indicated in the first column at the left and complete the model with the information of the table below.
• Remembers that this table is made for ambient temperatures of up to 45 ºC. For larger temperatures it is necessary to choose the controllers according to table more ahead.

NOTES:
1 - For 2-phase controllers it is enough to alter the model of SVMT... to SVMB...
2 - The controllers up to 25A are totally encapsulated in epoxi resin.
3 - A 3-phases load can be controlled with a controller type 2-phase in mode "Train of Pulses", conecting one phase directly. In the case of wanting complete protections in the three phases a controller type 3-phases can be ordered for economy. It have only two controlled phases. The third phase also passes internally to the controller and is monitored by the protection system. For this model increases the letters TB in the end of the purchase code.

3-Phase and 2-Phase PWM Controllers Without Protections

Normal Model - PWM Mode Power Controllers (3-Phases and 2- Phases) for resistive loads in AC1 mode with nominal current from 10 to 2000A and controler power supply in 110 VAC or 220VAC.

Basic Model complete with controller model as botton table:	Average Current (Nominal) (A)	Maximun Current (30S) (A)	Surge Current (10mS) (A)	Maximum Power AC1 (KW) 220/380/440V		
SVMT-10A-500V-***-IS	10	16	125	3,8	6,5	7,5
SVMT-15A-500V-***-IS	15	20	150	6	10	12
SVMT-20A-500V-***-IS	20	65	175	8	13	16
SVMT-25A-500V-***-IS	25	65	350	10	16	20
SVMT-30A-500V-***-IS	30	65	350	12	20	24
SVMT-40A-500V-***-IS	40	87	470	15	26	30
SVMT-50A-500V-***-IS	50	140	700	19	33	38
SVMT-75A-500V-***-IS	75	227	1480	29	49	58
SVMT-100A-500V-***-IS	100	318	1900	38	65	75
SVMT-125A-500V-***-IS	125	318	1900	48	82	96
SVMT-150A-500V-***-IS	150	455	3600	58	98	115
SVMT-200A-500V-***-IS	200	455	5200	75	130	150
SVMT-250A-500V-***-IS	250	560	5200	95	160	190
SVMT-300A-500V-***-IS	300	735	6600	115	200	230
SVMT-400A-500V-***-IS	400	735	8000	150	260	300
SVMT-500A-500V-***-IS	500	875	8000	190	330	380
SVMT-650A-500V-***-IS	650	1480	5700	250	430	500
SVMT-750A-500V-***-IS	750	1480	8000	285	490	570
SVMT-1000A-500V-***-IS	1000	2100	11500	380	660	760
SVMT-1250A-500V-***-IS	1250	2660	15000	475	820	950
SVMT-1500A-500V-***-IS	1500	3500	19000	570	990	1140
SVMT-1750A-500V-***-IS	1750	3500	19000	645	1120	1290
SVMT-2000A-500V-***-IS	2000	4200	30000	760	1315	1520

1-Phase PWM Controllers Without Protections

Normal Model - PWM Mode Power Controllers (1-Phase) for resistive loads in AC1 mode with nominal current from 25 to 200A and controler power supply in 110 VAC or 220VAC.

Basic Model complete with controller model as botton table:	Average Current (Nominal) (A)	Maximun Current (30S) (A)	Surge Current (10mS) (A)	Maximum Power AC1 (KW) 220/380/440V		
SVMM-25A-500V-***-IS	25	40	350	5,5	11	9,5
SVMM-30A-500V-***-IS	30	40	350	6,6	11,4	13
SVMM-40A-500V-***-IS	40	87	470	8,8	15	17
SVMM-50A-500V-***-IS	50	140	700	11	19	22
SVMM-75A-500V-***-IS	75	227	1480	16	28	32
SVMM-100A-500V-***-IS	100	318	1900	22	38	44
SVMM-125A-500V-***-IS	125	318	3600	27	47	54
SVMM-150A-500V-***-IS	150	455	3600	33	57	66
SVMM-200A-500V-***-IS	200	455	5200	44	76	88
Larger controllers abobe 200A - Consult Please						

Main advantages - see page B4	**Complete the controller model with the codes below:**
Types Selection - see page B5	107- P.Supply = 110VCA - Control Signal = 0 to 5V or 0 to 20mA or Potentiometer
General characteristics - see page B4	207- P.Supply = 220VCA - Control Signal = 0 to 5V or 0 to 20mA or Potentiometer
Operation Principle - see page B6	147- P.Supply = 110VCA - Control Signal = 1 to 5V or 4 to 20mA or Potentiometer
Application Exemple - see page B17	247- P.Supply = 220VCA - Control Signal = 1 to 5V or 4 to 20mA or Potentiometer
Mechanical Dimensions - see page B18	117- P.Supply = 110VCA - Control Signal = 0 to 10V or Potentiometer
Fuses - see page B20	217- P.Supply = 220VCA - Control Signal = 0 to 10V or Potentiometer

3-Phase and 2-Phase / Phase Angle Controllers Without Protections

Normal Model - Phase Angle Mode Power Controllers (3-Phases and 2- Phases) for resistive loads in AC1 mode with nominal current from 10 to 2000A and controler power supply in 110 VAC or 220VAC.

Basic Model complete with controller model as botton table:	Average Current (Nominal) (A)	Maximun Current (30S) (A)	Surge Current (10mS) (A)	Maximum Power AC1 (KW) 220/380/440V		
SVMT-10A-500V-***-FS	10	16	125	3,8	6,5	7,5
SVMT-15A-500V-***-FS	15	20	150	6	10	12
SVMT-20A-500V-***-FS	20	65	175	8	13	16
SVMT-25A-500V-***-FS	25	65	350	10	16	20
SVMT-30A-500V-***-FS	30	65	350	12	20	24
SVMT-40A-500V-***-FS	40	87	470	15	26	30
SVMT-50A-500V-***-FS	50	140	700	19	33	38
SVMT-75A-500V-***-FS	75	227	1480	29	49	58
SVMT-100A-500V-***-FS	100	318	1900	38	65	75
SVMT-125A-500V-***-FS	125	318	1900	48	82	96
SVMT-150A-500V-***-FS	150	455	3600	58	98	115
SVMT-200A-500V-***-FS	200	455	5200	75	130	150
SVMT-250A-500V-***-FS	250	560	5200	95	160	190
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SVMT-650A-500V-***-FS	650	1480	5700	250	430	500
SVMT-750A-500V-***-FS	750	1480	8000	285	490	570
SVMT-1000A-500V-***-FS	1000	2100	11500	380	660	760
SVMT-1250A-500V-***-FS	1250	2660	15000	475	820	950
SVMT-1500A-500V-***-FS	1500	3500	19000	570	990	1140
SVMT-1750A-500V-***-FS	1750	3500	19000	645	1120	1290
SVMT-2000A-500V-***-FS	2000	4200	30000	760	1315	1520

1-Phase / Phase Angle Mode Controllers Without Protections

Normal Model - Phase Angle Mode Power Controllers (1-Phase) for resistive loads in AC1 mode with nominal current from 25 to 200A and controler power supply in 110 VAC or 220VAC.

Basic Model complete with controller model as botton table:	Average Current (Nominal) (A)	Maximun Current (30S) (A)	Surge Current (10mS) (A)	Maximum Power AC1 (KW) 220/380/440V		
SVMM-25A-500V-***-FS	25	40	350	5,5	11	9,5
SVMM-30A-500V-***-FS	30	40	350	6,6	11,4	13
SVMM-40A-500V-***-FS	40	87	470	8,8	15	17
SVMM-50A-500V-***-FS	50	140	700	11	19	22
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SVMM-100A-500V-***-FS	100	318	1900	22	38	44
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SVMM-200A-500V-***-FS	200	455	5200	44	76	88
Larger controllers abobe 200A - Consult Please						

Main advantages - see page B4	**Complete the controller model with the codes below:**
Types Selection - see page B5	107- P.Supply = 110VCA - Control Signal = 0 to 5V or 0 to 20mA or Potentiometer
General characteristics - see page B4	207- P.Supply = 220VCA - Control Signal = 0 to 5V or 0 to 20mA or Potentiometer
Operation Principle - see page B6	147- P.Supply = 110VCA - Control Signal = 1 to 5V or 4 to 20mA or Potentiometer
Application Exemple - see page B17	247- P.Supply = 220VCA - Control Signal = 1 to 5V or 4 to 20mA or Potentiometer
Mechanical Dimensions - see page B18	117- P.Supply = 110VCA - Control Signal = 0 to 10V or Potentiometer
Fuses - see page B20	217- P.Supply = 220VCA - Control Signal = 0 to 10V or Potentiometer

CONTROLLER MODEL "NORMAL" MODE "PHASE ANGLE" WITHOUT PROTECTIONS.

The controllers with mode "Phase Angle" are appropriate for conecting resitive or inductive loads. Its selection is very simple:

• Selects the table adapted to the side and in the Power columns, for its tension, the number of KWs of its resistance group, locate the model indicated in the first column at the left and complete the model with the information of the table below.

• Remembers that this table is made for ambient temperatures of up to 45 ºC. For larger temperatures it is necessary to choose the controllers according to table more ahead.

NOTES:

1 - For 2-phase controllers it is enough to alter the model of SVMT... to SVMB...

2 - The controllers up to 25A are totally encapsulated in epoxi resin.

CONTROLLER MODEL "PLUS" MODE "TRAIN OF PULSES" WITH PROTECTIONS.

The controllers model "Plus", mode "Train of Pulses" with protections are appropriate for conecting resistive loads and they differ of the normal model mainly for including protections, control by current closed loop optional and output of a tension proportional to the current. Its selection is very simple:

• Selects the table adapted to the side and in the Power columns, for its tension, the number of KWs of its resistance group, locate the model indicated in the first column at the left and complete the model with the information of the table below.

• Remembers that this table is made for ambient temperatures of up to 45 ºC. For larger temperatures it is necessary to choose the controllers according to table more ahead.

NOTES:

1 - For 2-phase controllers it is enough to alter the model of SVMT... to SVMB...

2 - The controllers up to 25A are totally encapsulated in epoxi resin.

3 - A 3-phases load can be controlled with a controller type 2-phase in mode "Train of Pulses", conecting one phase directly. In the case of wanting complete protections in the three phases a controller type 3-phases can be ordered for economy. It have only two controlled phases. The third phase also passes internally to the controller and is monitored by the protection system. For this model increases the letters TB in the end of the purchase code.

3-Phase and 2-Phase PWM Controllers With Protections

Plus Model - PWM Mode Power Controllers (3-Phases and 2- Phases) for resistive loads in AC1 mode with nominal current from 10 to 2000A and controler power supply in 110 VAC or 220VAC.

Basic Model complete with controller model as botton table:	Average Current (Nominal) (A)	Maximun Current (30S) (A)	Surge Current (10mS) (A)	Maximum Power AC1 (KW) 220/380/440V		
SVMT-30A-500V-***-IP	30	65	350	12	20	24
SVMT-40A-500V-***-IP	40	87	470	15	26	30
SVMT-50A-500V-***-IP	50	140	700	19	33	38
SVMT-75A-500V-***-IP	75	227	1480	29	49	58
SVMT-100A-500V-***-IP	100	318	1900	38	65	75
SVMT-125A-500V-***-IP	125	318	1900	48	82	96
SVMT-150A-500V-***-IP	150	455	3600	58	98	115
SVMT-200A-500V-***-IP	200	455	5200	75	130	150
SVMT-250A-500V-***-IP	250	560	5200	95	160	190
SVMT-300A-500V-***-IP	300	735	6600	115	200	230
SVMT-400A-500V-***-IP	400	735	8000	150	260	300
SVMT-500A-500V-***-IP	500	875	8000	190	330	380
SVMT-650A-500V-***-IP	650	1480	5700	250	430	500
SVMT-750A-500V-***-IP	750	1480	8000	285	490	570
SVMT-1000A-500V-***-IP	1000	2100	11500	380	660	760
SVMT-1250A-500V-***-IP	1250	2660	15000	475	820	950
SVMT-1500A-500V-***-IP	1500	3500	19000	570	990	1140
SVMT-1750A-500V-***-IP	1750	3500	19000	645	1120	1290
SVMT-2000A-500V-***-IP	2000	4200	30000	760	1315	1520

1-Phase PWM Controllers With Protections

Plus Model - PWM Mode Power Controllers (1-Phase) for resistive loads in AC1 mode with nominal current from 25 to 200A and controler power supply in 110 VAC or 220VAC.

Basic Model complete with controller model as botton table:	Average Current (Nominal) (A)	Maximun Current (30S) (A)	Surge Current (10mS) (A)	Maximum Power AC1 (KW) 220/380/440V		
SVMM-30A-500V-***-IP	30	40	350	6,6	11,4	13
SVMM-40A-500V-***-IP	40	87	470	8,8	15	17
SVMM-50A-500V-***-IP	50	140	700	11	19	22
SVMM-75A-500V-***-IP	75	227	1480	16	28	32
SVMM-100A-500V-***-IP	100	318	1900	22	38	44
SVMM-125A-500V-***-IP	125	318	3600	27	47	54
SVMM-150A-500V-***-IP	150	455	3600	33	57	66
SVMM-200A-500V-***-IP	200	455	5200	44	76	88
Larger controllers abobe 200A - Consult Please						

	Complete the controller model with the codes below:
Main advantages - see page B4	107- P.Supply = 110VCA - Control Signal = 0 to 5V or 0 to 20mA or Potentiometer
Types Selection - see page B5	207- P.Supply = 220VCA - Control Signal = 0 to 5V or 0 to 20mA or Potentiometer
General characteristics - see page B4	147- P.Supply = 110VCA - Control Signal = 1 to 5V or 4 to 20mA or Potentiometer
Operation Principle - see page B6	247- P.Supply = 220VCA - Control Signal = 1 to 5V or 4 to 20mA or Potentiometer
Application Exemple - see page B17	117- P.Supply = 110VCA - Control Signal = 0 to 10V or Potentiometer
Mechanical Dimensions - see page B19	217- P.Supply = 220VCA - Control Signal = 0 to 10V or Potentiometer
Fuses - see page B20	

CONTROLLER MODEL "PLUS" MODE "PHASE ANGLE" WITH PROTECTIONS.

The controllers model "Plus", mode "Phase Angle" with protections are appropriate for conecting resistive or inductive loads and they differ of the normal model mainly for including protections, control by current closed loop optional and output of a tension proportional to the current. Its selection is very simple:

• Selects the table adapted to the side and in the Power columns, for its tension, the number of KWs of its resistance group, locate the model indicated in the first column at the left and complete the model with the information of the table below.

• Remembers that this table is made for ambient temperatures of up to 45 ºC. For larger temperatures it is necessary to choose the controllers according to table more ahead.

NOTES:

1 - For 2-phase controllers it is enough to alter the model of SVMT... to SVMB...

3-Phase and 2-Phase / Phase Angle Controllers With Protections

Plus Model - Phase Angle Mode Power Controllers (3-Phases and 2- Phases) for resistive loads in AC1 mode with nominal current from 10 to 2000A and controler power supply in 110 VAC or 220VAC.

Basic Model complete with controller model as botton table:	Average Current (Nominal) (A)	Maximun Current (30S) (A)	Surge Current (10mS) (A)	Maximum Power AC1 (KW) 220/380/440V		
SVMT-30A-500V-***-FP	30	65	350	12	20	24
SVMT-40A-500V-***-FP	40	87	470	15	26	30
SVMT-50A-500V-***-FP	50	140	700	19	33	38
SVMT-75A-500V-***-FP	75	227	1480	29	49	58
SVMT-100A-500V-***-FP	100	318	1900	38	65	75
SVMT-125A-500V-***-FP	125	318	1900	48	82	96
SVMT-150A-500V-***-FP	150	455	3600	58	98	115
SVMT-200A-500V-***-FP	200	455	5200	75	130	150
SVMT-250A-500V-***-FP	250	560	5200	95	160	190
SVMT-300A-500V-***-FP	300	735	6600	115	200	230
SVMT-400A-500V-***-FP	400	735	8000	150	260	300
SVMT-500A-500V-***-FP	500	875	8000	190	330	380
SVMT-650A-500V-***-FP	650	1480	5700	250	430	500
SVMT-750A-500V-***-FP	750	1480	8000	285	490	570
SVMT-1000A-500V-***-FP	1000	2100	11500	380	660	760
SVMT-1250A-500V-***-FP	1250	2660	15000	475	820	950
SVMT-1500A-500V-***-FP	1500	3500	19000	570	990	1140
SVMT-1750A-500V-***-FP	1750	3500	19000	645	1120	1290
SVMT-2000A-500V-***-FP	2000	4200	30000	760	1315	1520

1-Phase / Phase Angle Mode Controllers With Protections

Plus Model - Phase Angle Mode Power Controllers (1-Phase) for resistive loads in AC1 mode with nominal current from 25 to 200A and controler power supply in 110 VAC or 220VAC.

Basic Model complete with controller model as botton table:	Average Current (Nominal) (A)	Maximun Current (30S) (A)	Surge Current (10mS) (A)	Maximum Power AC1 (KW) 220/380/440V		
SVMM-30A-500V-***-FP	30	40	350	6,6	11,4	13
SVMM-40A-500V-***-FP	40	87	470	8,8	15	17
SVMM-50A-500V-***-FP	50	140	700	11	19	22
SVMM-75A-500V-***-FP	75	227	1480	16	28	32
SVMM-100A-500V-***-FP	100	318	1900	22	38	44
SVMM-125A-500V-***-FP	125	318	3600	27	47	54
SVMM-150A-500V-***-FP	150	455	3600	33	57	66
SVMM-200A-500V-***-FP	200	455	5200	44	76	88
Larger controllers abobe 200A - Consult Please						

Main advantages - see page B4	**Complete the controller model with the codes below:**
Types Selection - see page B5	107- P.Supply = 110VCA - Control Signal = 0 to 5V or 0 to 20mA or Potentiometer
General characteristics - see page B4	207- P.Supply = 220VCA - Control Signal = 0 to 5V or 0 to 20mA or Potentiometer
Operation Principle - see page B6	147- P.Supply = 110VCA - Control Signal = 1 to 5V or 4 to 20mA or Potentiometer
Application Exemple - see page B17	247- P.Supply = 220VCA - Control Signal = 1 to 5V or 4 to 20mA or Potentiometer
Mechanical Dimensions - see page B19	117- P.Supply = 110VCA - Control Signal = 0 to 10V or Potentiometer
Fuses - see page B20	217- P.Supply = 220VCA - Control Signal = 0 to 10V or Potentiometer

SOLIDVAR

CONTROLLER MODEL "NORMAL" MODE "MIXED" WITHOUT PROTECTIONS.

The controllers model "Normal" mode "Mixed" are appropriate for to be applied in the primary of a transformers, to avoid the "Inrush Currente" in each pulse, due to magnetization current of the transformer, its application is very simple:
• Selects the table adapted to the side and in the Power columns, for its tension, the number of KWs of its resistance group, locate the model indicated in the first column at the left and complete the model with the information of the table below.
• Remembers that this table is made for ambient temperatures of up to 45 ºC. For larger temperatures it is necessary to choose the controllers according to table more ahead.

NOTE:
1 - For 2-phase controllers it is enough to alter the model of SVMT... to SVMB...

3-Phase and 2-Phase / Mixed Mode Controllers Without Protections

Normal Model - Mixed Mode Power Controllers (3-Phases and 2- Phases) for indutive loads (Transformer`s Primary) with nominal current from 30 to 2000A and controler power supply in 110 VAC or 220VAC.

Basic Model complete with controller model as botton table:	Average Current (Nominal) (A)	Maximun Current (30S) (A)	Surge Current (10mS) (A)	Maximum Power AC1 (KW) 220/380/440V		
SVMT-30A-500V-***-FSM	30	65	350	12	20	24
SVMT-40A-500V-***-FSM	40	87	470	15	26	30
SVMT-50A-500V-***-FSM	50	140	700	19	33	38
SVMT-75A-500V-***-FSM	75	227	1480	29	49	58
SVMT-100A-500V-***-FSM	100	318	1900	38	65	75
SVMT-125A-500V-***-FSM	125	318	1900	48	82	96
SVMT-150A-500V-***-FSM	150	455	3600	58	98	115
SVMT-200A-500V-***-FSM	200	455	5200	75	130	150
SVMT-250A-500V-***-FSM	250	560	5200	95	160	190
SVMT-300A-500V-***-FSM	300	735	6600	115	200	230
SVMT-400A-500V-***-FSM	400	735	8000	150	260	300
SVMT-500A-500V-***-FSM	500	875	8000	190	330	380
SVMT-650A-500V-***-FSM	650	1480	5700	250	430	500
SVMT-750A-500V-***-FSM	750	1480	8000	285	490	570
SVMT-1000A-500V-***-FSM	1000	2100	11500	380	660	760
SVMT-1250A-500V-***-FSM	1250	2660	15000	475	820	950
SVMT-1500A-500V-***-FSM	1500	3500	19000	570	990	1140
SVMT-1750A-500V-***-FSM	1750	3500	19000	645	1120	1290
SVMT-2000A-500V-***-FSM	2000	4200	30000	760	1315	1520

1-Phase / Mixed Mode Controllers Without Protections

Normal Model - Mixed Mode Power Controllers (1-Phase) for indutive loads (tranformer`s primary) with nominal current from 30 to 200A and controler power supply in 110 VAC or 220VAC.

Basic Model complete with controller model as botton table:	Average Current (Nominal) (A)	Maximun Current (30S) (A)	Surge Current (10mS) (A)	Maximum Power AC1 (KW) 220/380/440V		
SVMM-30A-500V-***-FSM	30	40	350	6,6	11,4	13
SVMM-40A-500V-***-FSM	40	87	470	8,8	15	17
SVMM-50A-500V-***-FSM	50	140	700	11	19	22
SVMM-75A-500V-***-FSM	75	227	1480	16	28	32
SVMM-100A-500V-***-FSM	100	318	1900	22	38	44
SVMM-125A-500V-***-FSM	125	318	3600	27	47	54
SVMM-150A-500V-***-FSM	150	455	3600	33	57	66
SVMM-200A-500V-***-FSM	200	455	5200	44	76	88
Larger controllers abobe 200A - Consult Please						

	Complete the controller model with the codes below:
Main advantages - see page B4	107- P.Supply = 110VCA - Control Signal = 0 to 5V or 0 to 20mA or Potentiometer
Types Selection - see page B5	207- P.Supply = 220VCA - Control Signal = 0 to 5V or 0 to 20mA or Potentiometer
General characteristics - see page B4	147- P.Supply = 110VCA - Control Signal = 1 to 5V or 4 to 20mA or Potentiometer
Operation Principle - see page B6	247- P.Supply = 220VCA - Control Signal = 1 to 5V or 4 to 20mA or Potentiometer
Application Exemple - see page B17	117- P.Supply = 110VCA - Control Signal = 0 to 10V or Potentiometer
Mechanical Dimensions - see page B18	217- P.Supply = 220VCA - Control Signal = 0 to 10V or Potentiometer
Fuses - see page B20	

CONTROLLER MODEL "PLUS" MODE "MIXED" WITH PROTECTIONS.

The controllers model "Normal" mode "Mixed" are appropriate for to be applied in the primary of a transformers, to avoid the "Inrush Currente" in each pulse, due to magnetization current of the transformer, its application is very simple:

• Selects the table adapted to the side and in the Power columns, for its tension, the number of KWs of its resistance group, locate the model indicated in the first column at the left and complete the model with the information of the table below.

• Remembers that this table is made for ambient temperatures of up to 45 ºC. For larger temperatures it is necessary to choose the controllers according to table more ahead.

NOTE:

1 - For 2-phase controllers it is enough to alter the model of SVMT... to SVMB...

3-Phase and 2-Phase / Mixed Mode Controllers With Protections

Plus Model - Mixed Mode Power Controllers (3-Phases and 2- Phases) for indutive loads (Transformer`s Primary) with nominal current from 30 to 2000A and controler power supply in 110 VAC or 220VAC.

Basic Model complete with controller model as botton table:	Average Current (Nominal) (A)	Maximun Current (30S) (A)	Surge Current (10mS) (A)	Maximum Power AC1 (KW) 220/380/440V		
SVMT-30A-500V-***-FPM	30	65	350	12	20	24
SVMT-40A-500V-***-FPM	40	87	470	15	26	30
SVMT-50A-500V-***-FPM	50	140	700	19	33	38
SVMT-75A-500V-***-FPM	75	227	1480	29	49	58
SVMT-100A-500V-***-FPM	100	318	1900	38	65	75
SVMT-125A-500V-***-FPM	125	318	1900	48	82	96
SVMT-150A-500V-***-FPM	150	455	3600	58	98	115
SVMT-200A-500V-***-FPM	200	455	5200	75	130	150
SVMT-250A-500V-***-FPM	250	560	5200	95	160	190
SVMT-300A-500V-***-FPM	300	735	6600	115	200	230
SVMT-400A-500V-***-FPM	400	735	8000	150	260	300
SVMT-500A-500V-***-FPM	500	875	8000	190	330	380
SVMT-650A-500V-***-FPM	650	1480	5700	250	430	500
SVMT-750A-500V-***-FPM	750	1480	8000	285	490	570
SVMT-1000A-500V-***-FPM	1000	2100	11500	380	660	760
SVMT-1250A-500V-***-FPM	1250	2660	15000	475	820	950
SVMT-1500A-500V-***-FPM	1500	3500	19000	570	990	1140
SVMT-1750A-500V-***-FPM	1750	3500	19000	645	1120	1290
SVMT-2000A-500V-***-FPM	2000	4200	30000	760	1315	1520

1-Phase / Mixed Mode Controllers With Protections

Plus Model - Mixed Mode Power Controllers (1-Phase) for indutive loads (tranformer`s primary) with nominal current from 30 to 200A and controler power supply in 110 VAC or 220VAC.

Basic Model complete with controller model as botton table:	Average Current (Nominal) (A)	Maximun Current (30S) (A)	Surge Current (10mS) (A)	Maximum Power AC1 (KW) 220/380/440V		
SVMM-30A-500V-***-FPM	30	40	350	6,6	11,4	13
SVMM-40A-500V-***-FPM	40	87	470	8,8	15	17
SVMM-50A-500V-***-FPM	50	140	700	11	19	22
SVMM-75A-500V-***-FPM	75	227	1480	16	28	32
SVMM-100A-500V-***-FPM	100	318	1900	22	38	44
SVMM-125A-500V-***-FPM	125	318	3600	27	47	54
SVMM-150A-500V-***-FPM	150	455	3600	33	57	66
SVMM-200A-500V-***-FPM	200	455	5200	44	76	88
Larger controllers abobe 200A - Consult Please						

Main advantages - see page B4	**Complete the controller model with the codes below:**
Types Selection - see page B5	107- P.Supply = 110VCA - Control Signal = 0 to 5V or 0 to 20mA or Potentiometer
General characteristics - see page B4	207- P.Supply = 220VCA - Control Signal = 0 to 5V or 0 to 20mA or Potentiometer
Operation Principle - see page B6	147- P.Supply = 110VCA - Control Signal = 1 to 5V or 4 to 20mA or Potentiometer
Application Exemple - see page B17	247- P.Supply = 220VCA - Control Signal = 1 to 5V or 4 to 20mA or Potentiometer
Mechanical Dimensions - see page B19	117- P.Supply = 110VCA - Control Signal = 0 to 10V or Potentiometer
Fuses - see page B20	217- P.Supply = 220VCA - Control Signal = 0 to 10V or Potentiometer

Selection of Types for Ambient Temperatures above 45ºC.

Obviously, equipments with tyristors, dissipates a small portion of heat during the operation, due to tension fall on the tyristors (Approximately 0,7% of the controlled power). This heat needs to be transferred for the atmosphere through the heat exchangers, that also serve as base for the tyristors. This way if the surrounding air is very warm this transfer loses efficiency and the temperature of the heat exchangers can reach the point of turn off (85ºC), therefore for hot atmospheres, above 45ºC it is necessary on oversize the controller to improve the transfer of heat. In the side tables the controllers are being specified for the temperatures of 55 and 65ºC.

Choice Table for Controllers in Ambient Temperature range from 55ºC to 65ºC

Power Controllers (3-Phases and 2- Phases) for resistive loads in AC1 mode with nominal current from 10 to 2000A

Nominal - Ambient Temperature	Temperature 55ºC			Temperature 65ºC		
Basic Model: To complete the model code see the corresponding pages	Maximum Power AC1 (KW) 220V	380V	440V	Maximum Power AC1 (KW) 220V	380V	440V
SVMT-10A	3	5	6	2,5	4	5
SVMT-15A	5	8	10	4	6	8
SVMT-20A	7	10	13	6	8	10
SVMT-25A	8	13	16	7	10	13
SVMT-30A	10	16	19	8	13	15
SVMT-40A	12	21	24	10	17	19
SVMT-50A	15	26	30	12	21	24
SVMT-75A	23	39	46	18	31	36
SVMT-100A	30	52	60	24	41	48
SVMT-125A	38	65	76	30	52	60
SVMT-150A	46	78	92	37	62	73
SVMT-200A	60	104	120	48	83	96
SVMT-250A	76	128	152	61	102	121
SVMT-300A	92	160	184	74	128	147
SVMT-400A	120	208	240	96	166	192
SVMT-500A	152	264	304	121	211	243
SVMT-650A	200	344	400	160	275	320
SVMT-750A	228	392	456	182	313	364
SVMT-1000A	304	528	608	243	422	486
SVMT-1250A	380	656	760	304	524	608
SVMT-1500A	456	792	912	364	633	729
SVMT-1750A	516	896	1032	412	716	825
SVMT-2000A	608	1052	1216	486	841	972

Choice Table for Controllers in Ambient Temperature range from 55ºC to 65ºC

Power Controllers (1-Phases) for resistive loads in AC1 mode with nominal current from 25 to 200A

Nominal - Ambient Temperature	Temperature 55ºC			Temperature 65ºC		
Basic Model: To complete the model code see the corresponding pages	Maximum Power AC1 (KW) 220V	380V	440V	Maximum Power AC1 (KW) 220V	380V	440V
SVMM-25A	4	9	8	3	7	6
SVMM-30A	5	9	10	4	7	8
SVMM-40A	7	12	14	6	9	12
SVMM-50A	9	15	18	7	12	14
SVMM-75A	13	22	26	10	17	20
SVMM-100A	17	30	34	14	24	28
SVMM-125A	20	37	40	17	29	34
SVMM-150A	26	45	52	21	36	42
SVMM-200A	35	60	70	28	48	56
Larger controllers abobe 200A - Consult Please						

Control Modules.

The Varix`s power controllers presents several types of control modules, that can be seen in the corresponding table. The modules needs power supply that can be 110VAC or 220VAC.
The control modules are interchangeable, the same serves in the whole current range of a controller's of the same type, since 30A up to 2000A. OBS: The control module of the model Plus possesses auxiliary contacts NO/NC with maximun power of 220VAC/ 60VA or 150VCC/30W for Fail indication.

Control Modules for Normal Model Controllers PWM Mode (Impulse Train)	
Models	**Controler Power Supply and Control Signal**
VCT*-107	Alimentação 110VCA - Sinal de Controle 0 a 5V ou 0 a 20mA Potenc. Externo
VCT*-207	Alimentação 220VCA - Sinal de Controle 0 a 5V ou 0 a 20mA Potenc. Externo
VCT*-147	Alimentação 110VCA - Sinal de Controle 1 a 5V ou 4 a 20mA Potenc. Externo
VCT*-247	Alimentação 220VCA - Sinal de Controle 1 a 5V ou 4 a 20mA Potenc. Externo
VCT*-117	Alimentação 110VCA - Sinal de Controle 0 a 10V ou Potenciômetro. Externo
VCT*-217	Alimentação 220VCA - Sinal de Controle 0 a 10V ou Potenciômetro. Externo
Control Modules for Normal Model Controllers Phase Angle Mode	
Models	**Controler Power Supply and Control Signal**
VCF*-107	Alimentação 110VCA - Sinal de Controle 0 a 5V ou 0 a 20mA Potenc. Externo
VCF*-207	Alimentação 220VCA - Sinal de Controle 0 a 5V ou 0 a 20mA Potenc. Externo
VCF*-147	Alimentação 110VCA - Sinal de Controle 1 a 5V ou 4 a 20mA Potenc. Externo
VCF*-247	Alimentação 220VCA - Sinal de Controle 1 a 5V ou 4 a 20mA Potenc. Externo
VCF*-117	Alimentação 110VCA - Sinal de Controle 0 a 10V ou Potenciômetro. Externo
VCF*-217	Alimentação 220VCA - Sinal de Controle 0 a 10V ou Potenciômetro. Externo
Control Modules for Plus Model Controllers PWM Mode (Impulse Train)	
Models	**Controler Power Supply and Control Signal**
VCT*-107P	Alimentação 110VCA - Sinal de Controle 0 a 5V ou 0 a 20mA Potenc. Externo
VCT*-207P	Alimentação 220VCA - Sinal de Controle 0 a 5V ou 0 a 20mA Potenc. Externo
VCT*-147P	Alimentação 110VCA - Sinal de Controle 1 a 5V ou 4 a 20mA Potenc. Externo
VCT*-247P	Alimentação 220VCA - Sinal de Controle 1 a 5V ou 4 a 20mA Potenc. Externo
VCT*-117P	Alimentação 110VCA - Sinal de Controle 0 a 10V ou Potenciômetro. Externo
VCT*-217P	Alimentação 220VCA - Sinal de Controle 0 a 10V ou Potenciômetro. Externo
Control Modules for Plus Model Controllers Phase Angle Mode	
Models	**Controler Power Supply and Control Signal**
VCF*-107P	Alimentação 110VCA - Sinal de Controle 0 a 5V ou 0 a 20mA Potenc. Externo
VCF*-207P	Alimentação 220VCA - Sinal de Controle 0 a 5V ou 0 a 20mA Potenc. Externo
VCF*-147P	Alimentação 110VCA - Sinal de Controle 1 a 5V ou 4 a 20mA Potenc. Externo
VCF*-247P	Alimentação 220VCA - Sinal de Controle 1 a 5V ou 4 a 20mA Potenc. Externo
VCF*-117P	Alimentação 110VCA - Sinal de Controle 0 a 10V ou Potenciômetro. Externo
VCF*-217P	Alimentação 220VCA - Sinal de Controle 0 a 10V ou Potenciômetro. Externo
Control Modules for Normal Model Controllers Mixed Mode (Phase + PWM)	
Models	**Controler Power Supply and Control Signal**
VCM*-107	Alimentação 110VCA - Sinal de Controle 0 a 5V ou 0 a 20mA Potenc. Externo
VCM*-207	Alimentação 220VCA - Sinal de Controle 0 a 5V ou 0 a 20mA Potenc. Externo
VCM*-147	Alimentação 110VCA - Sinal de Controle 1 a 5V ou 4 a 20mA Potenc. Externo
VCM*-247	Alimentação 220VCA - Sinal de Controle 1 a 5V ou 4 a 20mA Potenc. Externo
VCM*-117	Alimentação 110VCA - Sinal de Controle 0 a 10V ou Potenciômetro. Externo
VCM*-217	Alimentação 220VCA - Sinal de Controle 0 a 10V ou Potenciômetro. Externo
Control Modules for Plus Model Controllers Mixed Mode (Phase + PWM)	
Models	**Controler Power Supply and Control Signal**
VCM*-107P	Alimentação 110VCA - Sinal de Controle 0 a 5V ou 0 a 20mA Potenc. Externo
VCM*-207P	Alimentação 220VCA - Sinal de Controle 0 a 5V ou 0 a 20mA Potenc. Externo
VCM*-147P	Alimentação 110VCA - Sinal de Controle 1 a 5V ou 4 a 20mA Potenc. Externo
VCM*-247P	Alimentação 220VCA - Sinal de Controle 1 a 5V ou 4 a 20mA Potenc. Externo
VCM*-117P	Alimentação 110VCA - Sinal de Controle 0 a 10V ou Potenciômetro. Externo
VCM*-217P	Alimentação 220VCA - Sinal de Controle 0 a 10V ou Potenciômetro. Externo
*** Complete the code with:** T=Trifásico, B=Bifásico, M=Monofásico	

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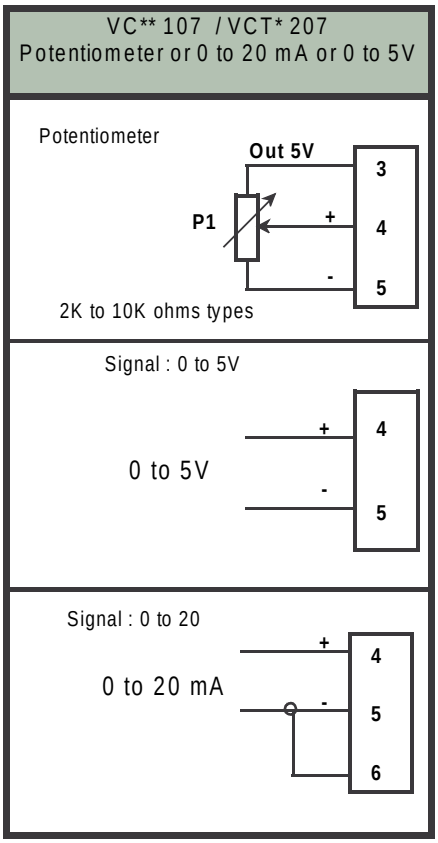
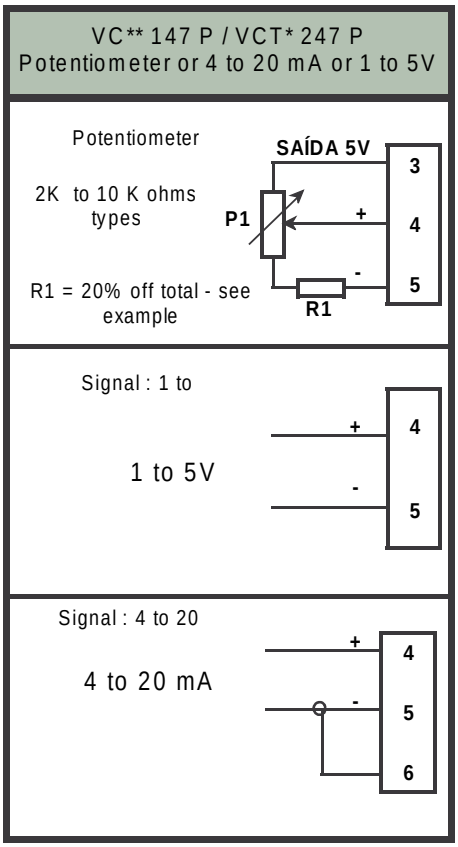
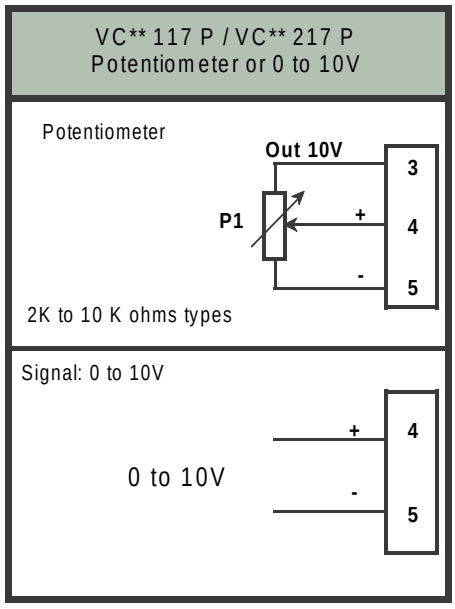
Available Control signals in the Module.

In the side diagrams are shown the available connections in each type of control module.
To certify the available control signals in its controller verifies their label.
Note: For 4 to 20mA the controller supplies minimum power for 4mA and maximum power for 20mA, (The same for another scales).







Installation

To proceed we presented some topics in general with respect to the controller's installation.

The Controllers can be fastened to the assembly foil by four screws in the same way that the conventional equipments. The controllers must be used in sheltered installation, being relatively immune to aggressive atmosphere, since the only mobile part is represented by the fans, in the larger models.

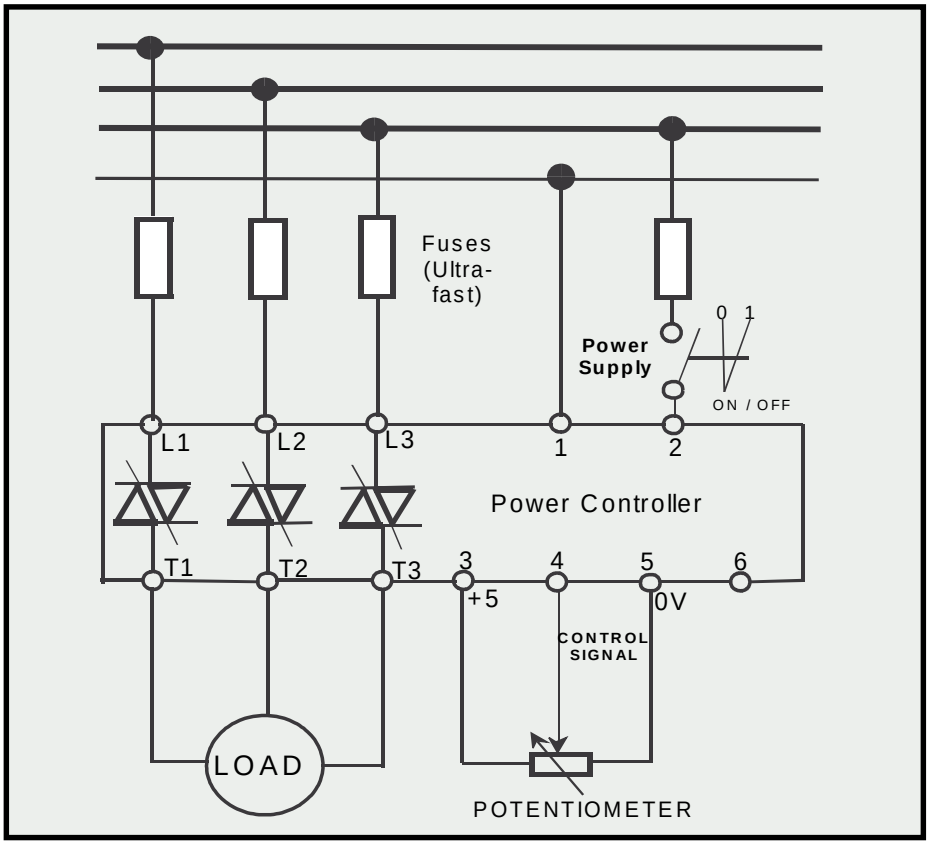
The very big controllers, use disk type Tyristors and should also be relatively protected of conductive powder or humidity accumulation.

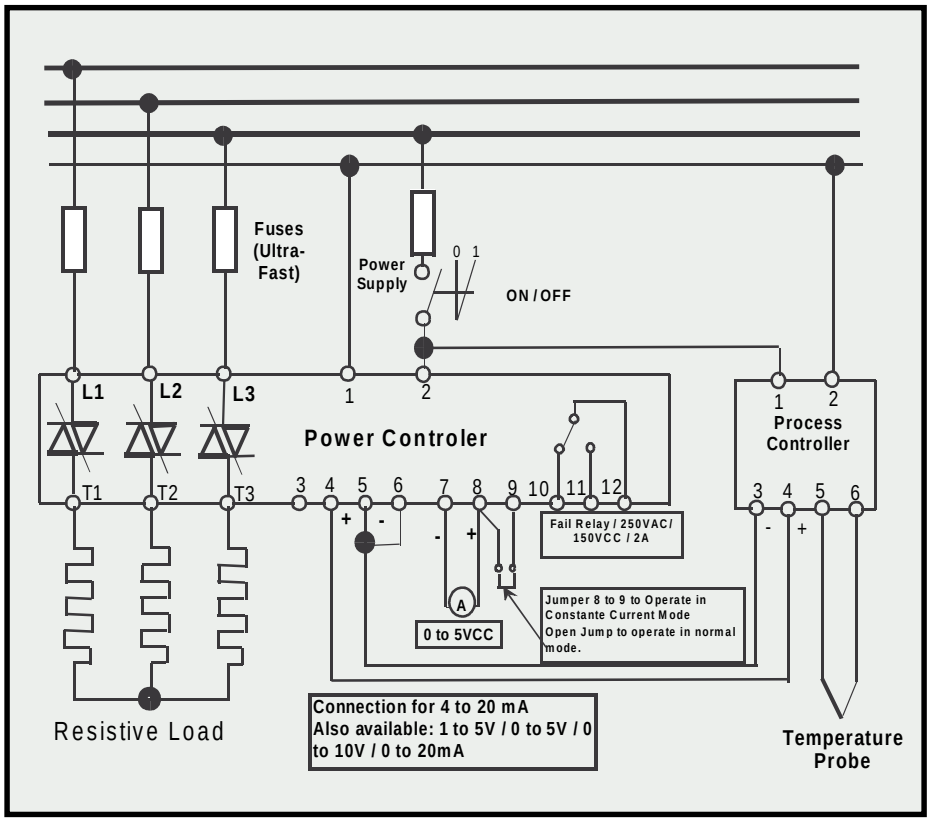
The controllers with or without incorporate fan, generate a quantity of heat, which should be extracted of the panel, because otherwise there would be an accumulation of heat, elevating the internal temperature of the panel a lot, doing that the controller's temperature protection acts. It is necessary, therefore to use fans with dust filte in the panel.

The fan mentioned above must be adequate to change the air of the panel and to maintain the appropriate temperatures of operation. To know the Watts losses of each controller, multiply the average current of the 3-Phases controller by 4,5, 2_Phases by 3 and 1-Phase by 1,5.

Avoid line-up too much controllers, so that the warmest air than leaves a controller, be the air that will be forced in the other.

The controllers starting from 75A possess incorporated fan. The fans only turn-on when the temperature of the heat exchangers reaches 50º C. In case the temperature of the heat exchangers surpasses 80º C, the Power output will be inhibited and only enabled again when the temperature be lowered.





Application Examples.

The power controllers' application is as simple as electromechanicals equipments, as we can observe.

Example 1: 3-Phases Power Controller without protections (Normal), controlled by potentiometer.
In this example the load is a bank of resistances conected in star. The connection of the control signal is configured for potentiometer. In the same controller it can also be used, voltage signal or current signal. The value of the potentiometer can be 1K Ohms to 10K Ohms. (see list of accessories in this bulettin).

Example 2: 3-Phases Power Controller with incorporated protections (Plus).
Notice in this case the signal output proportional to the current, in the terminals 7 and 8. it is Used for the current reading, a voltmeter with current scale or a PLC. Also notice the output of the contacts of the fail relay, in the terminals 10, 11 and 12. Still notice the optional jamper in the terminals 8 and 9 that selects the Constant current mode. In the same controller it can also be used, tension signal or potentiometer for the control signal.
The ultra-fast fuses is appropriated for protection of the tyristors in case of short-circuit and they are as common and cheap as the retarded fuses. In the fuse table we presented several makers' data, for each controller model with the values $i^2.t$.

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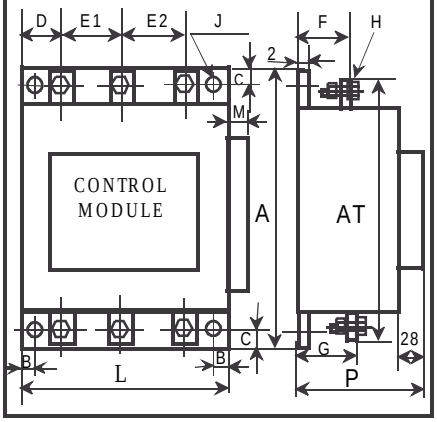
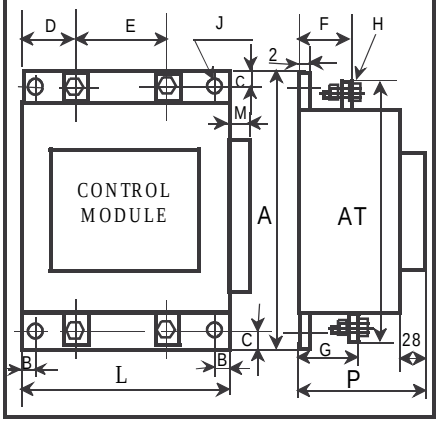
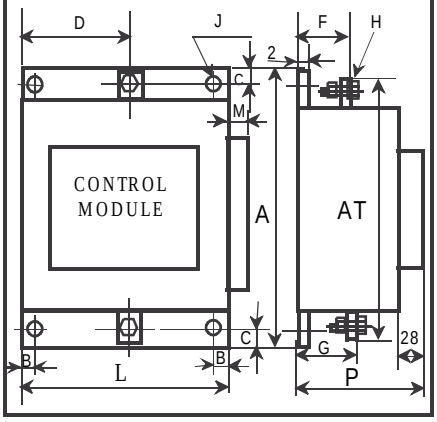
Normal - 3 Phases



Normal - 2 Phases



Normal - 1 Phase



3-PHASES - NORMAL MODELS

Model SVMT	COOLING Forced/ Natural	Width (L) mm	Height (A) mm	Depth (P) mm	Height (AT) mm	B mm	C mm	D mm	E1 mm	E2 mm	F mm	G mm	H mm	J mm	M mm
10A	N	105	170	100	150	10	5	15	22	22	58	58	M5	5	—
15A	N	105	170	100	150	10	5	15	22	22	58	58	M5	5	—
20A	N	105	170	100	150	10	5	15	22	22	58	58	M5	5	—
25A	N	105	170	100	150	10	5	15	22	22	58	58	M5	5	—
30A	N	150	145	166	177	20	5	35	46	46	103	103	M5	5	—
40A	N	150	145	166	177	20	5	35	46	46	103	103	M5	6	—
50A	N	150	170	250	200	10	7	37	47	47	186	186	M5	7	—
75A	N	200	170	250	200	10	7	40	60	60	186	186	M8	7	—
100A	F	150	170	250	200	10	7	37	47	47	186	186	M8	7	45
125A	F	200	170	250	200	10	7	40	60	60	186	186	M8	7	45
150A	F	200	170	250	200	10	7	45	80	80	190	190	M10	7	45
200A	F	250	170	250	200	10	7	45	80	80	190	190	M10	7	45
250A	F	240	291	260	305	20	7	42	61	61	190	190	M10	7	—
300A	F	251	280	275	264	20	20	62	85	85	194	220	M10	9	—
400A	F	377	280	275	264	20	20	62	126	126	194	220	M10	9	—
500A	F	377	330	275	313	20	20	62	126	126	194	220	M10	9	—
650A	F	377	430	275	420	20	20	62	126	126	214	214	M12	9	—
750A	F	377	480	275	470	20	20	98	126	126	214	214	M12	9	—
1000A	F	540	700	300	710	12	12	130	172	172	89	226	M12	11	—
1250A	F	800	700	350	720	12	12	130	278	261	121	278	M14	11	—
1500A	F	800	800	350	820	12	12	130	278	261	121	278	M16	11	—
1700A	F	800	850	350	870	12	12	130	278	261	121	278	2xM14	11	—
2000A	F	800	950	350	970	12	12	130	278	261	121	278	2xM14	11	—

2-PHASES NORMAL MODELS

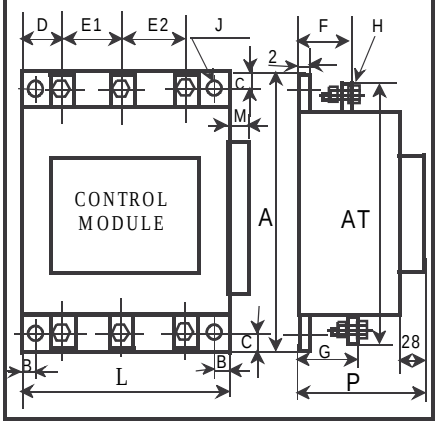
Model SVMB	COOLING Forced/ Natural	Width (L) mm	Height (A) mm	Depth (P) mm	Height (AT) mm	B mm	C mm	D mm	E mm	F mm	G mm	H mm	J mm	M mm
10A	N	105	170	100	150	10	5	15	44	58	58	M5	5	—
15A	N	105	170	100	150	10	5	15	44	58	58	M5	5	—
20A	N	105	170	100	150	10	5	15	44	58	58	M5	5	—
25A	N	105	170	100	150	10	5	15	44	58	58	M5	5	—
30A	N	100	145	166	177	20	5	47	56	103	103	M5	5	—
40A	N	150	145	166	177	20	5	47	56	103	103	M5	6	—
50A	N	150	170	250	200	10	7	47	56	186	186	M5	7	—
75A	N	200	170	250	200	10	7	50	100	186	186	M8	7	—
100A	F	150	170	250	200	10	7	40	70	186	186	M8	7	45
125A	F	200	170	250	200	10	7	50	100	186	186	M8	7	45
150A	F	200	170	250	200	10	7	50	100	190	190	M10	7	45
200A	F	250	170	250	200	10	7	60	130	190	190	M10	7	45
250A	F	250	170	250	200	20	7	60	130	190	190	M10	7	45
300A	F	251	280	275	264	20	20	62	127	194	220	M10	9	—
400A	F	377	280	275	264	20	20	62	127	194	220	M10	9	—
500A	F	377	330	275	313	20	20	62	127	194	220	M10	9	—
650A	F	377	430	275	420	20	20	62	127	214	214	M12	9	—
750A	F	377	480	275	470	20	20	95	127	214	214	M12	9	—
1000A	F	540	700	300	710	12	12	142	172	89	226	M12	11	—
1250A	F	800	700	350	720	12	12	142	275	121	278	M14	11	—
1500A	F	800	800	350	820	12	12	142	275	121	278	M16	11	—
1700A	F	800	850	350	870	12	12	142	275	121	278	2xM14	11	—
2000A	F	800	950	350	970	12	12	142	275	121	278	2xM14	11	—

1-PHASE NORMAL MODELS

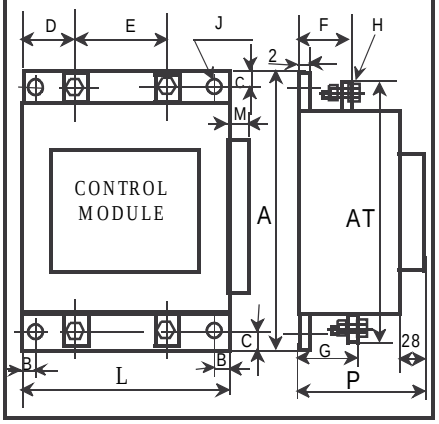
Model SVMM	COOLING Forced/ Natural	Width (L) mm	Height (A) mm	Depth (P) mm	Height (AT) mm	B mm	C mm	D mm	F mm	G mm	H mm	J mm	M mm
25A	N	100	145	166	177	10	5	50	103	103	M5	5	—
30A	N	100	145	166	177	10	5	50	103	103	M5	5	—
40A	N	100	145	166	177	10	5	50	103	103	M5	5	—
50A	N	100	145	166	177	10	5	50	103	103	M5	5	—
75A	N	100	200	250	200	10	7	50	186	186	M8	7	—
100A	N	100	200	250	200	10	7	50	186	186	M8	7	—
125A	N	100	200	250	200	10	7	50	186	186	M8	7	—
150A	F	150	200	250	200	10	7	75	190	190	M10	7	45
200A	F	150	200	250	200	10	7	75	190	190	M10	7	45

1-Phase Controllers above 200A - Consult

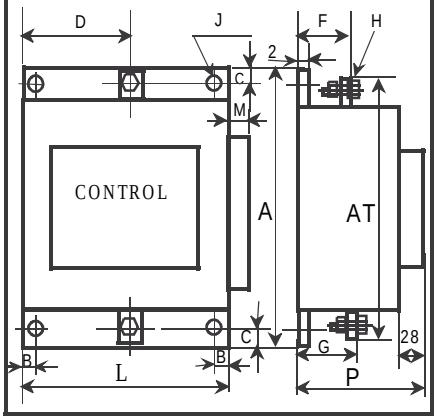
Plus - 3 Phases



Plus - 2 Phases



Plus - 1 Phase



3-PHASE PLUS MODELS

Model SVMT	COOLING Forced/ Natural	Width (L) mm	Height (A) mm	Depth (P) mm	Height (AT) mm	B mm	C mm	D mm	E1 mm	E2 mm	F mm	G mm	H mm	J mm	M mm
30A	N	220	145	160	177	20	5	55	42	42	103	103	M5	5	—
40A	N	220	145	160	177	20	5	55	42	42	103	103	M5	5	—
50A	N	220	145	160	177	20	5	55	42	42	103	103	M5	5	—
75A	N	220	170	260	200	10	7	55	42	42	186	186	M8	7	—
100A	N	220	170	260	200	10	7	55	42	42	186	186	M8	7	45
125A	F	220	170	260	200	10	7	55	42	42	186	186	M8	7	45
150A	F	250	170	260	210	10	7	78	45	45	190	190	M10	7	45
200A	F	250	170	260	210	10	7	78	45	45	190	190	M10	7	45
250A	F	240	291	260	305	20	7	42	61	61	190	190	M10	7	—
300A	F	251	280	275	264	20	20	62	85	85	194	220	M10	9	—
400A	F	377	280	275	264	20	20	62	126	126	194	220	M10	9	—
500A	F	377	330	275	313	20	20	62	126	126	194	220	M10	9	—
650A	F	377	430	275	420	20	20	62	126	126	214	214	M12	9	—
750A	F	377	480	275	470	20	20	98	126	126	214	214	M12	9	—
1000A	F	540	700	300	710	12	12	130	172	172	89	226	M12	11	—
1250A	F	800	700	350	720	12	12	130	278	261	121	278	M14	11	—
1500A	F	800	800	350	820	12	12	130	278	261	121	278	M16	11	—
1700A	F	800	850	350	870	12	12	130	278	261	121	278	2xM14	11	—
2000A	F	800	950	350	970	12	12	130	278	261	121	278	2xM14	11	—

2-PHASE - PLUS MODELS

Model SVMB	COOLING Forced/ Natural	Width (L) mm	Height (A) mm	Depth (P) mm	Height (AT) mm	B mm	C mm	D mm	E mm	F mm	G mm	H mm	J mm	M mm
30A	N	200	145	166	177	20	5	50	100	103	103	M5	6	—
40A	N	200	145	166	177	20	5	50	100	103	103	M5	6	—
50A	N	200	145	166	177	20	5	50	100	103	103	M5	6	—
75A	N	200	170	250	200	10	7	50	100	186	186	M8	7	—
100A	N	200	170	250	200	10	7	50	100	186	186	M8	7	—
125A	F	200	170	250	200	10	7	50	100	186	186	M8	7	45
150A	F	200	170	250	200	10	7	50	100	190	190	M10	7	45
200A	F	250	170	250	200	10	7	60	130	190	190	M10	7	45
250A	F	200	170	250	200	20	7	60	130	190	190	M10	7	45
300A	F	251	280	275	264	20	20	62	127	194	220	M10	9	—
400A	F	377	280	275	264	20	20	62	127	194	220	M10	9	—
500A	F	377	330	275	313	20	20	62	127	194	220	M10	9	—
650A	F	377	430	275	420	20	20	62	127	214	214	M12	9	—
750A	F	377	480	275	470	20	20	95	127	214	214	M12	9	—
1000A	F	540	700	300	710	12	12	142	172	89	226	M12	11	—
1250A	F	800	700	350	720	12	12	142	275	121	278	M14	11	—
1500A	F	800	800	350	820	12	12	142	275	121	278	M16	11	—
1700A	F	800	850	350	870	12	12	142	275	121	278	2xM14	11	—
2000A	F	800	950	350	970	12	12	142	275	121	278	2xM14	11	—

1-PHASE PLUS MODELS

Model SVMM	COOLING Forced/ Natural	Width (L) mm	Height (A) mm	Depth (P) mm	Height (AT) mm	B mm	C mm	D mm	F mm	G mm	H mm	J mm	M mm
30A	N	200	145	166	177	10	5	100	103	103	M5	5	—
40A	N	200	145	166	177	10	5	100	103	103	M5	5	—
50A	N	200	145	166	177	10	5	100	103	103	M5	5	—
75A	N	200	200	250	200	10	7	100	186	186	M8	7	—
100A	N	200	200	250	200	10	7	100	186	186	M8	7	—
125A	N	200	200	250	200	10	7	100	186	186	M8	7	—
150A	F	200	200	250	200	10	7	100	190	190	M10	7	45
200A	F	200	200	250	200	10	7	100	190	190	M10	7	45

1-Phase Controllers above 200A - Consult please

Recommended ultra-fast Fuses.

In the table to the side are being listed the recommended ultra-fast fuses.

The fuses can have it`s characteristics modified by the makers at any time. Therefore is responsibility of the user the correct specification of the fuses and the checking it´s characteristics with the maker of the fuses.

Note: When fuses in parallel are used the i^2t should be multiplied by 4 and not for 2 as it could seem. Therefore care in the fuse use in parallel. Other types can be used since the i^2t are at the recommended range. In the second column the controllers' value i^2t is being specified, for a protection keep the i^2t value of the fuses at least 20% smaller than of the controllers.

Protection		Ultra-fast fuses recomended for Power Controllers Applied to Resistive Loads Models SVMT... / SVMB... / SVMM...											
Characteristics		Siemens Fuses			TEE Fuses			DCA Fuses			Bussmann Fuses		
Model SVMT	I^2T ($A^2.S$)	IN (A)	I^2T ($A^2.S$)	Type (Refer.)	IN (A)	I^2T ($A^2.S$)	Type (Refer.)	IN (A)	I^2T ($A^2.S$)	Type (Refer.)	IN (A)	I^2T ($A^2.S$)	Type (Refer.)
10	265	16	200	5SD4-20	25	—	DZ16	—	—	—	—	—	—
15	265	20	410	5SD4-30	30	—	DZ20	—	—	—	—	—	—
20	510	25	200	5SD4-40	25	—	DZ25	—	—	—	—	—	—
25	510	35	410	5SD4-50	30	—	DZ35	—	—	—	—	—	—
30	610	35	410	5SD4-50	35	—	DZ35	—	—	—	—	—	—
40	1300	50	590	3NE4-217	50	1000	50SP155N	50	2000	3AC1 217U	50	515	170M3809
50	5000	63	1050	3NE4-218	63	1800	63SP155N	63	3000	3AC1 218U	63	770	170M3810
75	9800	100	3920	3NE4-221	100	5050	100SP155N	100	7000	3AC1 221U	100	2450	170M3812
100	9800	125	7960	3NE4-222	125	7000	125SP155N	125	10000	3AC1 222U	125	3700	170M3813
125	17100	160	15700	3NE4-224	160	14000	160SP155N	160	30.000	3AC1 224U	160	7500	170M3814
150	84000	250	18500	3NE4-227	200	22000	200SP255N	200	40.000	3AC1 325U	250	285000	170M3816
200	84000	315	35000	3NE4-330	300	60000	300SP255N	250	70.000	3AC1 327U	315	46500	170M3817
250	97000	315	35000	3NE4-330	300	60000	300SP255N	—	—	—	350	68500	170M3818
300	168000	450	123000	3NE4-333	400	120000	400SP255N	—	—	—	450	105000	170M5809
400	245000	500	170000	3NE4-334	450	160000	450SP355N	—	—	—	500	145000	170M5810
500	245000	500	170000	3NE4-334	500	180000	500SP355N	—	—	—	550	190000	170M5811
650	781000	710	485000	3NE4-337	800	510000	800SP455N	—	—	—	800	465000	170M6812
750	781000	—	—	—	800	510000	800SP455N	800	600000	3AC1 448U	800	465000	170M6812
1000	1051000	—	—	—	—	—	—	—	—	—	—	—	—
1250	1530000	—	—	—	—	—	—	—	—	—	—	—	—
1500	2530000	—	—	—	—	—	—	—	—	—	—	—	—
1750	4500000	—	—	—	—	—	—	—	—	—	—	—	—
2000	4500000	—	—	—	—	—	—	—	—	—	—	—	—

Spare Parts for Power controllers - Normal Model				
Description	**Model**	**Quantity Used 3-Phase**	**Quantity Used 2-Phase**	**Quantity Used 1-Phase**
Tyristor	Consult	3	2	1
Control Module	see page B16	1	1	1
Firing Module	VDA-4C (note1)	3	2	1
Firing Module	VDA-440 (note2)	3	2	1
Termperature switch (Fan On)	VR-N2-45-C1-P	*	*	*
Termperature Switch (Trip)	VR-N1-90-C1-P	****	***	**
Fan	Consult	****	***	**
* (to 75A not used) above 75A=1 ** (to 75A not used) from 100 to 200A=1 *** (to 75A not used) from 100 to 200A=1 above 300A=2 ****(to 75A not used) from 100 to 200A=1, from 250 to 300A=2 and above 300A=3				

Spare Parts for Power controllers - Plus Model				
Description	**Model**	**Quantity Used 3-Phase**	**Quantity Used 2-Phase**	**Quantity Used 1-Phase**
Tyristor	Consult	3	2	1
Control Module	see Page d16	1	1	1
Firing Module	VDA-4C (note1)	3	2	1
Firing Module	VDT-440 (note2)	3	2	1
Current Transformer	TCIA (to 500A)	3	2	1
Current Transformer	TCIB (650 to 750A)	3	2	1
Current Transformer	TCIC (above 750A)	3	2	1
Temperature switch (Fan On)	VR-N2-45-C1-P	*	*	*
Temperature switch (Trip)	VR-N1-90-C1-P	****	***	**
Fan	Consult	****	***	**
* (to 75A not used) above 75A=1 ** (to 75A not used) from 100 to 200A=1 *** (to 75A not used) from 100 to 200A=1 above 300A=2 ****(to 75A not used) from 100 to 200A=1, from 250 to 300A=2 and above 300A=3				
Note 1= Used in Phase angle and Mixed Modes Controllers Note 2= Usado in PWM (Pulse Train) Mode Controllers				

ACCESSORIES:

- VP1020B: - Control Panel: It integrates multi-turns potentiometer with digital scale for manual, adjustment, switch "Manual/Automatic", switch "Normal/ Constant Current", led "On" and led "Fail".
- VP1020A: - Same, even so without switch "Normal/Constant Current".
- VP1020C: - Same VP1020A even so without led "Fail".
- P10D: - Potentiometer 10K with digital scale.
- Ultra-fast Fuses (consult).
- VIC5 - Current Integrator for Normal model (Optional).

SPARE Parts:

Control modules: see corresponding table.

Firing modules:

- **VDT440:** - for "Train of Pulses" model.
- **VDA-4A:** - For "Phase Angle" and "Mixed" models.

Several:

- **TC-1A:** - Current Transformer for model with protections up to 500 A.
- **TC-1B:** - Current Transformer for model with protections up to 2000 A.
- **VV1 and VV2:** - Fans - consults data sheet in the manual.
- **VRN1 and VRN2:** - heat sensors - consults data sheet in the manual.
- **VC6:** - Connector female 6 ways for control module.
- **VC12:** - Connector female 12 ways for control module.

VP 1020B

PANELS WITH POWER CONTROLLERS

PANEL WITH POWER CONTROLLERS

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Rua Phelipe Zaidan Maluf 1501 - Distrito Industrial Unileste
Piracicaba - SP - CEP13.422.190 - Phone: (55) (19) 3424.4000 - Fax: (55) (19) 3424.4001
www.varix.com.br e-mail: info@varix.com.br

Varix Electronics USA:

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