

TGS3 Series Soft Starter

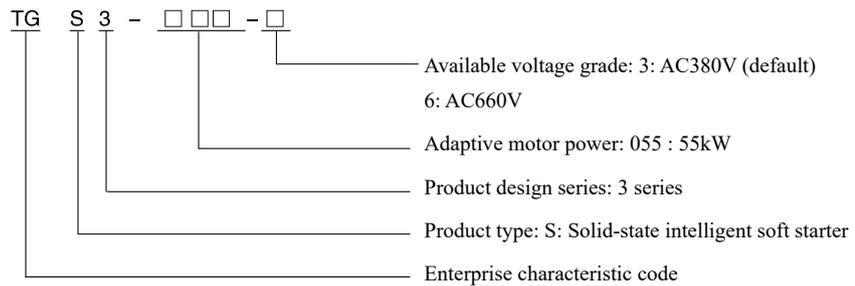


1 Product overview

With the advanced CPU control technology as core, TGS3 series soft starter can realize the soft startup and soft stop of (squirrel cage) 3-phase AC asynchronous motor by controlling the SCR module and has multiple optional protection functions such as overload, input phase loss, output phase loss, load short circuit, starting current-limit overtime, overvoltage, and undervoltage protections. This product is mainly used together with a complete set of control cabinet. To ensure normal operation, a bypass AC contactor of the corresponding specification must be provided. The product specification covers 11kW~400kW (squirrel cage) 3-phase AC asynchronous motor that is an electrical drive equipment widely used in many industrial fields such as metallurgy, petroleum, fire control, mines, and petrochemical. This product is the most ideal replacement product for traditional star-delta start and self-coupling reduced-voltage start.

Available standard: IEC 60947-4-2

2 Type designation



3 Product parameters

3.1 Power voltage:

3-phase AC 380V or 660V±15%, 50Hz is available for mains supply, self-provided power plate, and diesel generator unit, and the power capacity shall ensure that the soft starter satisfy the motor starting requirements.

3.2 Starting current limit: 0.5 ~ 1.5 times starting current limit.

3.3 Ramp down time: 0S ~ 60S.

3.4 Soft start initial up voltage: 30% U_e ~ 80% U_e.

3.5 Kickstart time: 0.1S.

3.6 Environment requirements

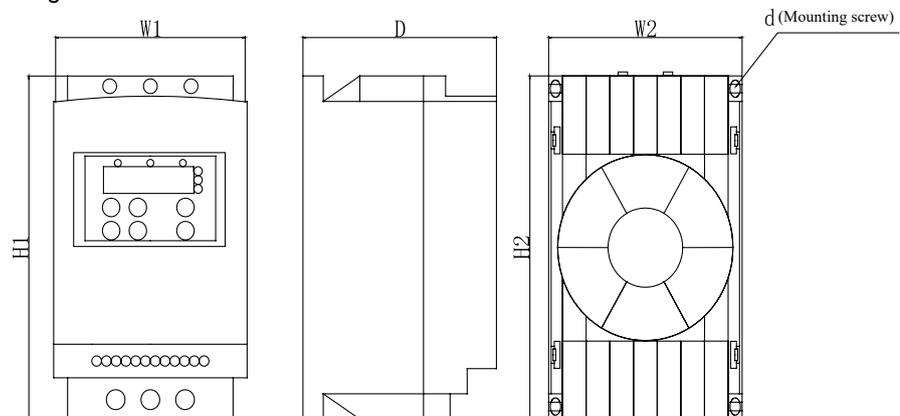
When the altitude exceeds 1000m, the capacity shall be reduced correspondingly; for more than 1000m, the current will be reduced by 0.5% by an increase of 100m;

The ambient temperature is ranged -10 C to 40 C , and the relative humidity does not exceed 95%;

Used in a well-ventilated indoors environment free of condensate, flammable or explosive gas, and conductive dust.

4 Outline and installation dimensions

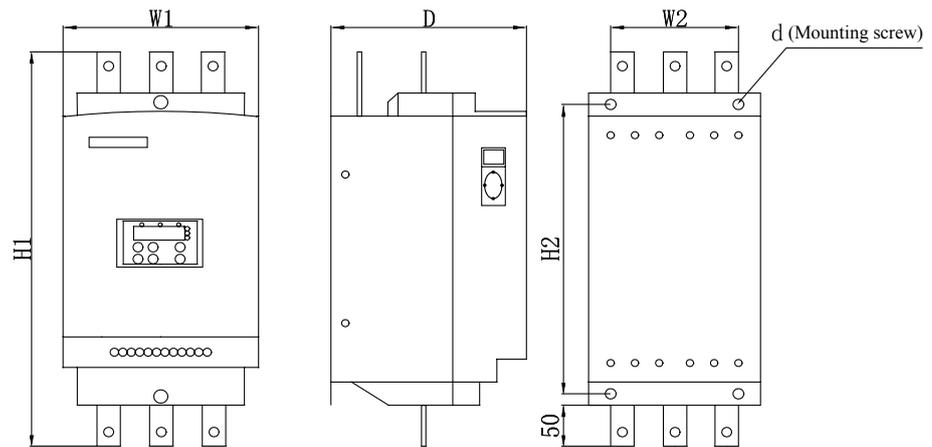
Fig. 7 TGS3-5.5~75



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Spec. & Model	Rated current (A)	Rated power (kW)	Outline and installation dimensions (mm)						Approx. weight (kg)	Outline drawing
			W1	H1	D	W2	H2	Mounting hole, d		
TGS3-5.5-3	11	5.5	146	271	158	131	251	M6	4	Fig. 7
TGS3-7.5-3	15	7.5	146	271	158	131	251	M6	4	Fig. 7
TGS3-011-3	23	11	146	271	158	131	251	M6	4	Fig. 7
TGS3-015-3	30	15	146	271	158	131	251	M6	4	Fig. 7
TGS3-18.5-3	37	18.5	146	271	158	131	251	M6	4	Fig. 7
TGS3-022-3	43	22	146	271	158	131	251	M6	4	Fig. 7
TGS3-030-3	60	30	146	271	158	131	251	M6	4	Fig. 7
TGS3-037-3	75	37	146	271	158	131	251	M6	4	Fig. 7
TGS3-045-3	90	45	146	271	158	131	251	M6	4	Fig. 7
TGS3-055-3	110	55	146	271	158	131	251	M6	4	Fig. 7
TGS3-075-3	150	75	146	271	158	131	251	M6	4	Fig. 7

Fig. 8 TGS3-075-400

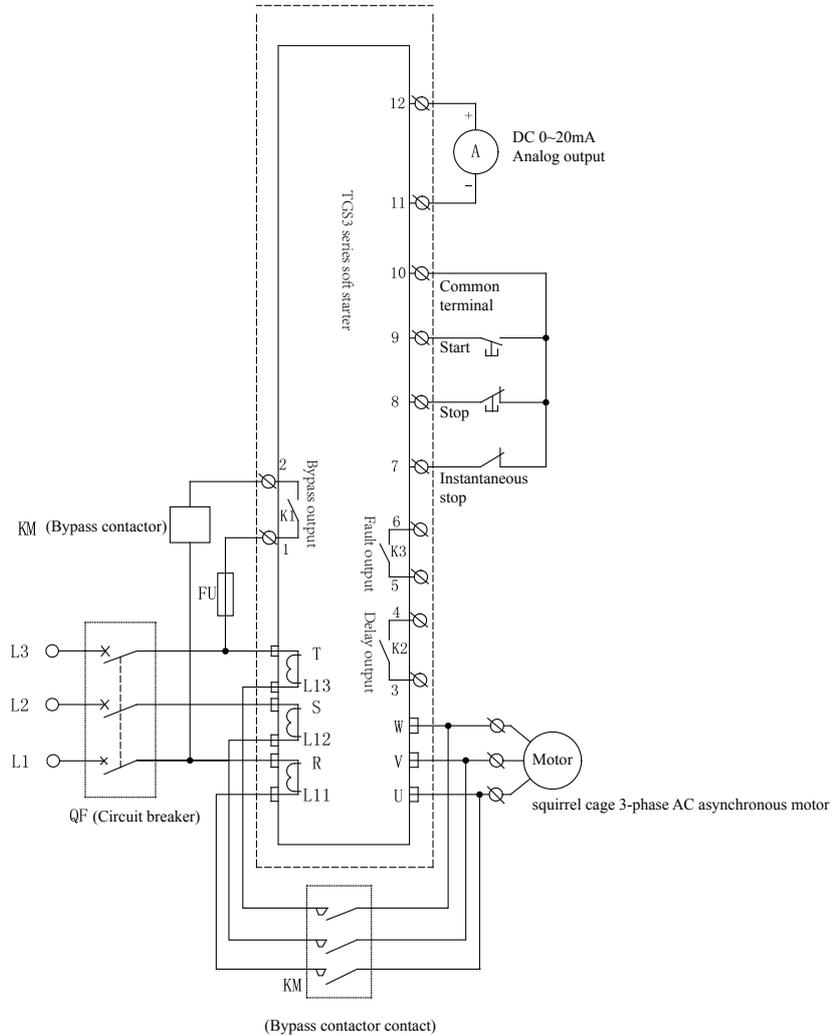


Spec. & Model	Rated current (A)	Rated power (kW)	Outline and installation dimensions (mm)						Approx. weight (kg)	Outline drawing
			W 1	H 1	D	W 2	H 2	Mounting hole, d		
TGS3-090-3	180	90	261	530	195	197	378	M8	20	Fig. 8
TGS3-115-3	230	115	261	530	195	197	378	M8	20	Fig. 8
TGS3-132-3	264	132	261	530	195	197	378	M8	20	Fig. 8
TGS3-160-3	320	160	261	530	195	197	378	M8	20	Fig. 8
TGS3-185-3	370	185	261	530	195	197	378	M8	20	Fig. 8
TGS3-200-3	400	200	261	530	195	197	378	M8	20	Fig. 8
TGS3-250-3	500	250	290	570	200	220	405	M8	20	Fig. 8
TGS3-280-3	560	280	290	570	200	220	405	M8	20	Fig. 8
TGS3-320-3	640	320	290	570	200	220	405	M8	20	Fig. 8
TGS3-400-3	800	400	290	570	200	220	405	M8	20	Fig. 8

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5 Wiring diagram

5.1 Wiring diagram



Note: The standard configuration is three-in and three-out type for 55KW and below 55KW soft starter, without operation monitoring protection function;
Six-in and six-out type can be configured according to the user requirements. The upper three wires are connected to circuit breaker and the lower three wires are connected to the bypass contactors for three-in wires.

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5.2 External terminal wiring description

K1 (terminals 1 and 2)	Bypass relay output, normally ON: Contact rating (5A/250VAC)	To control the bypass contactor
K2 (terminals 3 and 4)	Programmable relay output, normally ON: Contact rating (5A/250VAC)	Define the functions of this relay through the programming mode.
K3 (terminals 5 and 6)	Fault relay output, normally ON: Contact rating (5A/250VAC)	This relay will be closed in case of fault.
Terminal 7	Instantaneous stop terminal	The short circuit to terminal 10 is effective; when the Item FC is set to 0 (primary protection), the function of this terminal will be forbidden.
Terminal 8	Stop terminal	The short circuit to terminal 10 is effective
Terminal 9	Run terminal	The short circuit to terminal 10 is effective
Terminal 10	Common terminal	Common terminal for start, stop, and instantaneous stop terminals
Terminal 11	Negative pole of 0~20mA DC analog output	Negative pole of 0~20mA DC analog output Used to monitor the motor current in real time; in case of 20mA full-scale, the motor current is 4 times rated current of soft starter, and a 0~20mA DC ammeter is connected externally for display; this maximum output load resistance is 300Ω.
Terminal 12	Positive pole of 0~20mA DC analog output	

6 Product features

6.1 Perfect humanization design

- 6.1.1 Harmonious unity between artistic appearance and reasonable structure.
- 6.1.2 Harmonious unity between perfect function and simple operation.
- 6.1.3 Harmonious unity between reliable fastness and compact structure.
- 6.1.4 Excelsior artistic design of industrial product.

6.2 Reliable quality guarantee

- 6.2.1 Computer is used to simulate design.
- 6.2.2 SMT chip production process.
- 6.2.3 Excellent electromagnetic compatibility.
- 6.2.4 High-temperature aging and vibration test of the entire machine in factory.

6.3 Perfect and reliable protection

- 6.3.1 Voltage loss, undervoltage, and overvoltage protection.
- 6.3.2 Overheating and too-long starting time protection of soft starter.
- 6.3.3 Input phase loss, output phase loss, and 3-phase imbalance protection.
- 6.3.4 Starting overcurrent, operation overload, and load short-circuit protection.

6.4 Quick and thoughtful after-sales service

- 6.4.1 Reliable performance and quality lay the foundation for high-quality service.
- 6.4.2 Provide an excellent and perfect supporting design scheme.
- 6.4.3 Timely and thoughtful use consultation.
- 6.4.4 Improve the product performance continuously according to the user's opinion.

6.5 Six starting modes

6.5.1 Current-limiting starting mode:

Generally used in the occasions with strict limit requirements on starting current. (See Fig. 1)

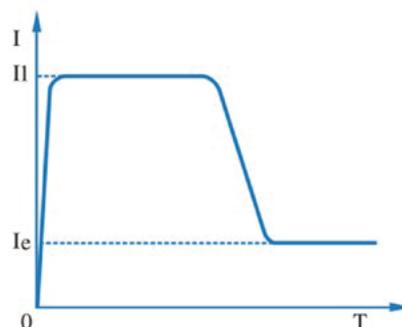


Fig. 1

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6.5.2 Voltage ramp starting mode:

Used in the occasions with lower requirements on starting current and with higher requirements on start-up stability. (See Fig. 2)

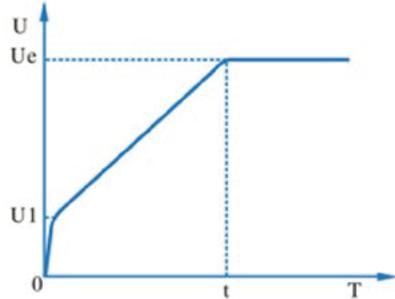


Fig. 2

6.5.3 Kickstart + current-limiting start:

Used in heavy-load occasions with too large static friction and with motor unable to start, with starting waveform shown in (Fig. 3).

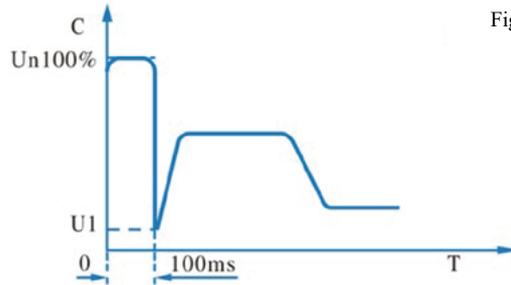


Fig. 3

6.5.4 Start under kickstart + ramp voltage:

Used in heavy-load occasions with too large static friction and with motor unable to start, with starting waveform shown in (Fig. 3).

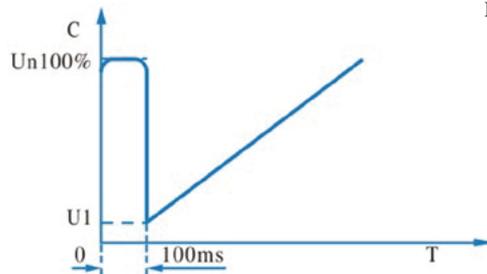


Fig. 4

6.5.5 Current ramp starting mode:

With higher acceleration capacity, suitable for two-pole motor; the starting time can be shortened within a certain range (See Fig. 5).

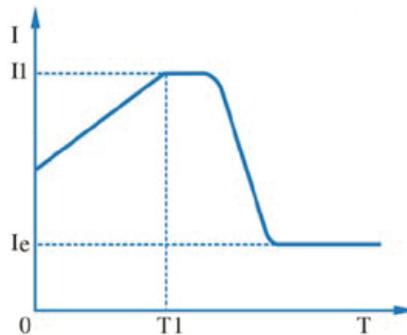


Fig. 5

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6.5.6 Voltage current-limiting dual closed-loop starting mode: suitable for occasion with a smooth start and with a strict current limit.

6.6 Five-grade protection setting

In order to adapt to different applications, there are five grades for TGS3 series soft starter, namely 0: primary, 1: light load, 2: standard, 3: heavy load, and 4: advanced. Those grades are set by Item FC, among them: the primary protection forbids the external connection of the instantaneous stop terminal and also input phase loss protection for overheat, short circuit and startup are only reserved, suitable for occasion with unconditional emergency stop required, such as fire pump.

Light load, standard, and heavy load protection grades have complete protection functions, and their difference is that the motor overload thermal protection time curve is different. The thermal protection time parameters of the motor see Table 1 and Fig. 6.

For advanced protection, the protection standard is stricter when startup, and other protection function parameters are same with those of the standard protection setting.

Table 1

FC setting	0 (primary)	1 (light load)			2 (standard)			3 (heavy load)			4 (advanced)			Description
Overload protection level during operation	No	Grade 2			Grade 10			Grade 20			Grade 10			According to the standard IEC60947-4-2
Starting current protection time	No	3s			15s			30s			15s			Based on the starting current exceeding 5 times F7 setting value
List of overload trip time during operation	Multiple of current (I/Ie)	3	4	5	3	4	5	3	4	5	3	4	5	Values listed in Table are typical values
	Trip time (s)	4.5	2.3	1.5	23	12	7.5	46	23	15	23	12	7.5	

The thermal protection trip time curve of the motor according to the standard IEC60947-4-2 is shown below:

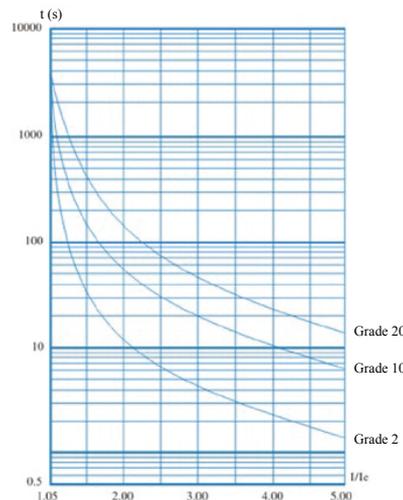


Fig. 6

6.6 Seven combined control modes: Seven different operation combinations are set for flexible and convenient start and stop of soft starter for selection by user as required, and combination modes for Set Item FD are listed in Table 2:

Table 2

Value	0	1	2	3	4	5	6	6
Keyboard	1	1	0	0	1	1	0	0
External control	0	1	1	1	1	0	0	0
Communication	0	0	0	1	1	1	1	0

In the table, 1 means Enabled and 0 means Forbidden. For example, if unexpected shutdown is not allowed after startup or when repair, this item can be set to 6 to forbid all start or stop operations.

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6.8 8 additional functions

- 6.8.1 Delay starting function: 0~999s, countdown displayed; start the machine when counting down to zero.
 - 6.8.2 Operation delay output function: 0~999s, delay starts when receiving the start command, and the output contact will be closed when the delay time expires.
 - 6.8.3 Start interval delay function: 0~999s, display the flashing prompt during delay, and allow restart after the delay time expires.
 - 6.8.4 Overheat release delay function: 0~999s, the rear delay is released when the soft starter is overheated to allow start the machine when the soft starter recovers to the cooling state.
 - 6.8.5 Fault information storage function: The last nine fault information can be stored and will not be lost in case of failure outage.
 - 6.8.6 Auto restart function: Nine automatic restarts can be set, suitable for long-term continuous operation occasions, such as unattended operation.
 - 6.8.6 0~20mA DC analog output: Indicate the motor current in real time, with the maximum load of 300Ω.
 - 6.8.8 Multi-function display: To accurately display power voltage, motor current, apparent power, and thermal balance coefficient, instead of external digital meter head, saving costs.
- ### 6.9 12 protection functions
- 6.9.1 External fault input protection (instantaneous stop terminal): used for external special protection device, such as thermal relay.
 - 6.9.2 No-voltage protection: The soft starter cannot start automatically when power-on again after power failure no matter the control terminal is located at which position to avoid injury accident.
 - 6.9.3 Too-long starting time protection: The soft starter will activate the self-protection function if the soft starter parameters are set improperly or the starter cannot start successfully for a long time due to other cause.
 - 6.9.4 Soft starter overheat protection: This protection will be activated when the temperature rises to $80\text{ C} \pm 5\text{ C}$, with the action time $<0.1\text{ s}$; when the temperature drops to 55 C (minimum), the overheat protection will stop.
 - 6.9.5 Input phase loss protection lag time: $<3\text{ s}$.
 - 6.9.6 Output phase loss protection lag time: $<3\text{ s}$.
 - 6.9.6 Three-phase unbalance protection lag time: $<3\text{ s}$; later, the current deviation greater than $50\% \pm 10\%$ as reference.
 - 6.9.8 Starting overcurrent protection time: The protection time when greater than 5 times rated working current of motor sees Table 1.
 - 6.9.9 Operation overload protection time: The inverse time lag is based on the rated working current of motor, and trip protection time curve is shown in Fig. 5.
 - 6.9.10 Under voltage protection lag time: When the power voltage is below 50% limit value, the protection action time is $<0.5\text{ s}$, otherwise the protection action time is $<3\text{ s}$ when below the set value.
 - 6.9.11 Over voltage protection lag time: When the power voltage is below 130% limit value, the protection action time is $<0.5\text{ s}$, otherwise the protection action time is $<3\text{ s}$ when higher than the set value.
 - 6.9.12 Load short circuit protection lag time: $<0.1\text{ s}$ short circuit, the current is more than 10 times nominal rated current of soft starter.

7 Ordering information

When ordering, select the required model and specification according to the model and meaning description:

Example 1: The controlled motor has the power of 45kW, 380V, and used together with a soft start cabinet or power distribution cabinet, with the order model TGS3-045-3;

Example 2: The controlled motor has the power of 90kW, 380V, and used together with a soft start cabinet or power distribution cabinet, with the order model TGS3-090-3;

Selection notice

This soft start is designed for Grade-4 (squirrel cage) three-phase AC asynchronous motor.

a.If motors rather than Grade-4 motor use soft start, it is recommended to select a higher grade:

Example: If the controlled motor has the power 90kW with 8-pole and works with the soft starting cabinet or power distribution cabinet with the order model TGS3-115-3.

b.When two-pole motor is soft started, as the starting current is larger, parameters can be set correctly according to the User Manual.

c.A higher grade of soft starter is recommended for occasion with heavier load.