ISA-A

GB **Instruction Manual**

Version: 08.01.2010

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2 Introduction

2.1 Safety Guidelines

- Read this manual carefully before operating the equipment and follow its instructions.
- Installation, operation and maintenance should be in strict accordance with this manual, national codes and good practice Installation or operating not performed in strict accordance with these instructions will void manufacturer’s warranty.
- Disconnect all power inputs before servicing the soft starter and/or the motor.
- Prior to installation, check and verify that no parts (bolts, washers etc.) felt into the starter.

Attention

- This product was designed and tested for compliance with IEC 60947-4-2 for class A equipment.
- The Igel Elektronik soft starters ISA-A comply to the UL classification.
- Use of the product in domestic environment may cause radio interference, in which case the user may be required to employ additional mitigation methods.
- Utilization category AC-53a or AC-53b. Form 1.
- For further information, see “Technical Specification”.

Warning

- Internal components and P.C.B.s are at line potential when the ISA-A is connected to line. This voltage is extremely dangerous and may cause death or severe injury if contacted.
- When soft starter is connected to line, even if start signal has not been issued, motor is stopped and control voltage is not connected, full voltage may appear on motor terminals. Therefore, for isolation purposes it is required to connect an isolating device (C/B, switch, line contactor etc) upstream to the soft starter. The soft starter cabinet must be properly grounded to ensure correct operation and safety.
- Check that Power Factor capacitors are not connected to the output side of the soft starter.
- Do not interchange line- and motor-connections!

2.2 Important Advices

Object of the Manual

This manual contains advices as well as basics and tips for the installation and commissioning of Igel Elektronik soft starters. The Igel Elektronik soft starter ISA-A is a motor control device for optimized starting and stopping of synchronous and 3-phase-asynchronous motors. The manual describes all the Igel Elektronik soft starter ISA-A functions as well as the programming and fault research.

Target Group

This manual is aimed at all users who deal with commissioning, service and maintenance as well as planning and configuration of plants.

Required Basic Knowledge

General knowledge in the field of electrical engineering is required for understanding this manual.

The installation and commissioning of soft starters should only be done by trained electrical engineers. The personnel for the commissioning and maintenance is required to be trained and experienced with this product.

Validity

This manual is valid for Igel Elektronik soft starters, series ISA-A. It contains a description of components that are valid at the time of publication. We reserve the right to include an updated product information leaflet with new components and new component versions.

Standards and Approvals

All Igel Elektronik soft starters are developped and manufactured according to the IEC standards, which are part of the International Standard Organisation ISO.
The Igel Elektronik soft starter ISA-A complies with IEC 60947-4-2 standard. For soft starters on board of ships additional certificates as GL (Germanischer Lloyd), LRS (Lloyd´s Register of Shipping) or other independent certification organisations are available. If required, please consult factory.

Disclaimer of Liability

The manufacturer of this system or machine is responsable for ensuring the overall functioning. Igel Elektronik GmbH cannot guarantee all properties of a system or machine not designed by Igel Elektronik.

Igel Elektronik cannot assume any liability for recommendations given or implied by the following description. No new guarantee / warranty or liability claims in excess of the general terms and conditions of Igel Elektronik GmbH can be deduced from the following descritpion.

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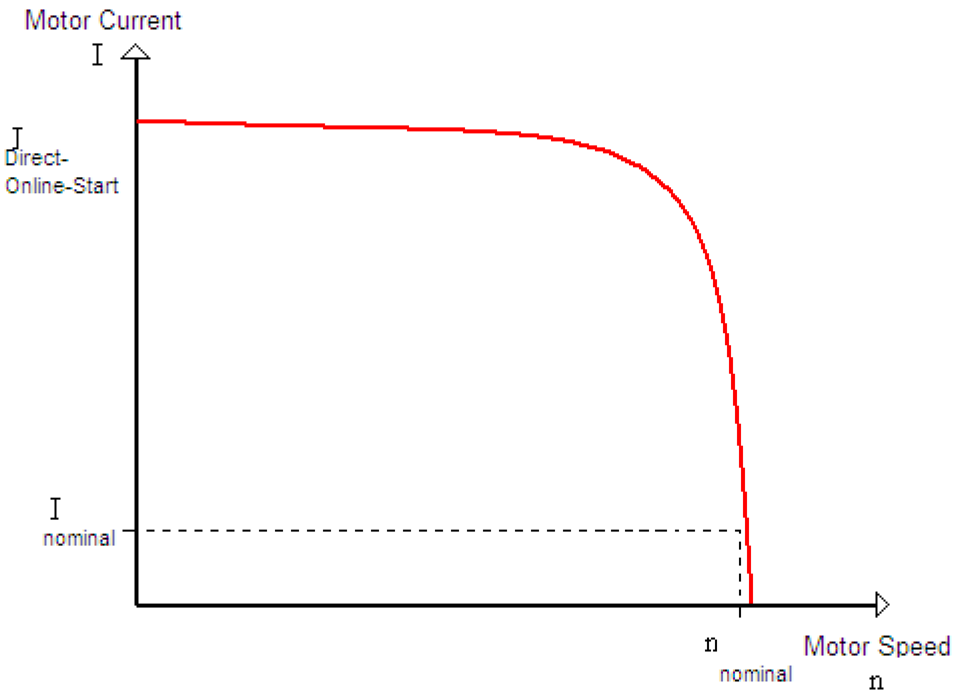
2.3 Physical Basics

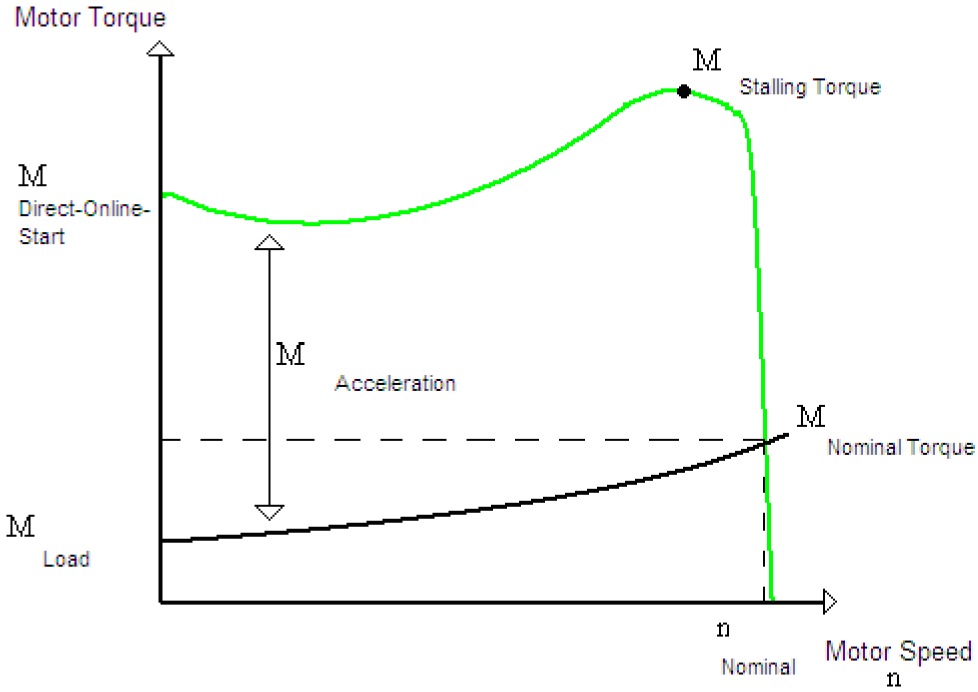
3-phase - asynchronous motor

3-phase asynchronous motors are used in large numbers because of their robust and simple design as well as low-maintenance operation in commercial applications, trade and industry. There they propel many different applications (e.g. pumps, compressors etc.)
The problem if switched on directly during the start-up the typical current and torque behaviour of the 3-phase-asynchronous motor may negatively influence the feeding supply network and the load machine.
The **direct starting current** of the 3-phase-asychronous motor is very high. This current may be 3 to 15 times the size of the rated operating current. 7 to 8 times the size of the motor current is a typical value for low voltage motors.
The **disadvantage** is that there is a higher load on the electrical supply network. This means that the supply network must be dimensioned to this higher output during motor start-up.



2-1 3-phase asynchronous motor's typical starting behaviour

Another **disadvantage** is the very high **starting torque.** The starting and the stalling torque can usually be assumed to be between 2 and 4 times the rated torque. This means for the load machine that the starting acceleration forces in relation to the rated operation result in increased mechanical load on the machine and the conveyed material. Thereby the machine's mechanic is more stressed and so there are higher costs because of application wear and maintenance.



2-2 3-phase asynchronous motor's typical starting torque

Solution: Using the Igel Elektronik soft starter the current and torque behaviour can be optimally adapted to the requirement of the application.

Operating mode of the Igel Elektronik soft starter

The soft starter has in each of the phases two antiparallel thyristors (except ISA-B2P and ISA-A2P); one thyristor for the positive and one thyristor for the negative half wave. Using phase angle control the r.m.s. value of the motor is fixed within a selectable voltage ramp. The voltage will be increased from a definable start voltage using various control methods to the motor rated voltage.

3-phase-asynchronous motor with soft start

The voltage applied to the motor acts proportional to the motor current. Thus the factor of the voltage that is applied to the motor reduces the starting current.
In relation to the voltage applied to the motor the torque behaves quadratically. The start torque is thus reduced quadratically based on the voltage applied to the motor

Example: With a 800 kW motor at 400V rated voltage.
Select soft starter ISA-D 1400-400-230-I

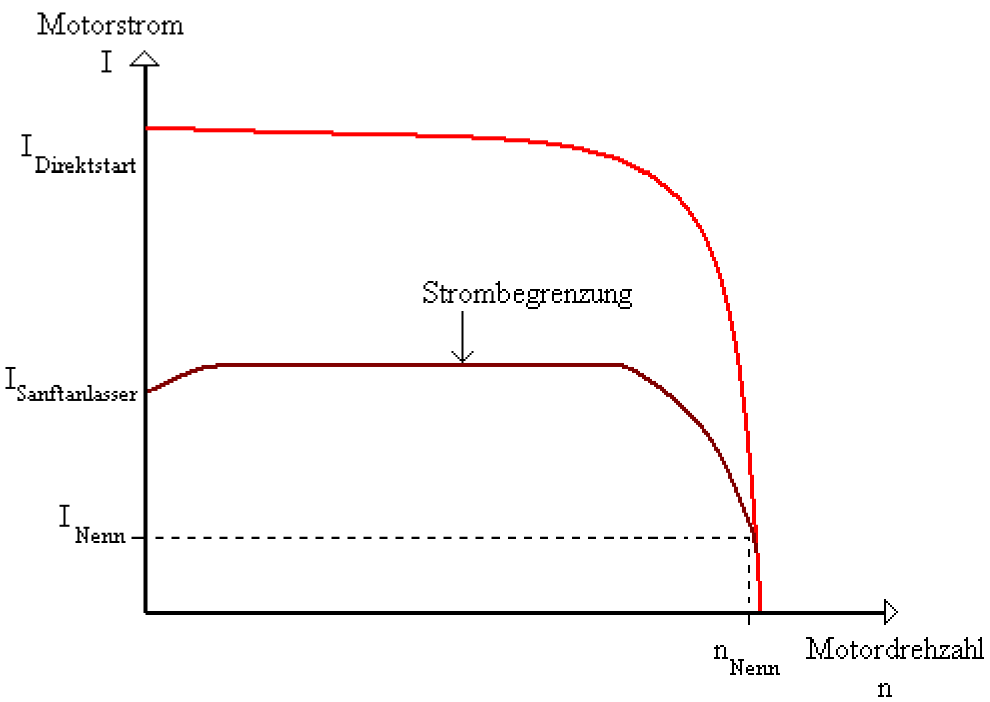
Motor Dates:	P:	800 kW
	I:	1400 A
	$I_{Direct\ on\text{-}line\ start}$:	7 x I_e 9800 A
	M:	5090 Nm
	$M_{Direct\ on\text{-}line\ start}$:	3 x M_e 15270
	n:	$1500min^{-1}$

Set start voltage: 30%

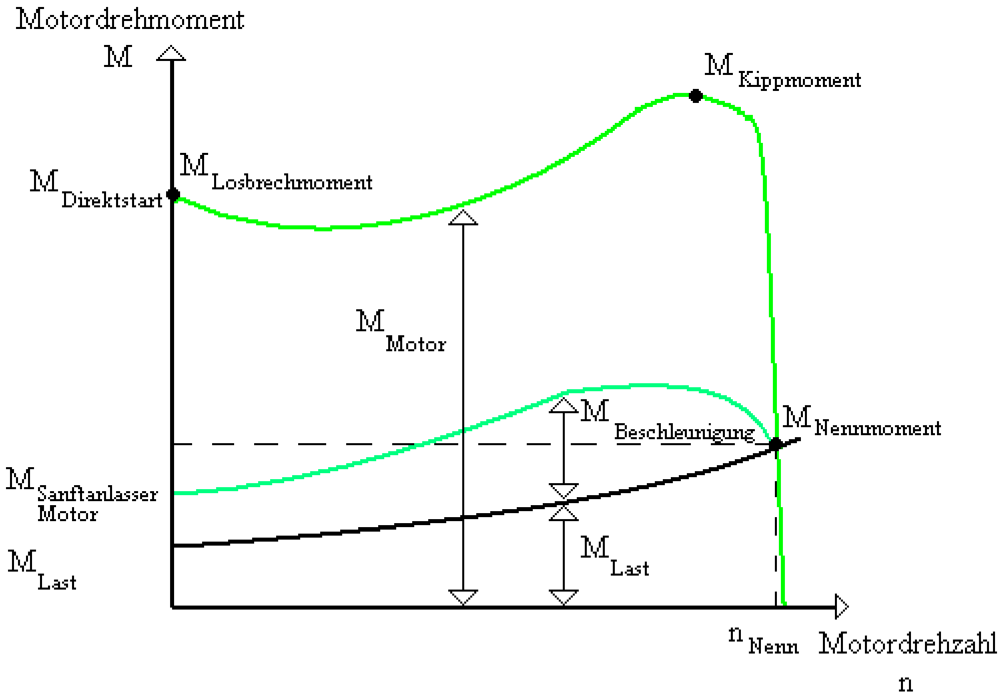
I_{Start} is 30% of $I_{Direct\ on\text{-}line\ start}$ because I ~ U so I = 2940 A

M_{Start} is 9% of $M_{Direct\ on\text{-}line\ start}$ because M ~ U^2 so M = 1374 Nm

The following graphs show the behaviour of the starting current and torque of a 3-phase asynchronous motor while using a soft starter.



2-3 3-phase asynchronous motor reduced current behaviour during start-up



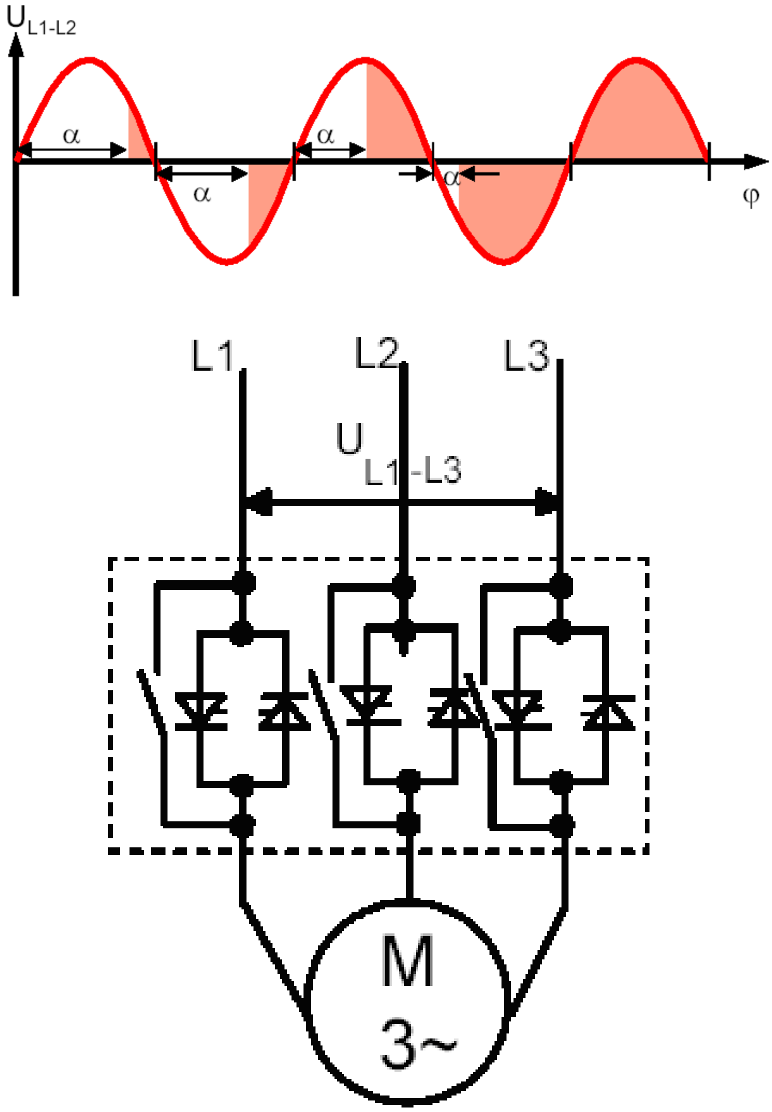
2-4 3-phase asynchronous motor reduced torque behaviour during start-up

Main advantages of a soft starter:

- the reduction of the start-up peak and so a lesser line's burden
- the reduction of the starting torque and so a lesser burden of the mechanical drive line systems like chains, gearing mechanisms or v-belts.

Upon completion of motor start-up, the thyristors are fully utilized, resulting in the complete network voltage being applied to the motor terminals. Since no motor voltage control is required during operation, the thyristors are bridged by bypass contacts. This reduces the waste heat developing during continuous operation which is caused by power loss of the thyristors. Therefore, the area around the switching devices heats up less.

The following graph shows the operation mode of the Igel Elektronik soft starter.



2-5 Phase Angle Control and schematic layout of a soft starter

Application and Use

Applications and selection criteria

The soft starters are an alternative to star-delta starters and frequency converters, slip-ring motor and transformer starters. The major benefits are smooth starting and stopping, uninterrupted changeover without current peaks that would stress the power supply, and their compact dimensions. The soft starters ISA-A, ISA-A2P, ISA-DS and ISA-D contain additionally an integrated motor protection function.

Applications: Possible applications include:

- Pumps
- Compressors
- Conveyor belts
- Powerd Roller Conveyors
- Ventilators/Fans
- Hydraulic pumps
- Stirres
- Centrifugal Machines
- Milling Machines
- Mills
- Crushers
- Disk saws/ribbon saws
- shredders
- conveyor screws
- …

Advantages: Centrifugal pumps, reciprocating pumps

- Prevention of water hammering in pipe systems
- Prevention of valve setbacks
- Lower maintenance costs for installations

Conveyor belts, transport systems:

- because of lower acceleration/decceleration reduced stress on transport belts

Stirrers, Mixers:

- Reduced starting current

Fans:

- Reduced stress on transmissions and V-belts

Ambient conditions for storage and operation

Permissiable ambient temperature for:

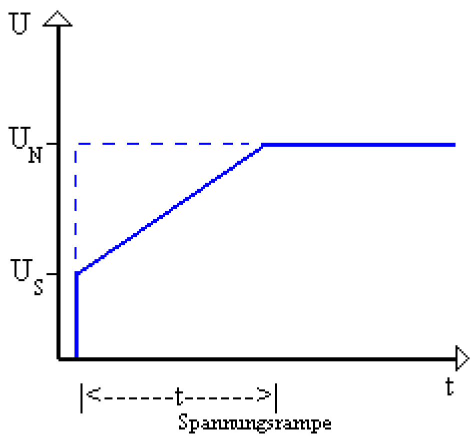
- Storage	-25 °C to +70 °C
- Operation	0 °C to +40°C, from 40 °C with derating
Permissable realtive air humidity:	up to 95 % non condensing
Maximum permissable installation height:	1000 m, from 1000m with derating

Caution:
Please ensure that no liquid, dust or conductive parts enter the soft starter!

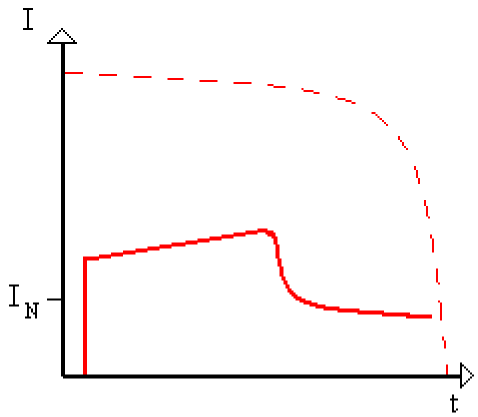
2.4 Start Procedures / Methods with Igel Elektronik Soft Starters

Soft Start with Voltage ramp

The motor starts with adjusted initial voltage and gets an additional linear rising voltage. At this kind of start up the starting current, which depends on the adjusted ramp-up time and the driven loading reaches 2 to 4 times of the motor's rated current.



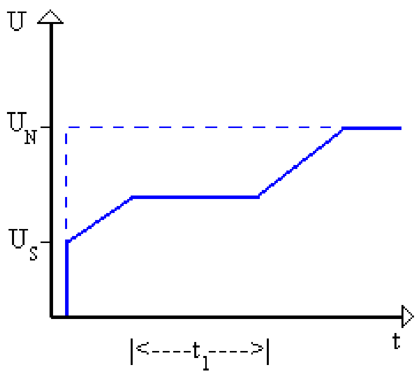
2-6 Motor's Terminal Voltage



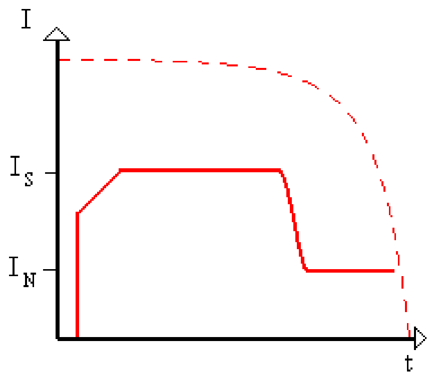
2-7 Current Course

Soft Start with Starting Current Limit

In this case the motor also starts at the adjusted initial voltage and gets an additional linear rising voltage. When the adjusted starting current is reached the voltage ramp Stops and the terminal voltage keeps constant till the motor's power consumption sinks under the adjusted starting current. The ramp-up time gets lengthened by the time of current limit.



2-8 Motor's Terminal Voltage with Current Limit

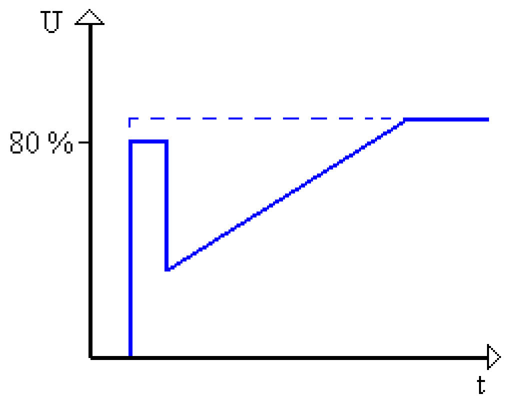


2-9 Current Course with Current Limit

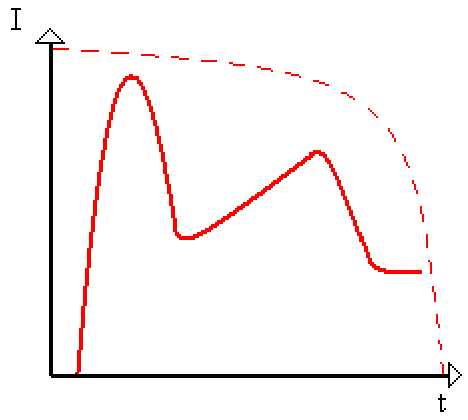
When the motor is started with Starting Current limit, you have to keep attention that the motor is able to get an acceleration torque against the loading.
When you select a too low starting current it could be possible that the motor or its soft starter gets a thermal overload.

Soft Start with Pulse Start

If driving elements have a too high fricitonal or inertial torque there is a possibility of a pulse-start. During the pulse start the terminal voltage gets limited to 80% of terminal voltage in a time domain from 0.1 – 1 sec. After that the soft start begins with the adjusted starting voltage and the adjusted ramp-up time.



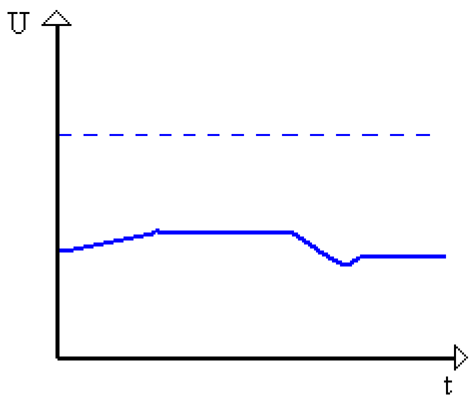
2-10 Voltage Course Pulse-Start



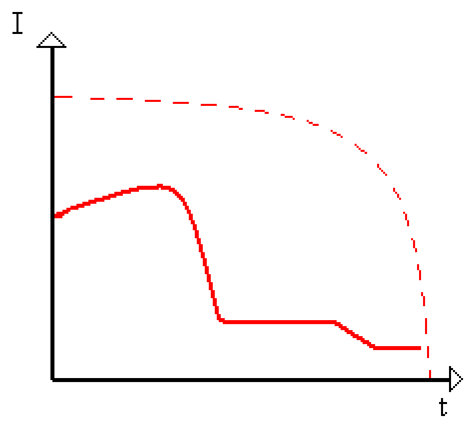
2-11 Current Course Pulse-Start

Energy Saving

Some electronic motor soft starters contain the function energy saving. This function improves the cosφ of the motor by controlling the terminal voltage of the motor by continous phase angle in part-load- or idle-speed-range of the motor. In consideration of the losses in the soft starter there is only a real energy saving in part-load-ranges possible which are never under 60 % of the rated loading of the motor. During an alternation of stress the motor's terminal voltage gets immediately adjusted by the soft starter so as to prevent a rev's breaking in. Disadvantage of the energy saving function is a load of the lines with harmonics by phase angle.



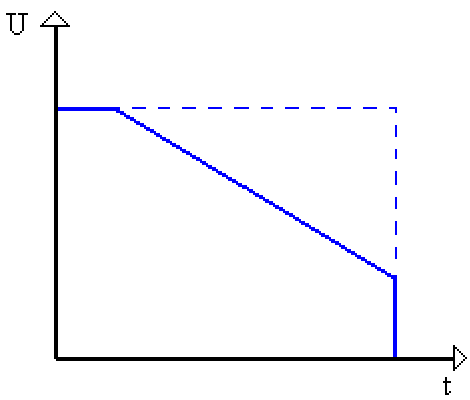
2-12 Voltage Course with Energy Saving



2-13 Current Course with Energy Saving

Soft Stop

All soft starters of the series ISA contain the Soft Stop function. By courtesy of this function you get a voltage-controlled run-out of the motor which prevents an abrupt stopping of the motor above all in pump applications.
In all cases the function Soft Stop lengthens the motor's natural run-out and works only during load torque. By courtesy of lowering of the motor-terminal-voltage you get a field weakening which after all implicates a rising motor current over the rated current.



2-14 Voltage Course Soft Stop

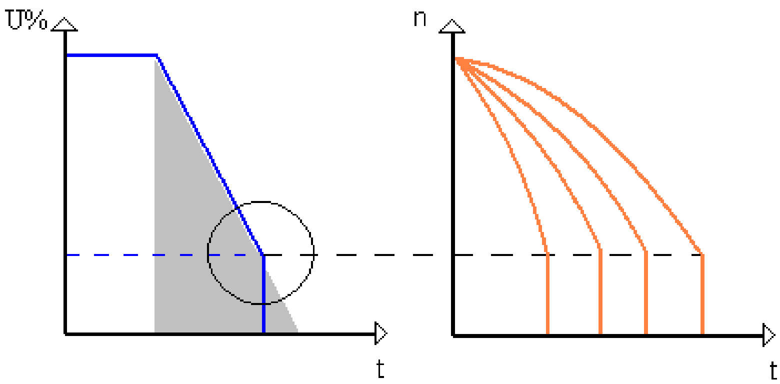
2-15 Current Course Soft Stop

Soft Stop for special pump curves

When liquid is pumped to a higher flat or to a duct system with higher pressures and the pump get turned off, big kickbacks (water hammer) accrue. A normal soft starter's run out ramp can only reduce this phenomen inessentially because with a voltage reduction of 20 % the water column brings the pump to a standstill. The sepcial pump software enables the pump run-down until the check valve closes softly and so it decreases the wear out of the duct system.

End Switch

The load of the water column closes the valve before the voltage can get reduced to zero. After that the pump rotates without load until the end of the adjusted run-out ramp. The end switch enables the immediate motor stop after the valve was closed.



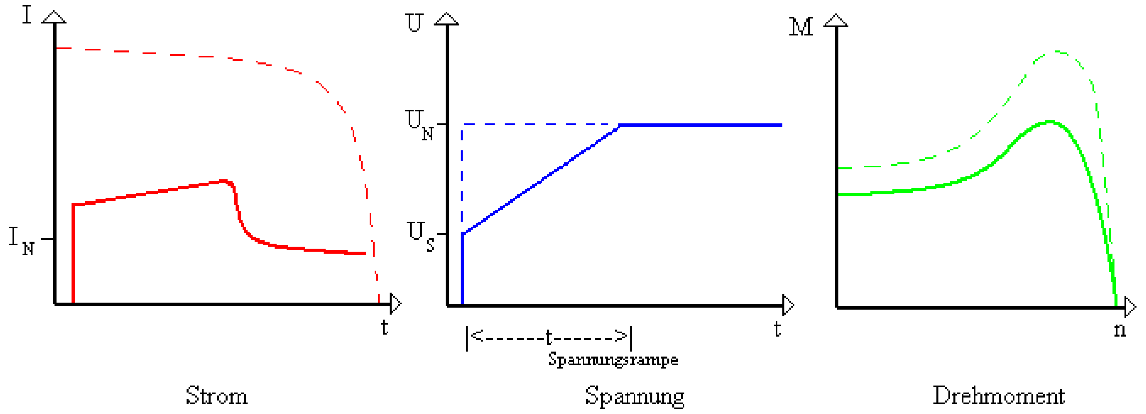
2-16 Soft Stop with pump curve

3 Technical Specifications

3.1 Introduction

Soft Start

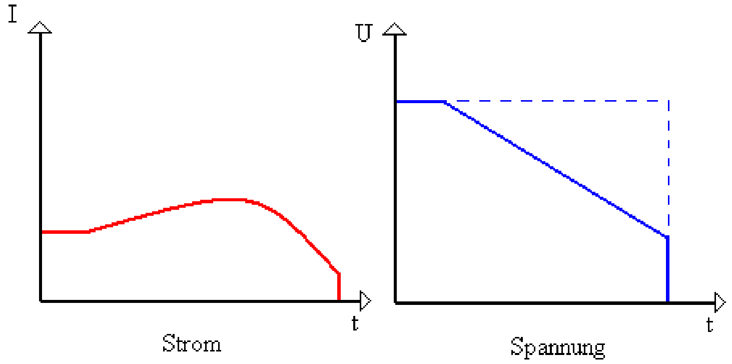
The ISA-A soft starter incorporates 3 sets of thyristors to start a squirrel cage asynchronous motor. By supplying a slowly increasing voltage, it provides a smooth and stepless acceleration while drawing the minimum current to start the motor.



3-1 Soft-Start Characteristics

Soft Stop

A soft stop function can be enabled when „Ramp Down" potentionmeter is adjusted. Upon opening the contact terminals A and B the stop signal is given. The starter's load is slowly reduced to zero.



3-2 Soft-Stop Characteristics

Note: The Igel Elektronik soft starters ISA- A are designed to operate under normal conditions. For frequent starts or starts at maximum ratings a larger sized starter should be selected.
For long starts PTCs should be used in the motor windings. For the soft run-out as well as pump-run out this is recommendable since it is only working during the run-out when current load occurs.

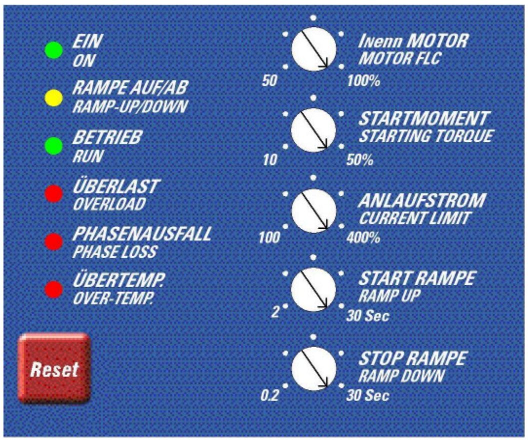
Do not install any capacitive loads between motor and soft starter (e.g. compensation). When soft starters are used do not incorporate any active filters.

3.2 Hardware

3-3 Front View

A soft starter is built up with a few main components: Printed circuit board, thyristors, cabinets and fans (for higher rated current). The thyristors in the main circuit are bypassed after ramp-up is completed. The control circuit board is controlling the motor current. Using a soft starter the low motor current, low motor voltage and low torque behavier during the start-up can be optimally used. The ISA-A incorporates an analog control circuit (see 3.3).

3.3 Operating Board



3-4 Operating element

The ISA-A incorporates 5 internal potentiometers:

1. The „Motor Full Load Current" adjusts the motor current at percentage. (Example: Set ISA-A58 at 100 % = motor voltage 58 A)

2. The „Starting Torque" determines the initial voltage to the motor. The torque is reducing directly proportional to the square of the motor voltage. (Range: 10 to 50 % of the nominal voltage)

3. The „Current Limit" determines highest current during starting. (Range: 100 to 400%, 1 – 4 times Motor FLC)

4. The „Ramp Up" determines the motor's ramp-up time from initial to full voltage.

5. The „Ramp Down" is used for a smooth motor stop against current load.

Note: Details in chapter 6 „Indications"

Anzeigen		
	ON – Green	Will lit when all 3 phases are connected to the ISA-A.
	RAMP UP / DOWN – Yellow	Will lit upon start signal or during soft stop.
	RUN – Green	Will lit upon end of starting. The internal bypass contacts are closed.
	OVERLOAD – Red	Electronic overload becomes operational upon end of starting (see chapter 11 - motor protection)
	PHASE LOSS – Red	Will lit when one or two pahses are missing for more than 1 sec.
Anzeige Leuchten (LEDs)	OVER TEMPERATURE - Red	Will lit and trip the starter when the heatsink temperature >85 °C.

3-1 LED Indications

4 Starter Selection

4.1 Prior to installation

Make sure that fuses and circuit breakers of the main electric circuit are rated to operate under direct start conditions and under the local short circuit conditions. Please order separately.

Select the circuit breaker (Trip selection) according to the harmonic content of the starting current.

Detailed table, see Technical Specification.

4.2 Soft Starter Selection

1. Motor Current

Select the starter according to motor's Full Laod Ampere (as indicated on its nameplate).

Ambient Temperature in °C	Start Current	Acceleration Time	Starts per hour
40°C	300%	30 sec	4 starts per hour at maximum ratings, at light load applications the starts can be increased (consult factory)
	400% In	5 sec	

4-1 Operating Conditions

2. Line Voltage

Each starter is factory set for one of the following levels. (Please mention on the order.)

Voltage	Tolerance
220 – 240 V 50/60Hz	+10 – 15%
380 – 415 V 50/60Hz	+10 – 15%
440 V 50/60Hz	+10 – 15%
460 – 500 V 50/60Hz	+10 – 15%
575 – 600 V 50/60Hz	+10 – 15%

4-2 Line Voltage

5 Installation

5.1 Installation and Prior to Installation

The motor rated current has to be lower or according to the current of the soft starter while the net voltage has to comply with the values on the nameplate. The soft starters comply with the classes of protection IP20 and IP00. Please ensure that no liquid, dust or conductive parts enter the soft starter.

Mounting

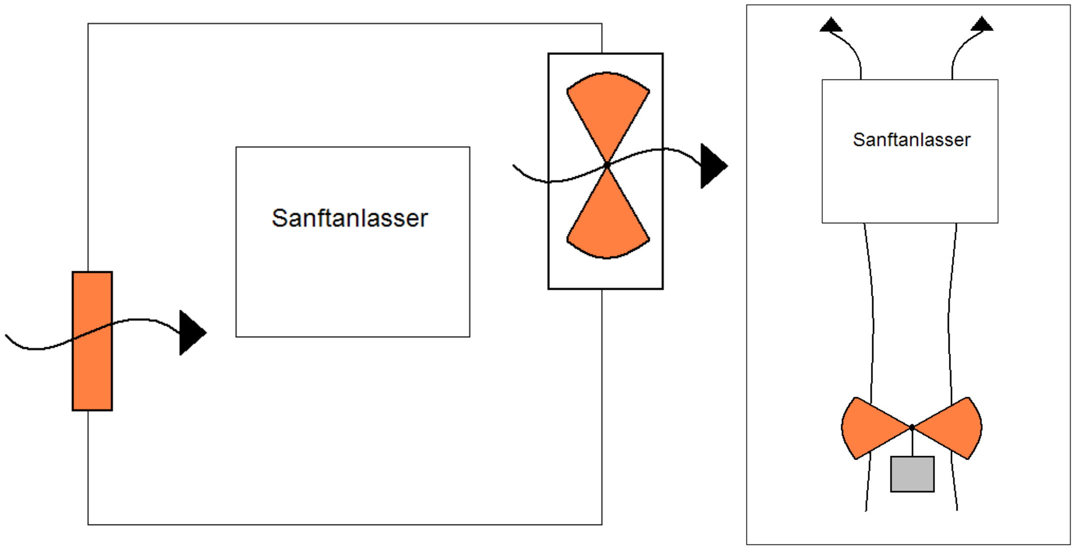
- The starter must be mounted vertically. Allow sufficient space above and below the starter for suitable airflow.
- It is recommended to mount the starter directly on the rear metal plate of the switchgear for better heat dissipation
- Do not mount the starter near heat sources.
- Protect the starter from dust and corrosive atmospheres.

Ambient Conditions

The starter is rated to operate at a temperature range of – 10°C to + 40°C. Relative non-condensed humidity inside the housing should not exceed 95 %.
The heat dissipation during continuous operation is approx. 0.3 x In (in watts).
The heat dissipation during the start is for a maximum of 30 seconds approx. 3 times the start current in watts. Please care for sufficient cooling in order to avoid an over temperature of the starter. Over temperature can be reduced using additional fans.

Example: When motor’s current is 100 Amp, heat dissipation will be approx. 30 watts.

Internal cabinet heating can be reduced using additional ventilation.



5-1 Fans for additional ventilation

Calculating the cabinet size, for non-ventilated metal cabinet:

Surface (m^2) = 0.12 x total heat dissipation (in watts) / 60 – max. ambient temperature

* heat dissipation of all cabinet equipment

Note: When using a plastic cabinet a bypass contactor must be built in. The ISA-A series are with already built-in bypass contactors.

Voltage Spike Protection
Voltage spikes may cause malfunction of the starter and damage the thyristors. When expected, use suitable protection such as Metal Oxid Varistors (consult factory for further details).

Short Circuit Protection

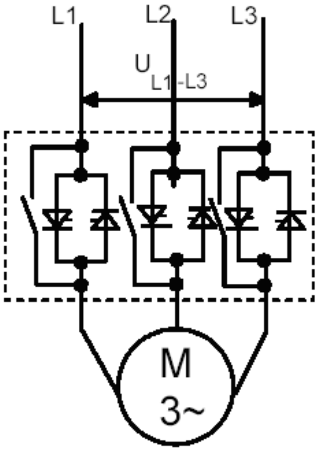
The ISA-A with thyristors should be protected against short circuit by semi-conductor fuses with I^2t-values. The recommended I^2t-values see chapter 10 Technical Specifications.

Attention
Power factor correction capacitors must not be installed on starter's load side. When required, install capacitors on the line side, with 2 m cable.

Warning
When lines voltage is connected to the starter, even if the start signal has not been initiated, full voltage may appear on the output terminals and on the starter's load terminals. Therefore, for isolation purposes it is required to connect a switch respectively a line contactor upstream to the soft starter.

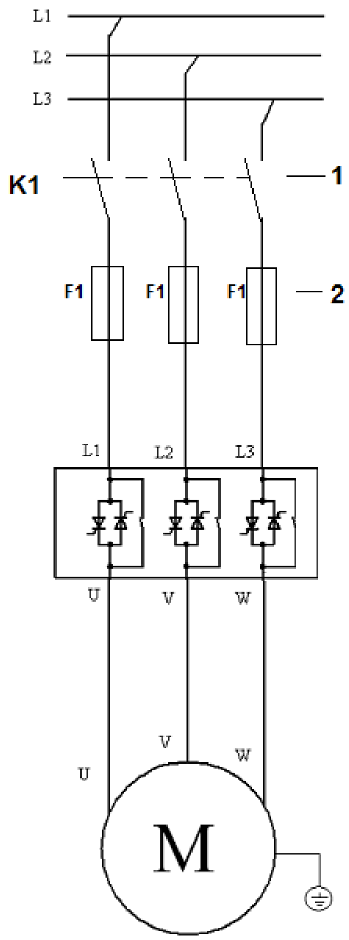
Built-in Bypass

The current flows through the thyristors only during starting process. At the end of the starting process, the built-in relays bypass the thyristors and carry the current to the motor. Upon soft stop command the bypass relays will open and the thyristors will then reduce slowly and smoothly the voltage to zero. In case of fault all three bypass relays will open and the thyristors will stop.



5-2 Bypass relays

5.2 Load



5-3 Circuit Schematic

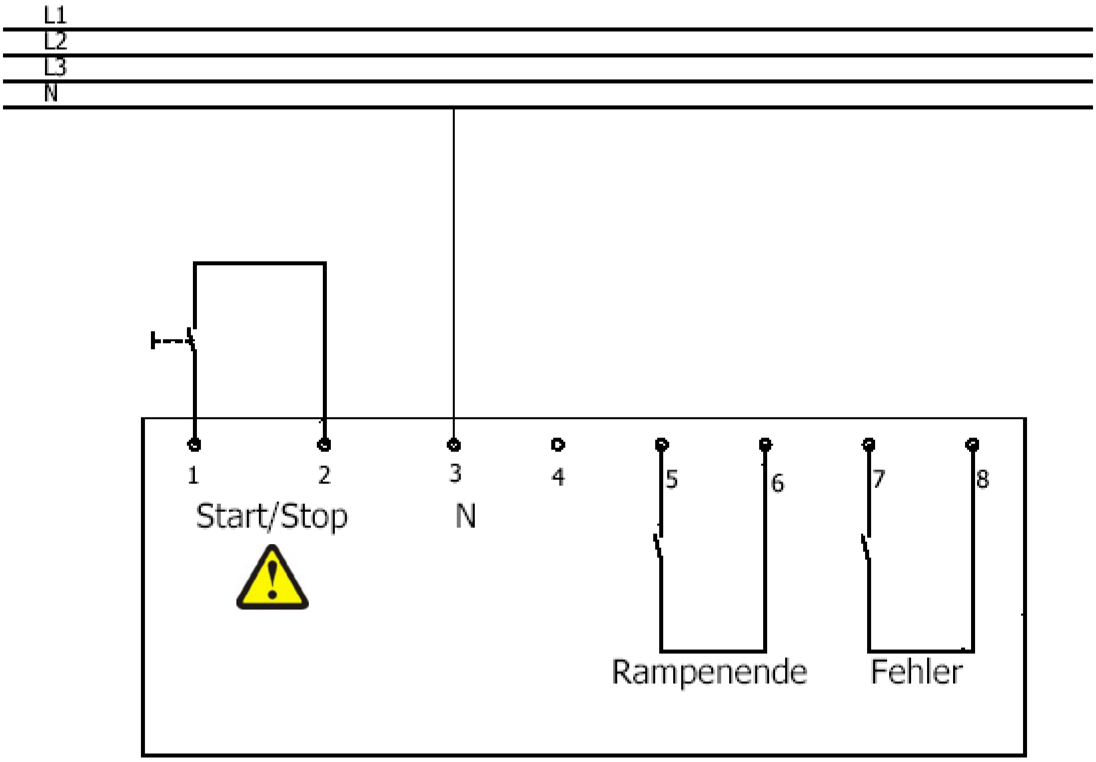
The soft starter incorporates two main voltage contacts (depending on the size of the soft starter).

- Busbar connections (IP00)
- Screw terminals (IP20)

The terminals L1/L2/L3 will be connected to the mains. Important: The short circuit protection should be installed in the mains. The motor protection is taken over by the soft starter. The terminals U/V/W are connecting the motor.

1) For the short circuit protection use fuses or circuit breakers.
2) For an emergency stop a main contactor must be installed.

5.3 Control Wiring



5-4 Circuit Diagram

Stop/Start **Terminals 1 – 2**
By voltage free contact (Dry contact)
Close: Start command
Open: Stop command

WARNING
Do not apply voltage to terminals A1 and A2!

Neutral **Terminal 3**
Neutral wire is required only for operation of the Phase Loss Protection (Phase Loss can not be detected when Neutral is not connected to Terminal 3).

Open terminal – not connected **Terminal 4**

End of Acceleration (closer) **Terminals 5 – 6**
Voltage free, 8 A / 250VAC, 2000 VA max.
The contact closes after the time adjusted on the "Ramp-Up" potentiometer. The contact returns to its original position upon stop signal, fault, disconnection of mains voltage or start of the soft stop.

Use of the "End of Accelaration" Contact
This contact can be used for:

- Activating a valve after a compressor has reached full speed.
- Release for loading a conveyor belt after the motor has reached full speed.

Fault Contact (Schliesser – Closing terminal) Terminals 7 - 8
Voltage free, 8 A/250VAC, 2000VA max.
The contact closes upon operation of any fault. The contact opens after the fault has been removed upon reset, or upon disconnection of mains voltage.

Warning
Do not use the fault contact to trip an upstream contactor. When the fault contact trips the upstream contactor, mains voltage will be disconnected, thus resetting the starter and the motor will be restart instantaneously upon voltage recoverage.

Attention
Start/Stop with a maintained contact!
When the line contactor is operated by a maintained contact in case of lines failure, the motor will be automatically restarted upon voltage recoverage. When resetting after a fault with the "Reset" button, the motor will restart immediately. It is therefore recommended not to connect the fault relay to the line contactor.

5 Starter Settings

Full Load Current (Motor FLC)
The starter settings allow an exact adjustment of the ISA-A to the connected motor.

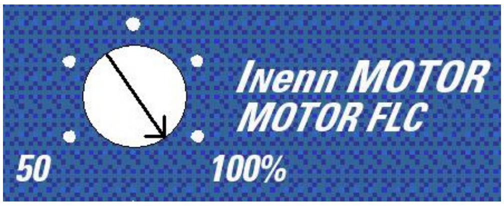
Set FLC potentiometer according to the following formula:

Motor FLC % = Motor FLA : starter FLC x 100

Example:

When starting a 27A motor using ISA-A 31:

FLC% = 27/31 x 100 = 87 %



5-1 Potentiometer

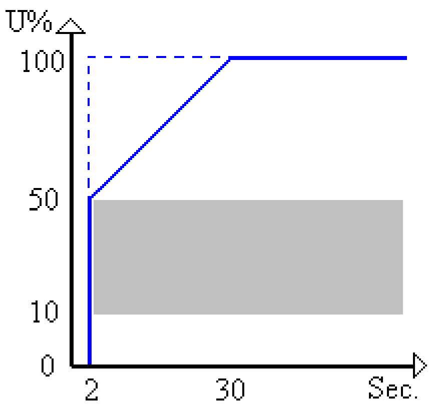
Therefore set the FLC% to a reading of 87%.

Starting Torque
The "Starting Torque" potentiometer determines the voltage to the motor. Torque is reducing directly proportional to the square of the voltage. (Range: 10 – 50 % of nominal voltage)

This adjustment also determines the inrush current and mechanical shock.

Too high of a setting may cause high initial mechanical shock and high inrush current, as the Starting Torque setting over-rides the Current Limit setting.

Too low of a setting may result in prolonged time until motor starts revolving. The motor should start revolving immediately after Start signal.



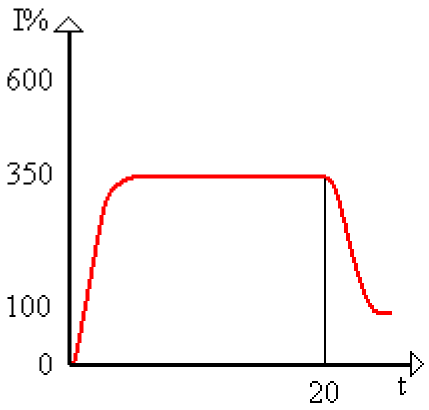
5-2 Starting Torque

Current Limit
Determines motor's highest current during starting. Range is 100 – 400 % of motor FLC.

A high of a setting will allow high currents to be drawn from mains, resulting in fast acceleration.

Too low of a setting may prevent the motor from completion the acceleration process and reaching full speed within the maximum starting phase. The starting phase will be stopped because of overload.

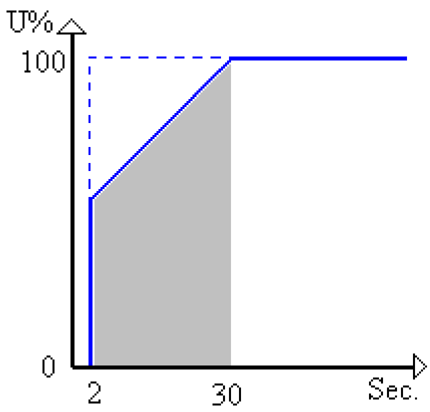
Generally, this setting should be adjusted to the highest acceptable value while the ramp-up time still may influence the soft start.



5-3 Current Limit

Ramp-up Time

Determines motor's voltage ramp-up time from initial to full voltage. (Range: 2 – 30 sec.)



5-4 Ramp-up Time

It is recommended to set Ramp-Up time to the value < 5 sec. when using the starting current limit. In case of high starting current the starting phase of the soft start has to be extended.

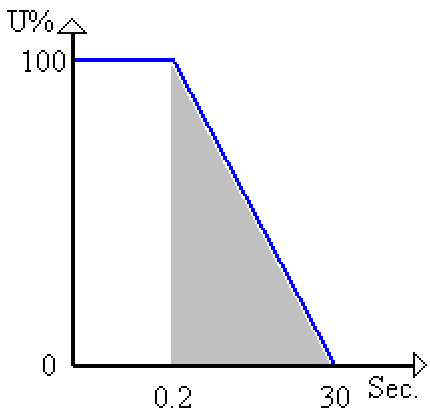
Note:

1. Setting current limit low it will extent the start.
2. When motor reaches full speed before voltage reaches nominal, ramp-up time adjustment is overridden, causing voltage to quickly ramp up to nominal

Attention
The starting current should not exceed the allowable conditions as shown in chapter 4 – Starter Selection.

Ramp-Down time (Soft-stop)

The soft stop function allows a soft motor stop against a (high friction) load. Main applications are pump controls in order to avoid water hammering in pipe systems and kickbacks. Range: 0,2 – 30 sec.

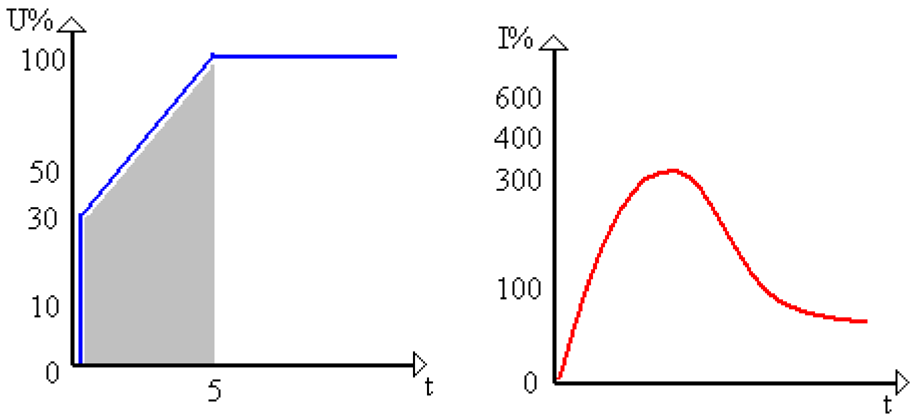


5-5 Ramp-down Time

Note:
When Ramp-Down potentiometer is set to allow soft-stop process, upon stop command, the bypass relays will open immediately and the current will flow through the thyristors. The voltage will then be reduced slowly and smoothly to zero.

Examples of Starting Curves

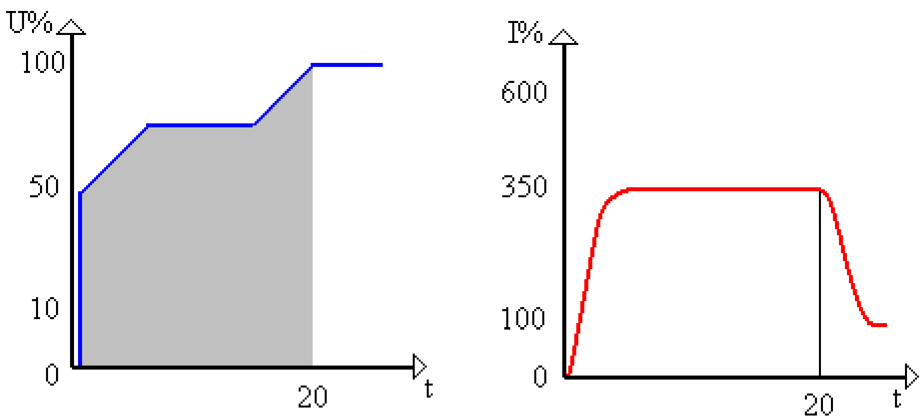
Light Loads	-	Pumps, fans etc.
Current limit	-	set to approx. 300 %
Initial Voltage	-	set to approx. 30 %
Ramp-up time	-	set to approx. 5 sec.



5-6 Examples of Starting Curves 1

Upon start the voltage quickly increases to the Initial Voltage value of 30 % U and than gradually ramps up to nominal.
The current will simultaneously increase to peak current value, which can be current limit setting or less, before smoothly decreasing to the operation current.
The motor will accelerate to full speed smoothly.

High loads	-	Conveyor belts, Crushers etc.
Current limit	-	set to approx. 350 %
Initial Voltage	-	set to 50 %
Ramp-Up time	-	set to 5 sec.



5-7 Examples of Starting Curves 2

Upon start the voltage quickly increases to a value of 50 % U and than the voltage and current increase simultaneously until current reaches current limit value.
The voltage remains at this value until motor reaches nominal speed.
When current starts to decrease the voltage ramp will be free again so that voltage continues to ramp-up to nominal. At this time the motor should have smoothly accelerated to full speed.

6 Start-up Procedure

1. Set Motor Full Load Current according to the following calculation:
   Motor FLC % = Motor FLC / Starter FLC x 100
2. Set other potentiometers according to the application (see examples)
3. Connect mains voltage, the motor and the control to the starter.
4. Start the motor (contact to terminals 1 – 2), if it begins revolving shortly after start signal proceed to 5. If not, increase Initial Voltage setting until motor starts to turn shortly after start signal.
   When mechanical shock and initial inrush current are too high, decrease current limit setting and proceed to 6.
5. If motor begins to turn shortly after start signal and smoothly accelerates to nominal proceed to 6. If current during acceleration is too high, slightly decrease current limit setting. If motor not accelerates to nominal as required increase the current limit.
6. Stop order (open Terminals 1 and 2), wait until the motor stops.
7. Slightly increase both potentiometers (Initial Voltage and Current Limit) adjustments to allow for load variations.
8. Start the motor again and verify that acceleration process to full speed is as required.
9. If acceleration time is too short, increase Ramp-Up time setting.

When soft stop is required set Ramp-Down Potentiometer to the required time (minimum deceleration time is recommended). After setting all parameters check that process is as required.

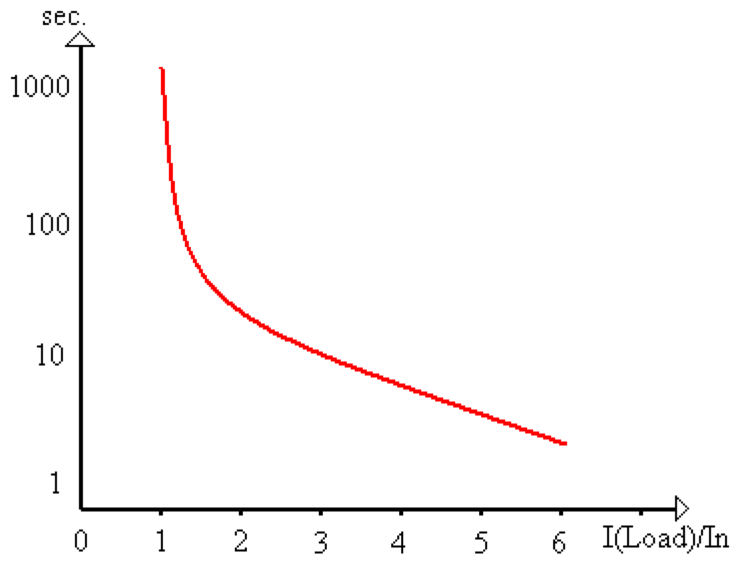
Attention

If Ramp-Down potentiometer is not in the minimum setting the adjusted ramp-down time determines the motor. An advance stop may only be performed by disconnecting the mains voltage. Emergency stop or emergency switch off must be effected through advance installed contact element. The soft starter itself has no emergency stop function.

7 Motor Protection

Elektronic Overload

The built-in electronic overload function becomes operational after end of acceleration process. Trip current is factory set to 115 % of Motor Full Load Current which is adjusted through Motor FLC potentiometer.



7-1 Electronic Overload

In order to change the trip point, change the Motor FLC potentiometer setting. Trip time varies from 60 sec. at 115 % of nominal current to 2 sec. at 600 % of nominal current.

When exceeding the maximum acceleration process the electronic overload protection becomes operational immediately in order to protect the soft starter as well as the motor in case of wrong adjustment or motor overload.

Phase Loss

During starting process or operation the phase loss protection becomes operational when one or two phases are missing for more than 1 sec.

When phase loss occurs during starting or when motor is not loaded it may happen that motor will stop without accurate indication of the Phase Loss LED.

Note

Phase loss protection operates only when Terminal 3 is connected to Neutral.

Fault Logic, Alarm and Reset Circuits

Upon operation of the above-mentioned protection functions the motor acceleration process will be interrupted respectively the motor will be stopped. At the same time the fault contact closes and the proper fault indication LED light shows fault.
To reset the soft starter, after the fault has been removed, press “Reset” button or disconnect mains voltage.

Over Temperature Protection

The over temperature protection function is installed to protect the soft starter. A thermal sensor mounted on the heatsink switches off when its heatsink temperature rises above 85°C.

Warning

This over temperature protection is designed to operate under normal conditions and will operate in case the following faults occur:

- Incorrect starter selection
- Too frequent starting at max. conditions
- Repeated starting under fault conditions
- Extended overload
- Insufficient ventilation
- Other abnormal conditions

In case of frequent starting the internal thyristors may overheat before the heatsink reaches its over-temperature protection of 85 °C.

Attention

When soft starter is operated by a maintained contact and start command still is adjusted, resetting the fault will start the motor immediately.

Warning

Do not use the fault contact to trip an upstream contactor.
In case Start/Stop input is not changed thus resetting the ISA-A as well as the upstream contactor and the motor will restart instantaneously.

8 Frequently Asked Questions

Main contactor

Question: Is there any requirement to put a main contactor in series before the soft starter?

Answer: The soft starter does not require any main contactor but we recommend the use of one for emergency stop and/or trip the overload relay. In some applications a moulded case circuit breaker (MCCB) can be used instead of the main contactor.

Ambient Temperature

Question: Can I use a soft starter if the ambient temperature is higher than the recommended value during operation?

Answer: The soft starter can normally be operated at higher ambient temperature during operation if the rated current for the unit is derated according to the manufacturer's recommendation.

Thyristor shorted

Question: Is it possible to run a softstarter with one thyristor shorted?

Answer: Yes, it is possible but not for all types of thyristors.

Soft stop applications

Question: What applications are suitable for soft stop?

Answer: Pumps and conveyor belts loaded with fragile products are the two main applications suitable for soft stop.

Advantages of by-pass

Question: What are the advantages of using by-pass?

Answer: Reduction of power loss.

Power loss

Question: What is the power loss of a soft starter during a continuous run?

Answer: The values can normally be found in the catalogue. For Igel Elektronik soft starter the following formula can be used:
3 x starting current for max. 30 sec. (without by-pass)

Utilisation category

Question: What utilisation category should be used for the main contactor?

Answer: Main contactor: always use AC-3

Fault indication when starting

Question: Why does the soft starter indicate a fault when the start signal is given to the main contactor and soft starter at the same time?

Answer: If main contactor is closed too late the soft starter will indicate this as a phase loss fault. Delay the start signal to the soft starter by approx. 5 sec. to solve this problem.

Test without motor

Question: Can I test a soft starter without using a motor?

Answer: No, this is not possible since there will be no current going through the soft starter and some types will also indicate that no motor is connected.

Overload relay trips during starting

Question: Why does the overload relay trip during start?

Answer: Possible reasons can be one of these:

- too low current limit
- too long ramp time
- too low initial voltage
- wrong tripping class on the overload protection
- wrong setting on the overload protection

Separate overload relay when using by-pass

Question: Do I need a separate overload relay when using a soft starter with built-in electronic overload and by-pass?

Answer: If the current transformer of the soft starter can be installed so that the measuring can be performed when by-passed a separate relay is not required. **<u>Also when by-passed the protection functions of Igel Elektronik soft starters are always in setted.</u>**

Different frequency

Question: Can I use the same soft starter for both 50 and 60 Hz?

Answer: It is possible with all type of Igel Elektronik soft starters as long as the curve is sinusoidal.

Voltage fluctuations

Question: What voltage fluctuations are allowed for the soft starters?

Answer: The minimum and maximum value where we can guarantee full function is – 15% to + 10 % of the rated value. This is also stated in the IEC-standard.

Example: 400 V – 15 % to + 10 %. Range: 340 V – 440 V.

Semi-conductor fuses

Question: Do I always have to use semi-conductor fuses?

Answer: When using semi-conductor fuses a type 2 co-ordination can be achieved. It is possible to use a moulded case circuit breaker (MCCB) or fuses instead but then with a type 1 co-ordination.

Use at high altitudes

Question: Can I use the soft starter at high altitudes and what do I have to consider?

Answer: It is possible. When using soft starters at high altitudes the rated current for the unit has to be derated due to less cooling. In some cases a larger soft starter is required to be able to cope with the motor current when used at high altitudes. For questions, please consult factory.

9 Technical Specifications

Environment		
Supply Voltage	Three Phases, phase to phase 380 – 415Vac+10% - 15% 460 – 500Vac+10% -15% 575 – 600Vac+10% - 15%	
Frequency	50 / 60 Hz	
Load	Three-Phase– asynchronous motor in star- or delta connection	
Degree of protection	cabinet A1-IP 20 cabinet A2/A3/A4 – IP 00	
Altitude	1000 m above sea level	In case of different altitudes please consult Igel.
Adjustments		
Motor FLC	50 – 100%	
Starting Torque (Initial Voltage)	10 – 50% of nominal voltage	
Current Limit	100% - 400% of nominal current	
Ramp-Up Time (Soft Start)	2 – 30 sec	
Ramp-Down Time (Soft Stop)	0.2 – 30 sec	
Protection		
Electronic Overload	I^2t, factory set at 115% overload, active only during run.	
Phase Loss	Trips when one phase is missing (only when Neutral is connected)	
Over Temperature	Trips when heatsink temperature of the soft starter >85 °C	
Reset Button	To reset the starter, after the fault has been removed.	
Temperatures		
Operation	-10 – 40°C	
Storage	-20 – 70 °C	
Relative Humidity	95 % non condensed	

Soft Starter Type	Max. Rated Motor Curent	Fuses for normal start (for 30 sec. 4 x Inenn)	Fuses for heavy duty start (for 60 sec. 5 x Inenn)	I²t of thyristors	Semi-conductor fuses (for 30 sec. 4 x Inenn)
ISA-A 8	8	20 000 13.20	20 000 13.25	400	20 477 20.40
ISA-A 17	17	20 000 13.40	20 000 13.50	2000	20 477 20.80
ISA-A 31	31	20 000 13.63	20 000 13.80	3000	20 209 20.100
ISA- A 44	44	20 000 13.80	20 000 13.100	6000	20 209 20.125
ISA- A 58	58	20 000 13.100	20 000 13.125	12000	20 209 20.160
ISA- A 72	72	20 001 13.125	20 001 13.160	18000	20 211 20.200
ISA- A 85	85	20 001 13.160	20 003 13.200	40000	20 211 20.250
ISA- A 105	105	20 003 13.200	20 003 13.250	60000	20 212 20.350
ISA- A 145	145	20 003 13.224	20 004 13.315	100000	20 212 20.400
ISA- A 170	170	20 004 13.315	20 004 13.400	140000	20 213 20.450

9-3 Selection of normal and semi-conductor fuses / Article Numbers

Soft Starter Type	Starter Current [A]	Size [kW] 230V	Size [kW] 400V	Size [kW] 480V	Size [kW] 600V
ISA-A 8	8	1,5	4	4	5,5
ISA-A 17	17	4	7,5	9	12,5
ISA-A 31	31	8	15	18,5	25
ISA-A 44	44	12,5	22	25	30
ISA-A 58	58	15	30	37	45
ISA-A 72	72	20	37	45	59
ISA-A 85	85	25	45	55	59
ISA-A 105	105	30	55	59	80
ISA-A 145	145	40	75	90	110
ISA-A 170	170	51	90	110	140

9-4 ISA-A Sizes

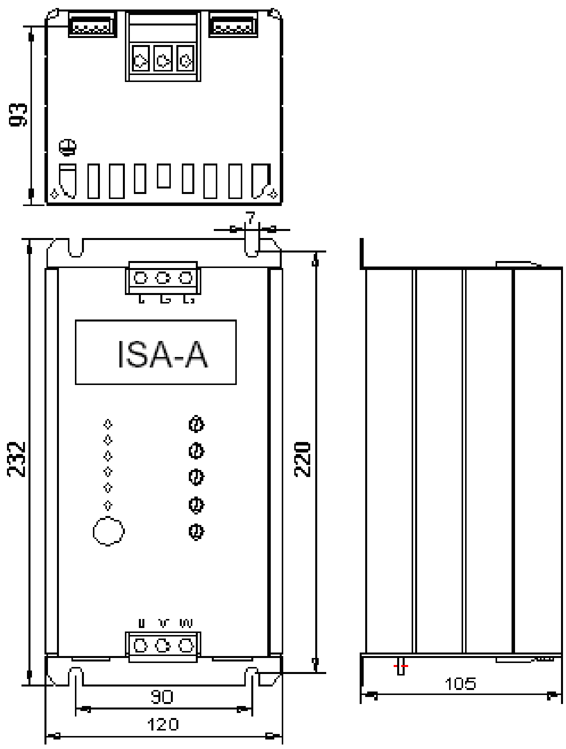
Gehäuse	Breite	Höhe	Tiefe	Gewicht (Kg)
A1	120	232	105	2,6
A2	129	275	185	5
A3	120	380	185	8,4
A4	172	380	195	11,8

9-5 Cabinet Dimensions: Size (mm) & Weight (kg)

EMC		
Immunity to radio electric interference	EN 1000-4-3 Level 3	According to EN 60947-4-2
Electrostatic discharge	EN 1000-4-2 Level 3	According to EN 60947-4-2
Immunity to electrical transient	EN 1000-4-4 Level 4	According to EN 60947-4-2
Shock Waves: Voltage / Current	EN 1000-4-5 Level 3	According to EN 60947-4-2
Radiated and conducted emissions	EN 1000-4-6 Level 3	
Radio Frequency emissions	Gemäß EN 55011 Klasse A	According to EN 60947-4-2
Mechanical		
Shock resistance	8gn	According to EN 60947-4-2
Vibration resistance	2gn	According to EN 60947-4-2
Output relay		
End of Acceleration Contact	N.O.	
Rated Operating Current	5 A, 250 V – Größe A1 8 A, 250 V – Größe A2	

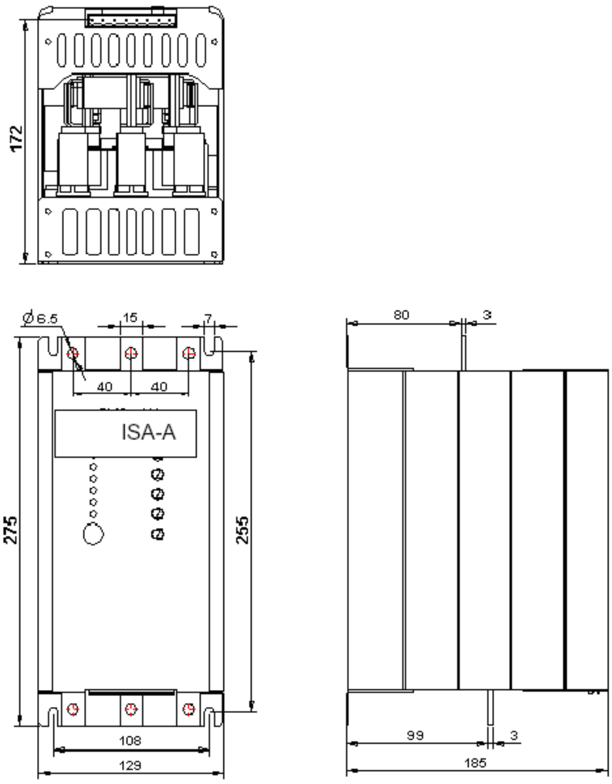
9-6 Soft Starter Standards

Sizes ISA-A 8, 17, 31, 44



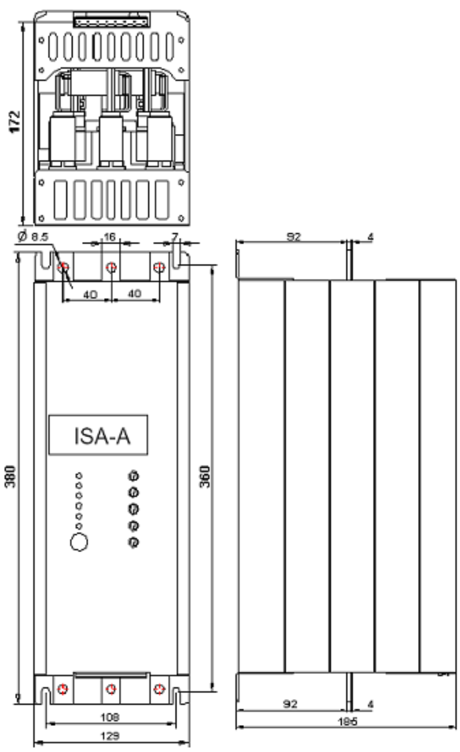
9-1 Dimension Drawing of Cabinet A1

Size A2 ISA-A 58, 72



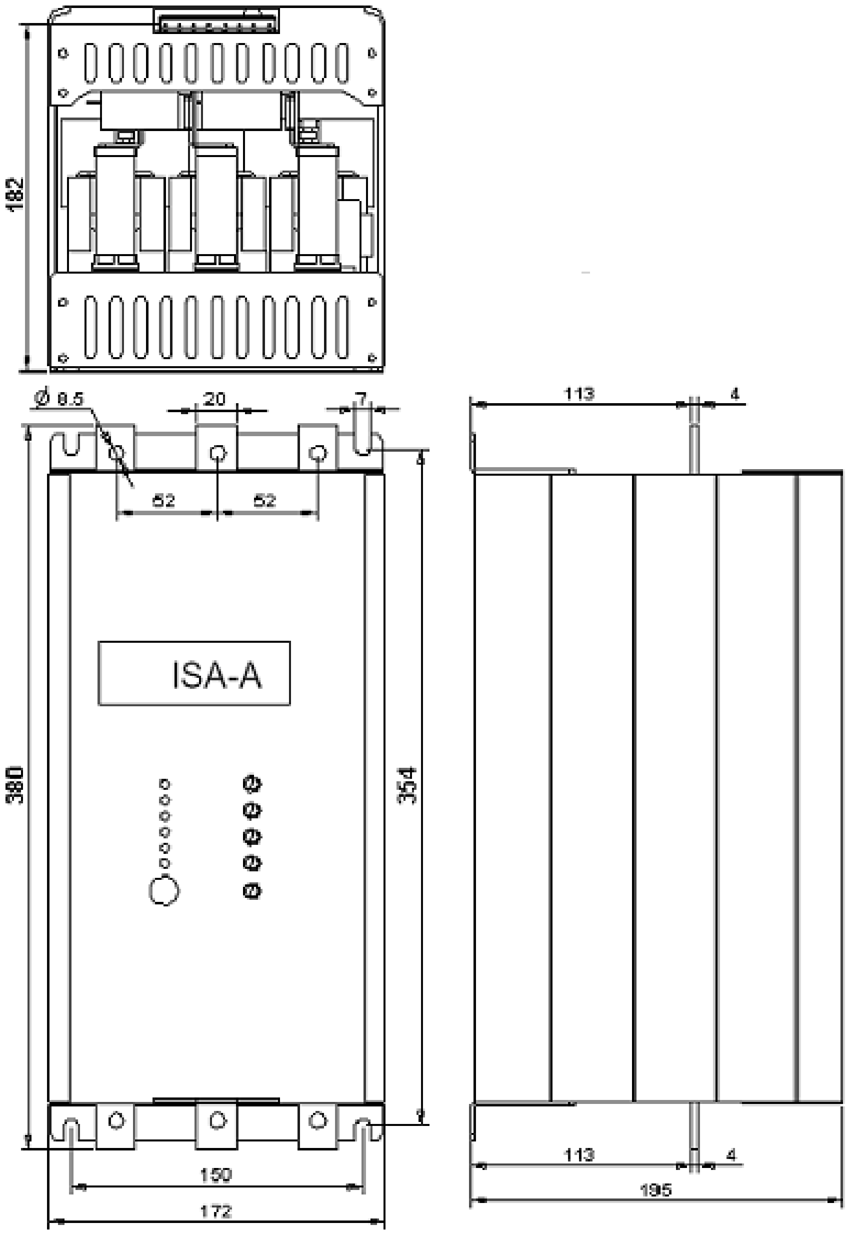
9-2 Dimension Drawing of cabinet A2

Size A3 ISA-A 85, 105



9-3 Dimension Drawing of cabinet A3

Size A4 ISA-A 145, 170



9-4 Dimension Drawing of cabinet A4

10 Odering Information

Example: ISA- A

	85	-480	-8	-I
ISA- A	-xxxx	-xxxx	-xxx	-xxx

Starter Rated Current (1)

Line Voltage Motor (2)

Options (3)

Design (4)

(1) Starter Current	8, 17, 31, 44,58,72,85,105,145, 170	
(2) Line Voltage	to specify	
	400	380-440 VAC + 10%-15%
	480	460-500 VAC + 10%-15%
	600	575-600 VAC + 10%-15%
(3) Options	to specify	
	0	no options
	8	Design for rough environment
(4) Design	to specify	
	I	Standard

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