

Technical manual

# VAREOSOFT SAG M400

Digital Soft Start Units for 3-phase Asynchronous Motors

## IMPORTANT SAFETY INFORMATION - PLEASE READ

This manual contains all the necessary information for the correct application and installation of VAREOSOFT SAG soft start units. It is intended for use by technically qualified personnel. These are persons who, because of their training, experience and position, as well as their knowledge of appropriate standards, regulations, health & safety requirements and working conditions, are authorised to be responsible for the safety of the equipment, at all times, even whilst carrying out their normal duties, and are therefore aware of, and can report, possible safety hazards (Definition of qualified employees according to IEC 364)

### Safety Instructions

The following instructions are provided for the personal safety of operators and also for the protection of the described product and connected equipment.



Warning!  
Hazardous Voltage  
Failure to observe can kill, cause serious injury or damage

- ▶ Isolate from mains before installation or dismantling work, as well as for fuse changes or post installation modifications.
- ▶ Observe the prescribed accident prevention and safety rules for the specific application.
- ▶ Before putting into operation check if the rated voltage for the unit conforms with the local supply voltage.
- ▶ Emergency stop devices must be provided for all applications. Operation of the emergency stop must inhibit any further uncontrolled operation.
- ▶ Electrical connections must be fitted with protective covers.
- ▶ Earth bonding must be tested after installation!
- ▶ It is recommended that semi conductor fuses are used to protect the soft start units

### Specified Use

The units described herein are electrical controllers for installation in industrial plant.  
They are designed for controlling 3-phase motors.

### Typical Applications

The SAG range can be used on

- ✓ Lifts and Elevators
- ✓ Machines with drives, belts and chains
- ✓ Conveying systems
- ✓ Grinding, hobbing and sawing machines
- ✓ Fans, pumps, compressors and air conditioning equipment

### Benefits

- ✓ Reduced wear and down time, increased machine and plant efficiency
- ✓ Reduced start up current demand, less drain on supply, better tariffs
- ✓ Lower installation costs
- ✓ Less process waste

Please contact your supplier below if you have any doubt:-

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## Introduction - M400 Digital Soft Starts

This micro-processor controlled soft start unit complements the SAG range of simpler, trimmer adjusted units. Most larger motors are provided with six terminals, to simplify connection to a conventional star/delta starter. The controller exploits this facility by utilising all six terminals connected in an open delta configuration (also known as inside delta or six-wire connection). The advantage of this is that current carried by the SAG semiconductors is just 58% of the rated motor current. Consequently a much smaller soft start unit can be specified. Savings of upto 40% can be made when utilising this method, although actual savings will depend of the cable run because 6 feeder conductors have to be used. There are also space saving and reduced heat loss benefits.

By optimizing the use of the microprocessor control, it is possible to limit the amount of current drawn during the start-up phase. This has two advantages, not only does it prevent a current in-rush (or voltage dip) but it also ensures that the motor speed builds up as quickly as possible, which can be an important consideration in time related operations.

All settings are entered through a touch panel that incorporates a digital display.

## Functional Description of the SAG M400

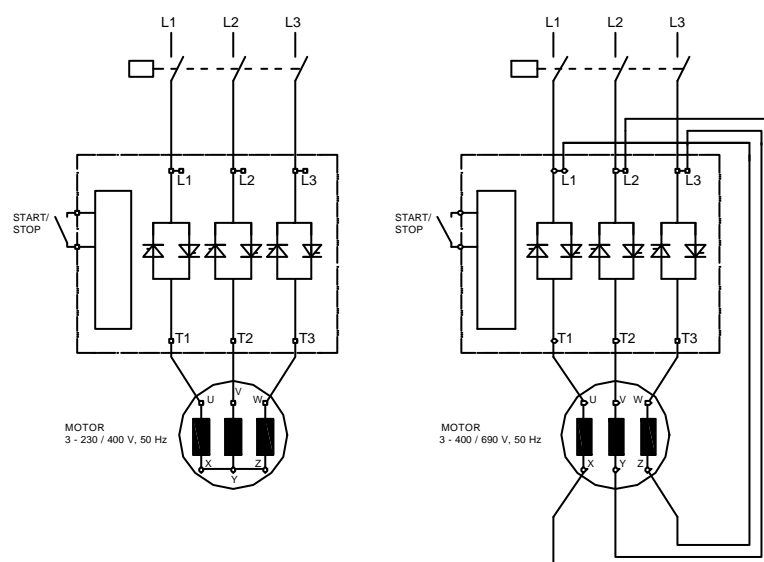
The start-up current is limited by adjusting the firing angle of thyristors, which regulate the voltage, using the phase-angle principle, in response to a current feedback signal. Once the output voltage has reached maximum (full conduction or 0° firing angle) an output relay is energized, indicating that the "top of the ramp" has been reached.

Unit ratings are to the maximum motor power and rated motor current  $I_{nom}$ . The starting current is set as a percentage of the unit rated current (0...100%) and if no specific start-up ramp is selected, the controller will automatically ramp-up in the fastest time allowed by the current limit.

It is also possible to use the conventional three-wire connection so that the current limiting function can be used but the controller must be derated accordingly.

## Principles of 3-wire / 6-wire circuits

The circuits below show the conventional star (3-wire) and the alternative, open delta (6-wire) connections to a motor. The open delta configuration allows the use of a controller that is much smaller and hence more efficient and cost effective.



## Technical Data

Operating Voltage 380...400 V +/- 10%; 50/60 Hz

SAG Model	16	23	32	45	63	75
Max motor power [kW]	7.5	11	18.4	22	30	37
Rated motor current [A]	15.2	21.7	29.4	41	55	68

Starts / h	60 x 15...20 secs (33% duty cycle)
Ramp up time	0...60 secs (adjustable)
Ramp down time	0...60 secs (adjustable)
Initial torque	0...100% (adjustable)
Fault relay	Change-over contact 250V, 1A (AC)
Top of ramp relay	Change-over contact 250V, 1A (AC)
Protection	IP00 - VBG4
Operating temp range	0...+45 degrees C
Storing temp	-20...+70 degrees C
Relative air humidity	Humidity 93% without dew
Contamination level	Degree 1 (IEC 664)
Mounting height	1000 m 0.5% rated current reduction for each additional 100 m
Mounting position	Vertical
Standards	EN 50081-1, EN50082-2, EN 60947-4-2

## Adjustable Parameters

Parameters		Code	Default Settings	Access Code:
Starting voltage (initial breakaway torque)	0...100 %	U.	0 %	002
Starting Current	0...100 %	I.	100 %	002
Ramp up time	0...10 secs	/.	0.1 secs	002
Ramp down time	0...10 secs	\.	0.1 secs	002
Standard 3-Line or 6-Line Mode	0 / 1	6.L	0 (3-line)	002
Peak current display (ramp up peak)	% from I <sub>max</sub>	I.		005
User adjusted parameter are saved		PUSH		143
User adjusted parameters are re-instated		US.PA.		210
Return to basic settings		FAC		210

**Starting voltage:** To overcome the friction within the mechanical system, the starting voltage can be set to a value that is greater than zero, thus ensuring a positive start of the motor.

**Starting current:** Current limit during start-up.

**Ramp-up time:** Used in conjunction with the starting current limit to pre-determine the start time. Can be adjusted up to a maximum of 60 secs.

**Ramp-down time:** Utilised in applications which require a controlled stop, pump motor control for example. Can be adjusted up to a maximum of 60 secs.

**Peak current display:** Controls the current during the start-up phase and is set as percentage of the rated motor current (up to 300 %). The display can be used to monitor the start-up current

**Save new settings:** The adjusted parameters are saved so that they may be recalled, if subsequent changes are made

**Recall saved settings:** Resets system to user set parameters.

**Recall factory settings:** Resets system to factory set parameters.

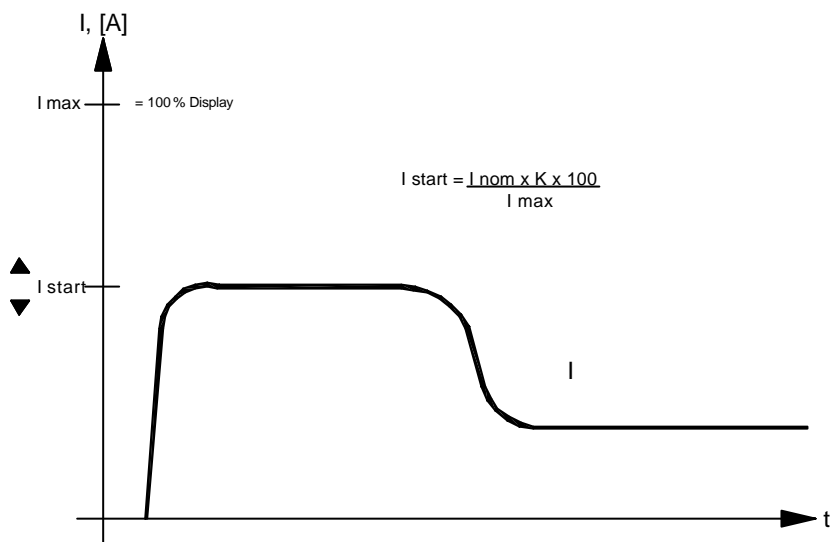
## Determination of starting current

The control unit has a value of semiconductor peak current, which represents the maximum possible start-up current. A value in percent of this maximum current is adjusted as the starting current.

Provided the selected SAG unit is correctly specified for use with the motor, then the maximum start-up current will be approximately 300 % of the rated motor current (with 3-line circuit).

Example: Motor = 11 kW  $I_{nom} = 23$  A approx  
Soft Start unit SAG M 23

Maximum starting current = 70 A  
Required starting current =  $1.5 \times I_{nom}$   
Setting for starting current = 49.3 %



K	Factor starting current excess
$I_{max}$	Maximum start-up current
$I_{nom}$	Rated motor current
$I_{start}$	Starting current in % of the max start-up current