ISA-D

GB **Instruction Manual**

New!!!
Protection covers for all sizes
Protection against accidential contact / Finger protection

06.06.2012

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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 the installation, check and verify that no parts (bolts, washers, etc) will fall into the starter.

Attention

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

Warnings

- Internal components and P.C.B's are at Mains potential when the ISA-Start is connected to mains. This voltage is extremely dangerous and may cause death or severe injury if contacted.
- When the Soft starter is connected to Mains, even if start signal has not been issued, full voltage may appear on motor's terminals. Therefore, for isolation purposes it is required to connect an isolating device (C/B, switch, line contactor, etc) upstream to the SOFT STARTER.
- Starter must be properly grounded (except 8-22A) to ensure correct operation and safety.
- Check that Power Factor capacitors are not connected to the output side of the soft starter.
- Don't interchange the mains- and the 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 Electric soft starters. The IGEL Electric soft starter ISA-D is a motor control device for optimized starting and stopping of asynchronous and 3-phase-asynchronous motors. The manual describes all the IGEL Electric soft starter ISA-D functions as well as the programming and fault research.

Target group

The manual is aimed at all users who deal with commissioning, service, the maintenance, planning and configuration of plants.

Required basic knowledge

General knowledge in the field of general electrical engineering is required for understanding this manual and to do the installation as well as the commissioning.

Validity

This manual is valid for the IGEL Electric soft starters, series ISA-D. It contains a description of the 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

The Soft Starter complies to the IEC/EN 60947-4-2 standard.

All IGEL Electric soft starters are developed and manufactured according to the IEC standards, which are part of the International Standard Organisation ISO.
The IGEL Electric soft starter ISA-D 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 special certificates are required, please consult factory.

Disclaimer of liability

The manufacture of this system or machine is responsible for ensuring the correct overall functioning. The manufacture of this soft starter cannot guarantee all properties of a system or machine not designed by the manufacture of this soft starter.

The manufacture of this soft starter can also not assume liability of recommendations given or implied by the following description. No new guarantee / warranty or liability claims in excess of the general terms and conditions of the manufacture of this soft starter can be deduced from the following description.

Information

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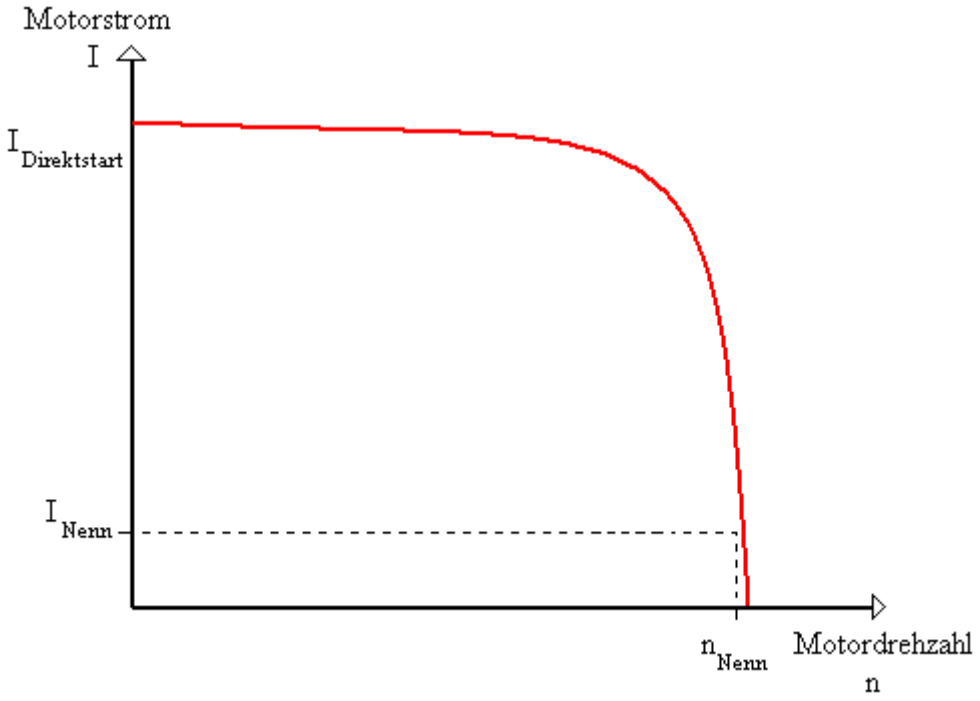
2.3 Physical Basics

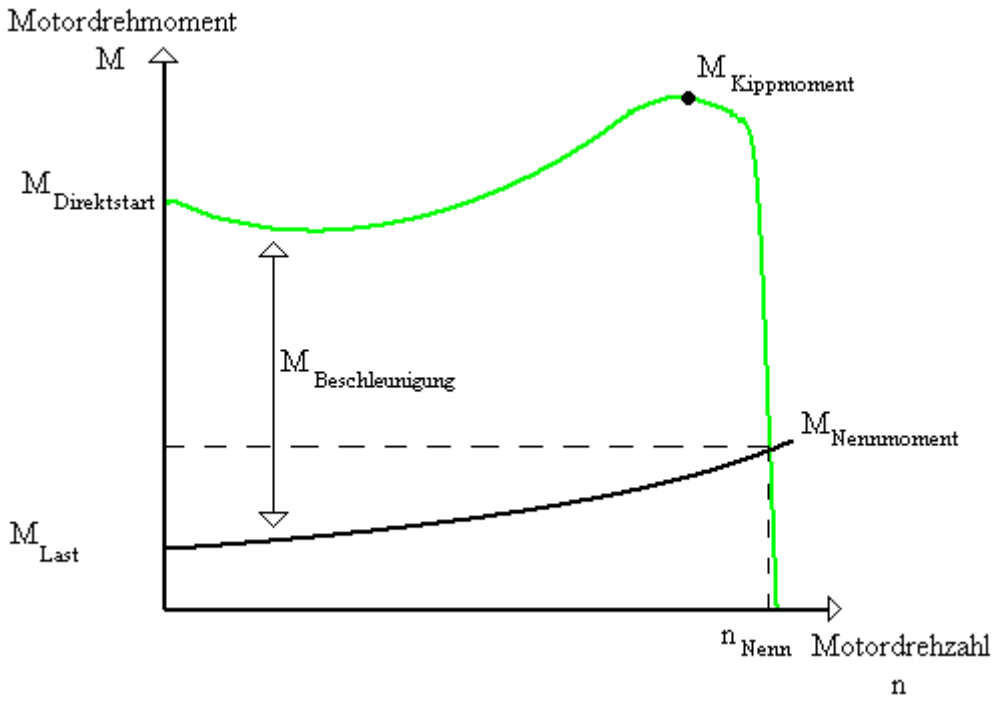
3-phase aynchronous motor

3-phase asynchronous motors are used in large numbers because their robust and simple design and low-maintenance operation, in commercial applications, trade and industry.
There they propel many different applications (e.g. compressors, pumps).
The **problem** is if switched on directly, during the start-up, the typical current and torque behaviour of the 3-phase asynchronous motors may negatively influence the feeding supply network and the load machine.
The **direct starting current** of the 3-phase asynchronous motors are very high. This current may be 5 times to 15 times the size of the rated operating current.
7 to 8 times the size of the motor rated current is a typical value.
The following **disadvantage** is that there is a higher load on the electrical supply network what means that the supply network must be dimensioned to this higher output during motor start-up.



2-1 3-phase asynchronous motor's typical current behavior

Another **disadvantage** is the very high **starting torque**. The starting and 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 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 start torque behavior

Solution: Using the IGEL Electric soft starter current and torque behavior during start-up can be optimally adapted to the requirement of the application.

Operating mode of the IGEL Electric soft starter

The soft starter has got two antiparallel thyristors in each of the two phases (except ISA-A2P and ISA-B2P). There is one for the positive and one for the negative half wave.
Using phase angle control and various control methods, the r.m.s. value of the motor voltage is increased from definable start voltage or start torque to the motor rated voltage within a selectable starting time.

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 quadratic. The start torque is thus reduced quadratic based on the voltage applied to the motor**.** The reduction of the start torque will result in a smooth acceleration of the motor.

Example: With an 800 kW motor at 400V nominal voltage.
Selected soft starter ISA-D 1400-400-230-I

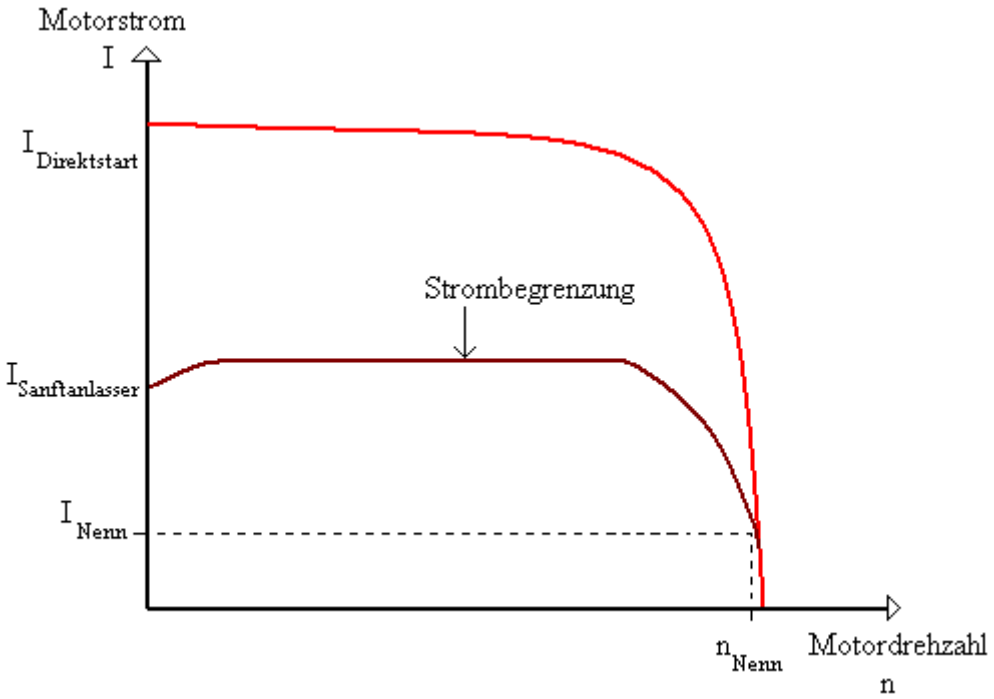
Motor's data:	P:	800 kW
	I:	1400 A
	$I_{Direct\ on\text{-}line\ start}$	7 x I_e 9800 A
	M:	5090 Nm
	$M_{Direct\ on\text{-}line\ start:}$	3 x M_e 15270
	n:	1500min^{-1}

Set start voltage: 30%

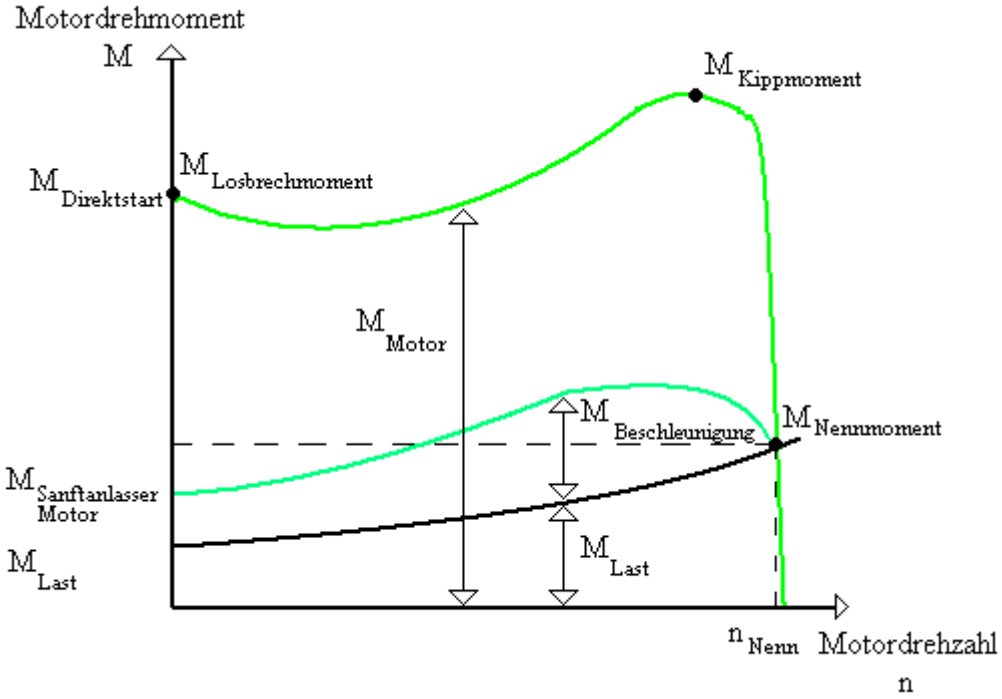
I_{Start} is 30% of $I_{Direct\ on\text{-}line\ start}$ because I ~ U so I = 2940 A

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

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



2-3 3-phase asynchronous motor's reduced current behavior during start-up



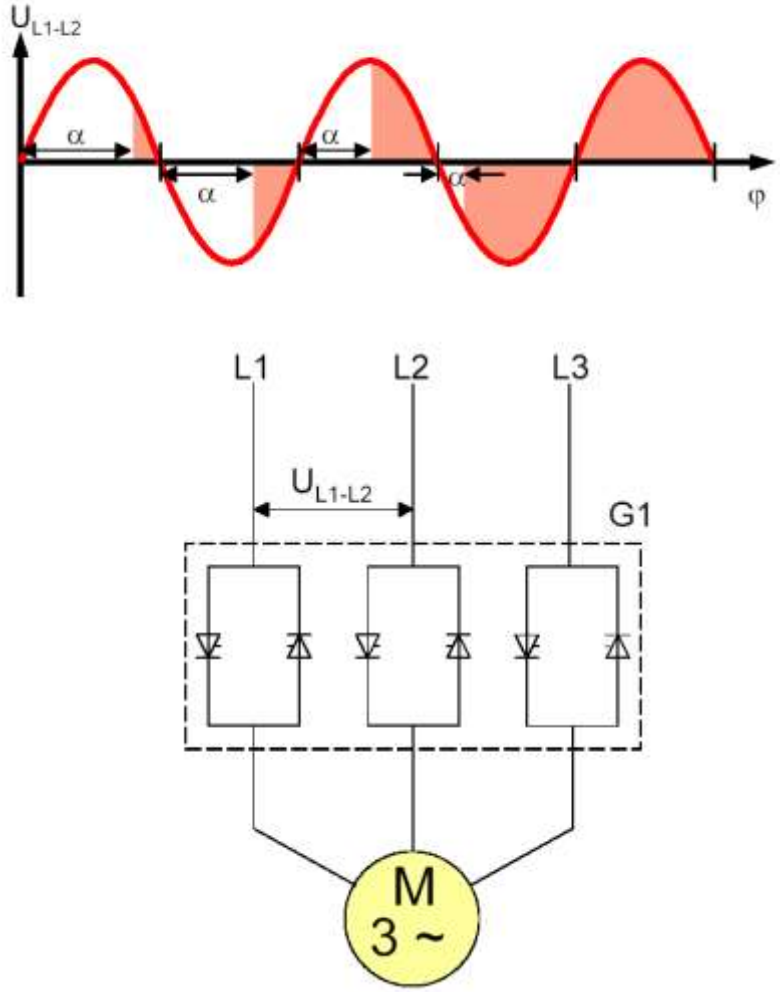
2-4 3-phase asynchronous motor's reduced behavior during start up

Main advantages:

- the reductions of the start-up peak and so a lesser mains' burden
- the reductions of the starting torque and so a lesser burden of the mechanical drive-line systems like chains, gearing mechanisms or V-belt.

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 thyristor. Therefore, the area around the switching devices heats up less.

The following graph shows the operation mode of an IGEL Electric 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 for star-delta starters, frequency converters, slip-ring motors and transformer starters**.** Their 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 additional an integrated motor protection function.

Applications: Possible applications include:

- Pumps
- Compressors
- Conveyor belt
- Powered roller conveyors
- Ventilators/Fans
- Hydraulic pumps
- Stirres
- Centrifugal machines
- Milling machines
- Mills
- Crushers
- Disk saws/ribbon saws
- shredder
- Screw conveyor
- …

Advantages: Centrifugal pumps, reciprocating pumps:

- Water hammering in pipe systems is avoided
- Pressure shocks on valves are avoided
- Lesser service costs for installations

Conveyor belts and systems:

- slower acceleration/braking spare the machines

Stirrers, mixers:

- Reduced starting current

Fans:

- Reduced stress on transmissions and V-belts

Boundary conditions for storage and operation

Permissible ambient temperature for:

- Storage	-25 °C to +70 °C
- Operation	0 °C to +50°C, from 70 °C with derating
Permissible relative air humidity:	10 to 95 %
Maximum permissible installation height:	1000m, from 1000m with derating

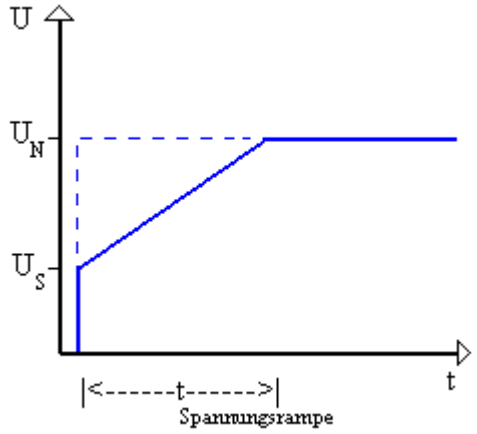
Caution:

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

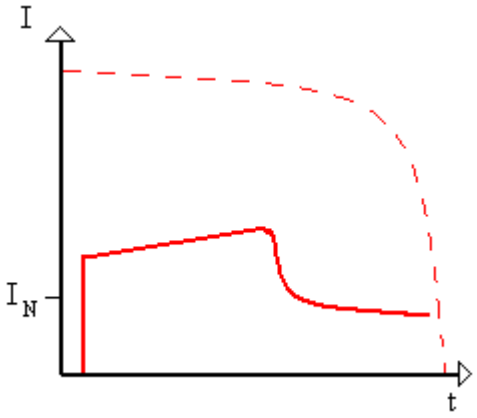
2.4 Start Procedure / IGEL Electric Soft Starter Methods

Soft Start with voltage ramp

The motor starts with the 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.



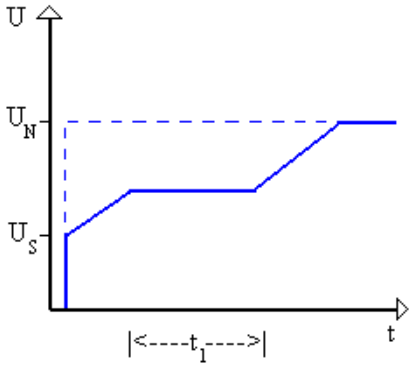
2-6 Motor's Terminal Voltage



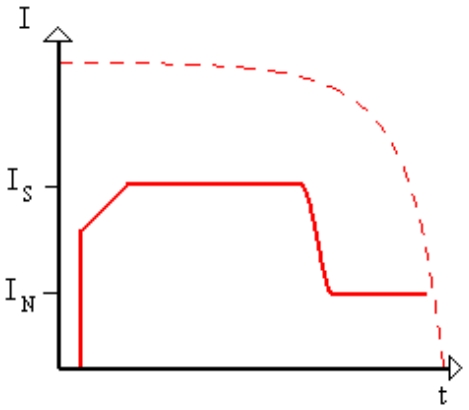
2-7 Current Course

Soft Start with Starting Current Limit

In this case the Motor also starts with 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 with the time of current limit.



2-8 Motor's Terminal Voltage with Current Limit

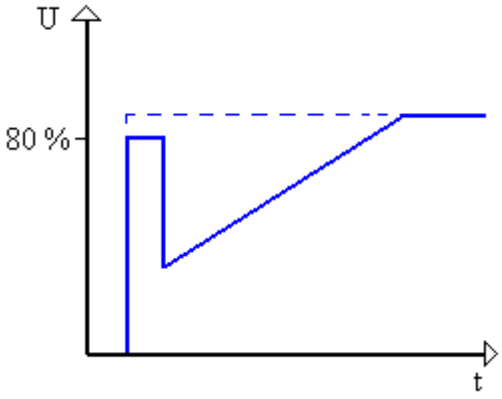


2-9 Current Course with Current Limit

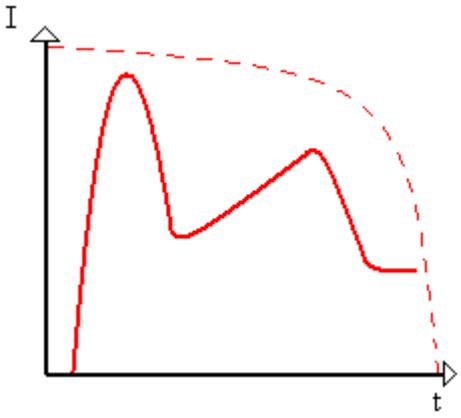
When the motor get started with Starting Current Limit, you have to keep attention that the motor is able to get an acceleration torque against the loading.
If you select a too low starting current it could be possible that the motor or its soft starter gets a thermal overload.

Soft Start with Pulse Start

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



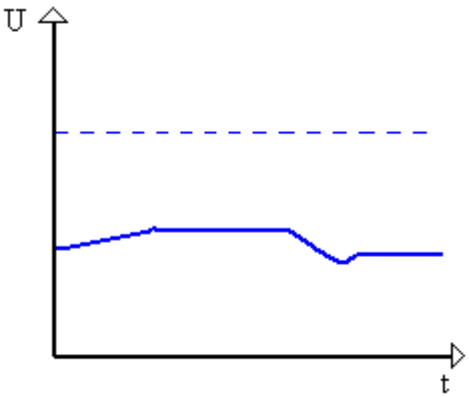
2-10 Voltage Course Pulse-Start



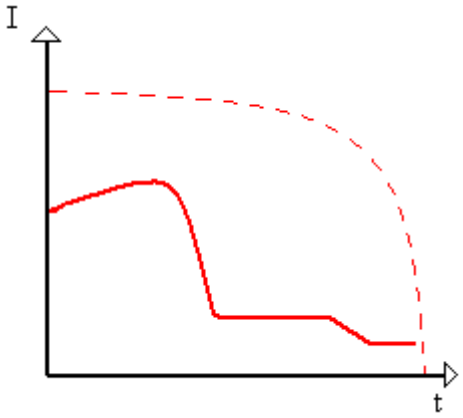
2-11 Current Course Pulse-Start

Energy Saving

Some electronic soft starters contain the function energy saving. This function improves the cos φ of the motor by controlling the terminal voltage of the motor by continuous 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 revs' breaking in. Disadvantage of the energy saving function is a load of the mains with harmonics by phase angle.



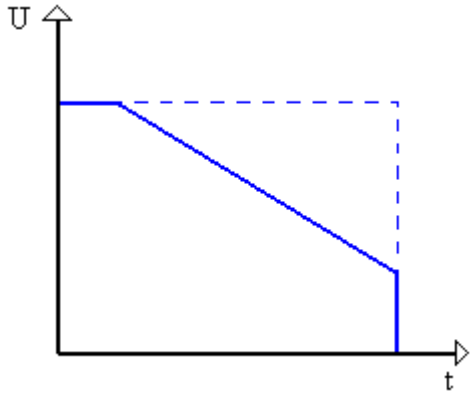
2-12 Voltage Course with Energy Saving



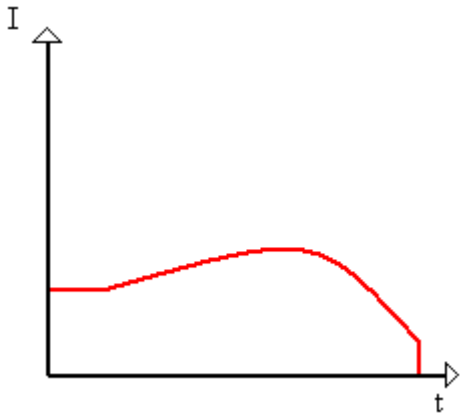
2-13 Current Course with Energy Saving

Soft Stop

All Soft Starter of the ISA series 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 implicate a rising of the motor current over the rated motor current.



2-14 Spannungsverlauf Sanftstopp



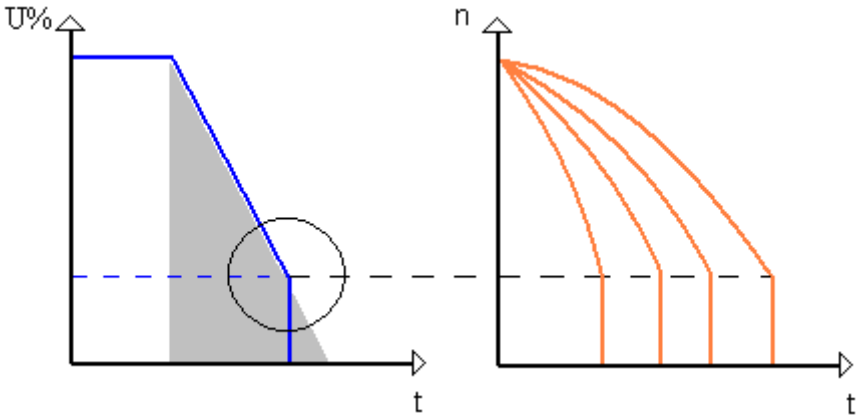
2-15 Stromverlauf Sanftstopp

Soft Stop with sepcial 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 reduces this phenomenon in essentially because with a voltage reduction of 20% the water column brings the pump to a standstill. The special pump software enables the pump run-down until the check valve closes softly and so it decreases the wear out of the duct system effectively.

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.



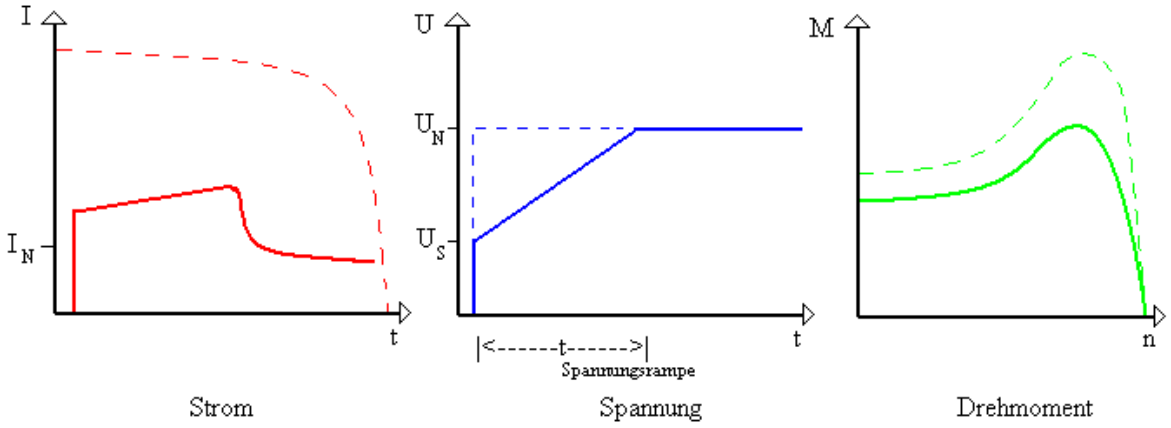
2-16 Soft Stop with pump curves

3 Technical Data

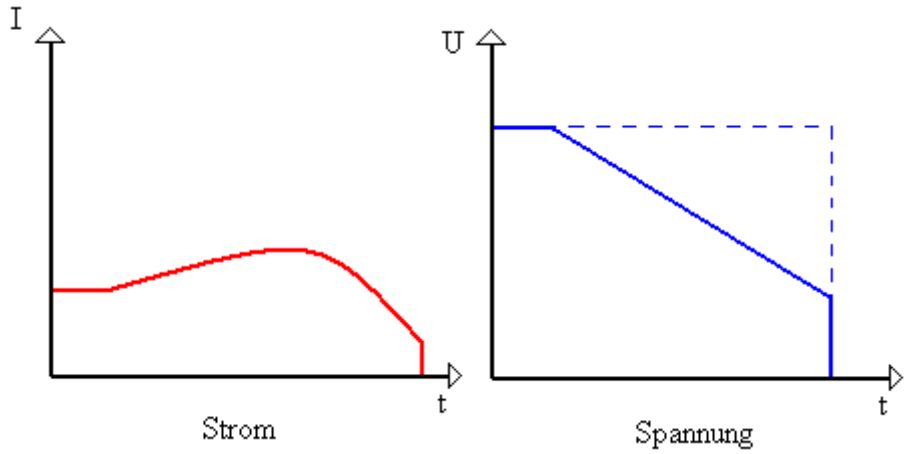
3.1 Introduction

The ISA-D is a highly sophisticated and reliable starter design for smooth starting and stopping of 3-phase asynchronous motors (squirrel cage induction motors). It provides the best method of reducing current and torque during motor starting.
The ISA-D motor starts the motor by supplying a slowly increasing voltage to the motor, providing soft start and smooth acceleration, while drawing a minimum current necessary to start the motor.
The third generation, microprocessor based digital circuitry provides unique features like pump control, slow speed, electronical reversing and accurate motor protection with optional insulation protection, thermistor input, by-pass preparation (option 9) etc. reducing heat dissipation and saving energy.

The optional RS 485 communication (Modbus and Profibus protocol) enables parameter setting, control and supervision. Up to 32 motor soft starters can optional be connected.



3-1 Soft-Start Characteristics



3-2 Soft-Stop Characteristics

The soft stop characteristics may be used for the controlled pump or motor run-outs with high frictional load.
The Igel soft starters ISA-D are designed to operate under normal as well as heavy duty start-up conditions. For frequent starts or starts at maximum ratings a larger sized starter should be selected.
For long starts, soft stops and pump run-outs a PTC should be installed in the motor windings which only works during run-out when current load occurs.
Do not install any capacitive loads (e.g. compensation) between soft starter and motor.
When soft starters are used do not incorporate any active filters.

3.2 Hardware

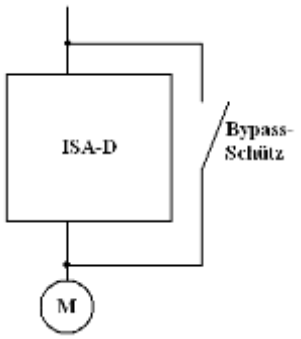
3-3 Front View

A motor soft starter is built up with a few main components: Printed circuit board, thyristors, housing, connecting terminal and fans (for higher rated current). The main circuit incorporates 3 antiparallel switched thyristor units. The control circuit board controls the motor current. Using a soft starter the low motor voltage, low motor current as well as low torque behaviour during the start up can be optimally used. The ISA-D incorporates a digital control circuit.

3.3 Bypass

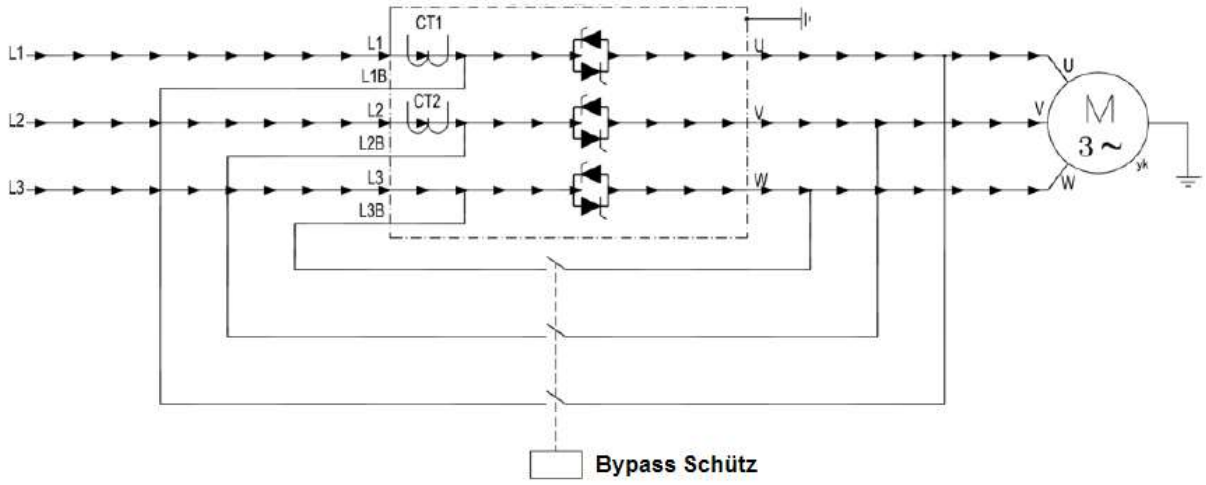
Under normal conditions the heat dissipated by an electronic soft starter causes heating of the enclosure and energy loss.
The heating and losses can be eliminated by the use of an external bypass contactor which will by pass the ISA-D after completion of the start-up. In this case the voltage protection functions will be maintained, except the current protection, as the current will not flow through the internal current transformers after the bypass closes.

In order to maintain current protection after the by-pass contactor closes, option 9 must be ordered.



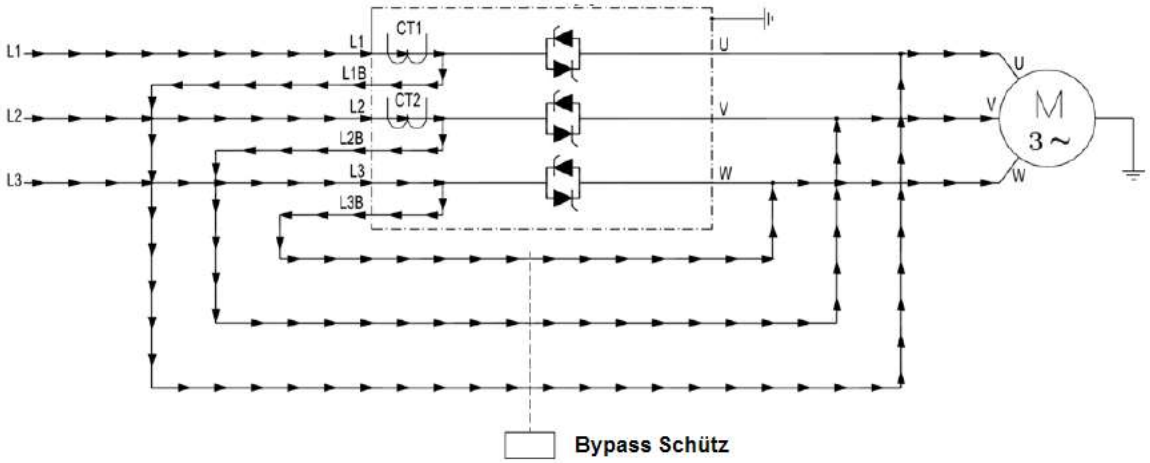
3-4 By-pass contactor

Note: The soft starter sizes from 950A and all 1000V Soft Starters must be external supplied with bypass contactor. Bypass preparation is standard in models ISA-D 85-170A.



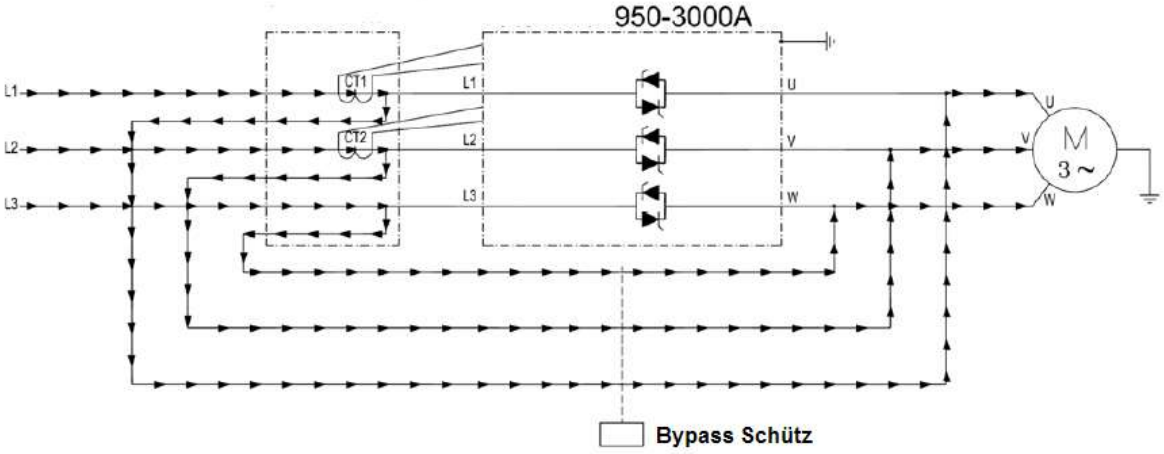
3-5 Current course during start-up and soft stop phase

All current protections are maintained and the CT's also measure the current after the by-pass closes.



3-6 Current course after the by-pass closes

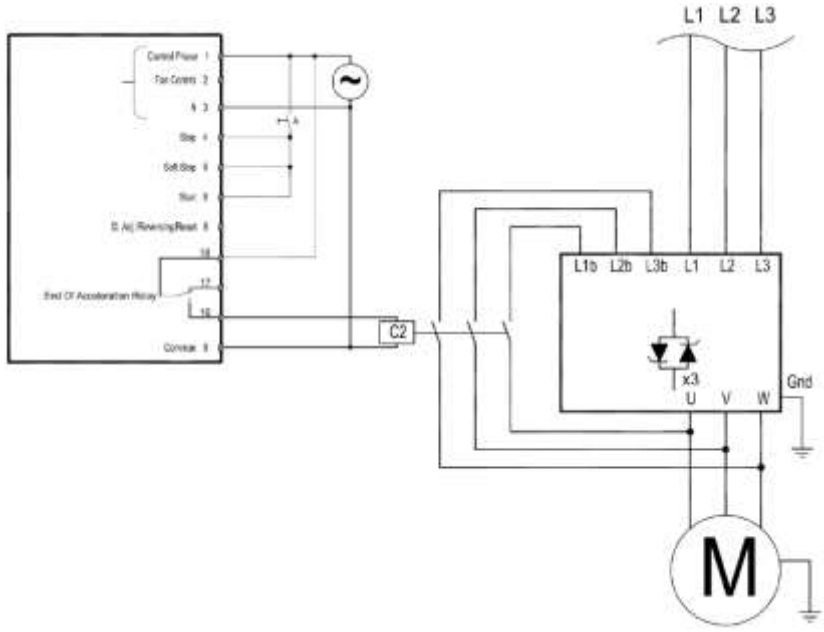
Note: After the by-pass closes a soft starter without preparations for by-pass contactor (no option 9), will not maintain the following protections: under current, overload, short circuit.



3-7 Current course of ISA-D 950-3000A after by-pass closes

The soft starter sizes from 950A will be supplied without by-pass preparation. The by-pass contactor has to be installed by the customer. Current transformers CT1 and CT2 are supplied separately and must be connected to the ISA-D as shown below. If the connection is as shown all protection functions are maintained also after by-pass is closed.

Control wiring by-pass contactor

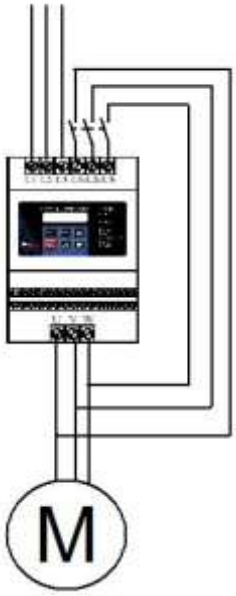


3-8 Control wiring of a by-pass contactor

Preparation for by-pass contactor (option 9)

Frame Size A (8 – 72 A)

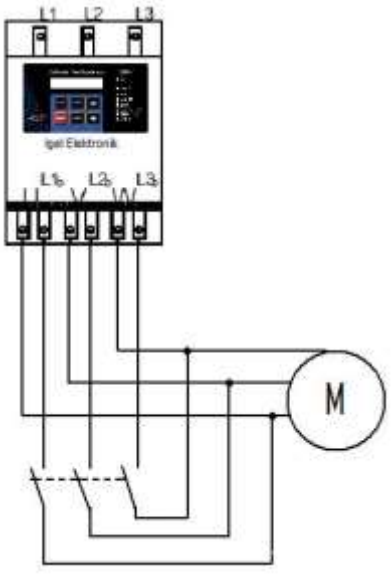
The soft starters will be factory supplied, three additional terminals are added, marked L_{1b}, L_{2b}, L_{3b}. These terminals are connected after the internal CT's intended for connection to the by-pass.



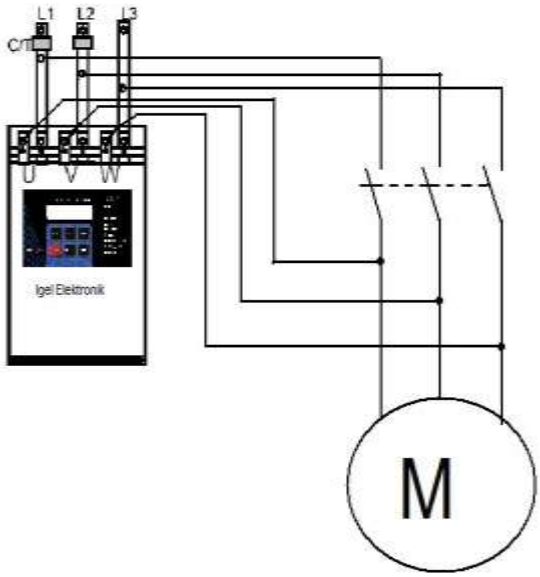
3-9 By-pass contactor for frame size A

Frame Size B (Old and New 105-170A)

Old – Additional set of bus-bars can be field mounted on the line side, after the CT's, so that the by-pass contactor could be connected to L_{1b}, L_{2b}, L_{3b} (option).
New – Additional set of bus-bars is built-in while the line side is on top, the motor side is at bottom with the by-pass terminals L_{1b}, L_{2b}, L_{3b}.



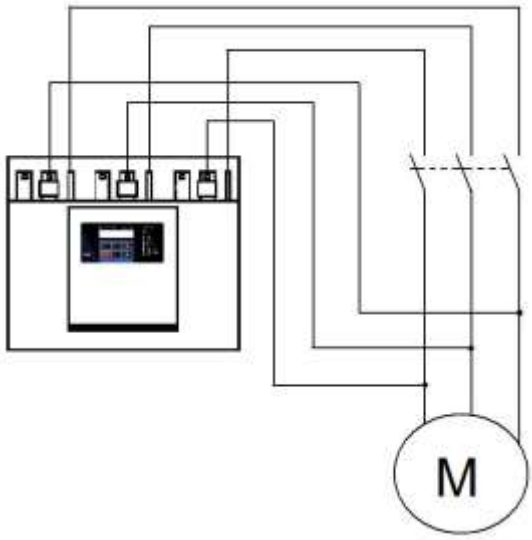
3-10 By-pass contactor for frame size B



3-11By-pass contactor for frame size B New

Frame Size C (210 – 390A)

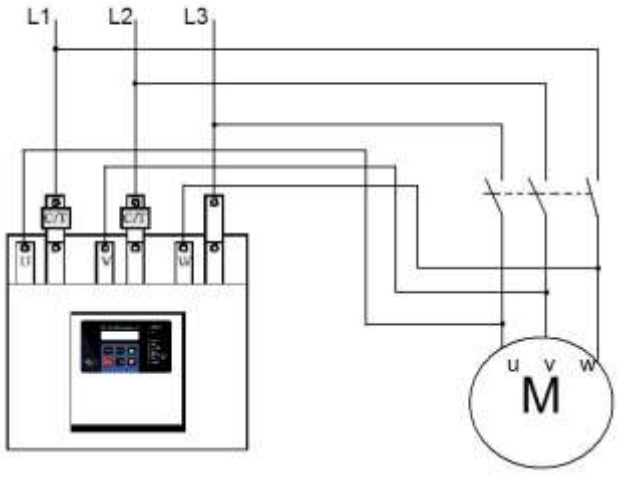
Additional set of bus bars can be field mounted on the line side, after transformer marked $L_{1b,}$ $L_{2b,}$ L_{3b}. The by-pass cables should be connected to these bus bars.



3-12 By-pass contactor for frame size C

Frame Size D (460 – 820A)

Additional set of bus bars can be field mounted on line side, after transformer marked $L_{1b,}$ $L_{2b,}$ L_{3b}. The by-pass cables should be connected to these bus-bars.

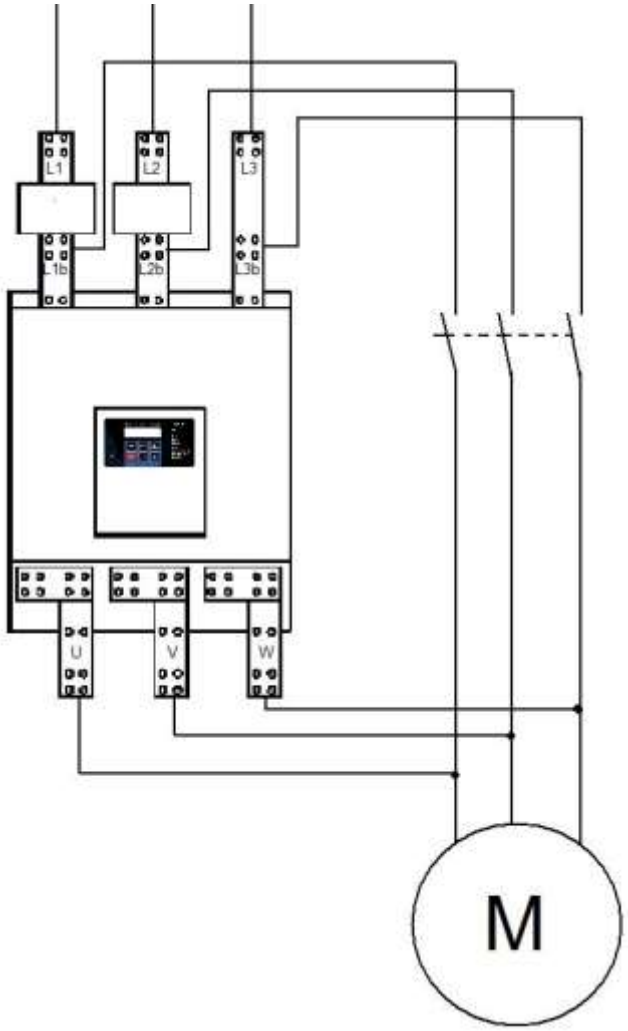


3-13 By-pass contactor for frame size D

Note: Starter frame sizes C and D can be field modified to have line and load bus bars at the bottom. (Contact IGEL Electric for further information).

950A to 3000A

Additional set of bus bars can be field mounted on line side, after transformer marked $L_{1b,}$ $L_{2b,}$ L_{3b}. The by-pass cables should be connected to these bus-bars.



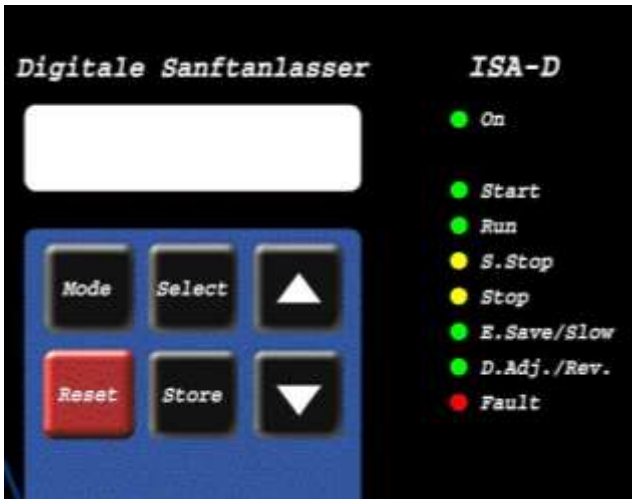
3-14 By-pass contactor for frame sizes E, F, G

Note: Connect as follows:

- Line to L1, L2, L3
- By-pass contactor, Input to $L_{1b,}$ $L_{2b,}$ L_{3b}, Output to U, V, W
- Motor (load) to U, V and W

Attention:
Do not interchange line and load connections.

3.4 Front Panel



3-15 Front Panel

Keypad	Provides selection of the following modes:
Mode	• % rated motor current • Main Parameters • Start Parameters • Stop Parameters • Dual Adjustment Parameters • EN.Save &SL SPS Parameters • Fault Parameters • I/O Programming Parameter • Communication Parameter • Statistical Data
Select	To select function within each mode.
▲	To increase adjusted parameters. Press momentarily and continuously. On side „Statistical Data“ function „scroll forward“.
▼	To decrease adjusted parameters. Press momentarily and continously. On side „Statistical data“ function „scroll back“
Store	To save.
Reset	To reset the soft starter after fault has been removed, and allows restarting.

3-1 Front Panel Description

LED Arrangement	Significance
On	Lights when control supply is connected to the starter
Start	Lights up when during start up process, indication the motor supply voltage is ramping up.
Run	Lights up after completion of starting process, indicating that motor is receiving full voltage. Flashes during 1/6 rotation speed.
S.Stop	Lights up during soft Stop process, indication the motor supply voltage is ramping down.
Stop	Lights up when motor is stopped.
E.Save/Slow	Lights up when energy save is in operation, flashes when motor is running at 1/6 rotation speed.
D.Adj./Rev.	Lights up when Dual Adjustment is in operation; flashes when motor is running in the reverse direction at 1/6 rotation speed.
Fault	Lights up upon operation of any of the built-in protection. Flashes upon alarm of the isolation alarm relay (option).

3-2 LED Arrangement/Significance

LCD Arrangement

Two lines of 16 alphanumeric signs, four selectable languages: English, German, Spanish, French, (see language selection)

- Upper line displays funtions.
- Lower line displays setting and measured values.

Example:

3-16 Example: LCD Arrangement

4 Starter Selection

4.1 Prior to Installation

Make sure that fuses and circuit breakers of the main electric circuit are rated to oprate under direct start conditions and under the local short circuit conditions. Please order separately.
Select the circuit breaker (Trip selection) according to the harmonic load of the starting current.
General calculation is 2 times In (see table).

4.2 Soft Starter Selection

660**Motor Current and Starter Settings**

Select the soft starter according to motor's Full Load Ampere – as indicated on its nameplate – even if the motor is never fully loaded.
The ISA-D is designed to operate under the following maximum conditions:

Ambient Temperature in °C	Start Current	Acceleration Time	Starts per hour
50	400% In	30 sec	4 starts per hour at maximum ratings. Up to 60 starts per hour at light load applications. (Contact factory)

4-1 Operation Conditions

Note: For trip operation, the maximum starting current should be considered as the Full Load Ampere.

2. Main Voltage (line to line)

Thyristor's PIV rating, internal circuitry and insulation defines four voltage levels:

Voltage	Tolerance
220 – 440 V 45-65Hz	+10 – 15%
460 – 500 V 45-65Hz	+10 – 15%
575 – 600 V 45-65Hz	+10 – 15%
660 – 690V 45-65Hz	+10 – 15%
1000V (Consult factory)	+ 10 - -15%

4-2 Main Voltage

3. Control Voltage

The control voltage operates the electronical circuit and the by-pass-contacts.
Two voltage levels are available:

Voltage	Tolerance
220 - 440 V 45-65Hz (Standard)	+10 – 15%
110 – 120 V 45-65Hz	+10 – 15%
110 VDC	+10 – 15%

4-3 Control Voltage

4. Control Inputs

Control Input Voltage (start, stop etc.) can be the same as Control Supply above, or 24-240 AC/DC by special order.

Voltage	Tolerance
90 - 230 V 50-60Hz (standard)	+10 %
90 - 230 V DC	+10 %
24 V 50/60Hz	+10/-15%
24 V DC	+10/-15%
48 V 50/60Hz	+10/-15%
48 V DC	+10/-15%

4-4 Voltage Control Inputs

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.

Mounting

- The soft starter has to be mounted vertically. Allow sufficient space above and below the starter for suitable airflow.
- It is recommended to mount the soft 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 atmosphere.

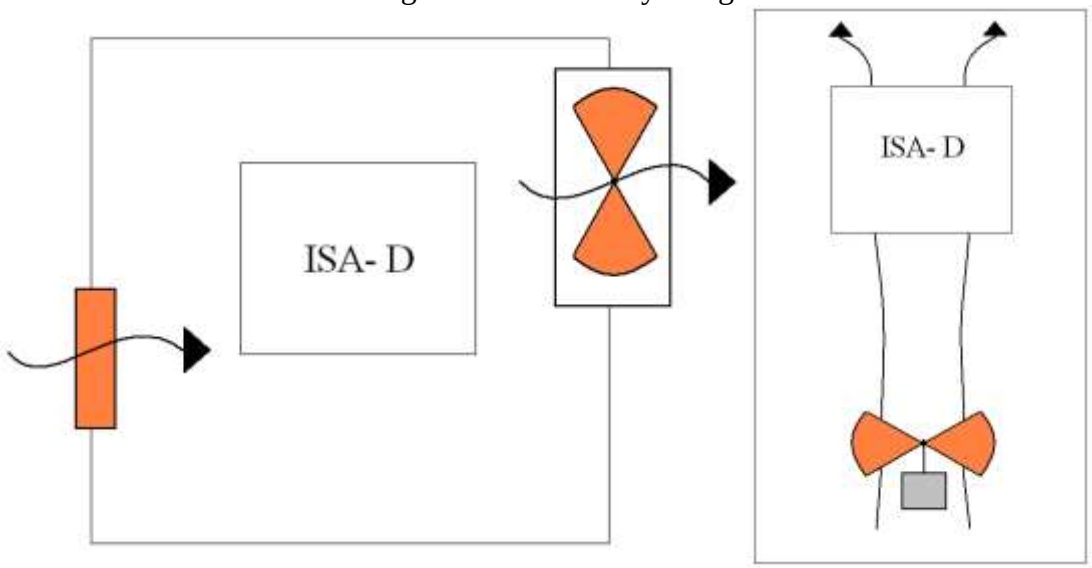
Note:
For harsh environments it is recommended to order the starter with option 8.

Ambient Conditions

The soft starter ISA-D is rated to operate over a temperature range of -10 °C to +50 °C.
The non condensed humidity inside the housing should not exceed 95%.
Die Verlustleistung am Sanftanlasser beträgt maximal 0,8% der angeschlossenen Leistung. Als Näherungsformel kann 3x des Stroms in Watt angenommen werden.

Example: motor's current is 100 A x 3 = 300 watts heat dissipation

Important note: In case of frequent motor starts the cabinet should be built for higher dissipation.
The internal enclosure heating can be reduced by using additional ventilation.



5-1 Fans for additional ventilation

Calculating the enclosure size for non-ventilated metal cabinets:

$$\text{Surface } (m^2) = \frac{0{,}12 \times \text{total heat dissipation}^* \text{ (W)}}{60 - \text{max. ambient temperature}}$$

*heat dissipation of all cabinet equipment.

Note: Using a plastic cabinet a bypass contactor must be used.

Voltage Spike Protection

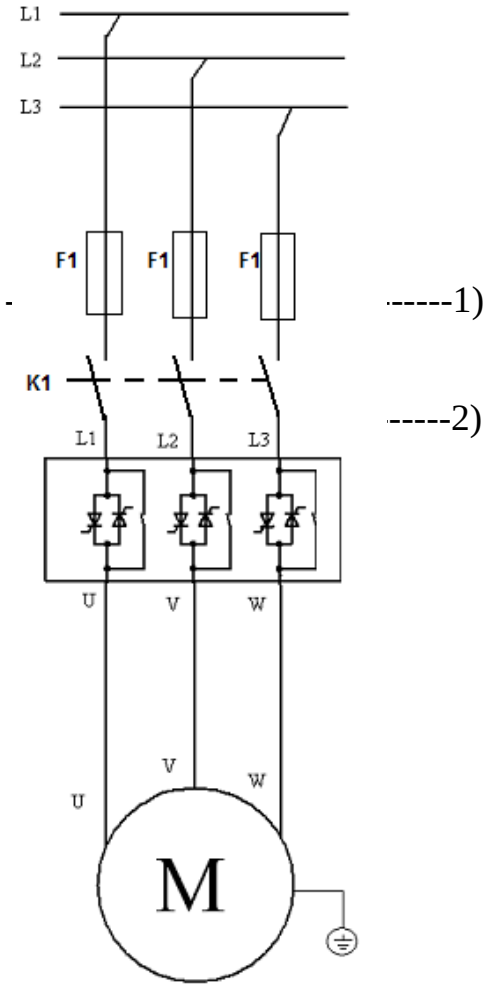
Voltage spikes may cause malfunction of the soft starter and damage the thyristors. When expected, use suitable protection such as Metal Oxid Varistors. (Consult factory for further details.) Metal Oxid Varistors (MOV) are already built in soft starters sizes B – E for protection against voltage spikes.
When higher spikes are expected for size A, use external protection. (Please consult factory.)

Short circuit protection

Protect the thyristors in the ISA-D by semi-conducter fuses with I^2t-values:
Dimension of protection fuses, see chapter 14, Technical Data.

Warnung
When lines voltage is connected to the starter, even if the start signal has no 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.
Power factor correction capacitors must not be installed on starters load side. When required install capacitors on starter's line side with a 2 m cable.

5.2 Load



5-2 Load Connection Plan (standard)

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

- bus bar connections
- screw terminals

The terminals L1/L2/L3 will be connected to the line.
The terminals U/V/W are connected to the motor.

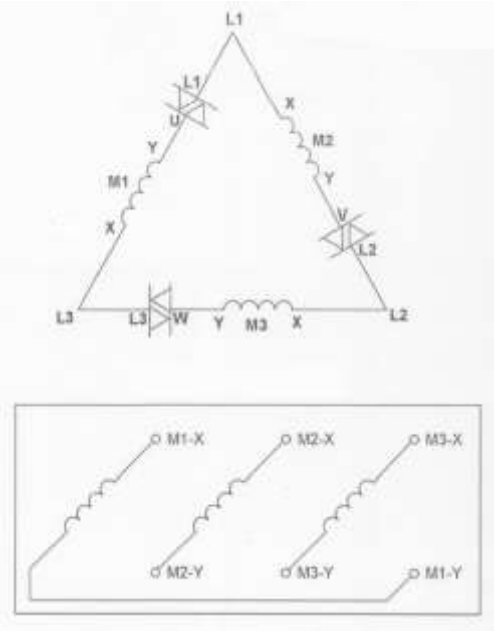
1) For short circuit protection use fuses or circuit breaks. For type 2 conditions use semi-conductor fuses.

2) For emergency stop a main contactor must be installed.

5.3 Inside Delta Connection

When the ISA-D is installed Inside Delta, the individual phases of the ISA-D are connected in series with the individual motor windings (6 conductor connections as with the star-delta starter). The ISA-D must only conduct about 58 % (=1\√3) of the rated motor current. This allows the use of a significantly smaller ISA-D.

Note that although when connected Inside Delta the current is reduced by 1.73 (√3), you should choose an ISA-D as if current is reduced only by 1.5. (1/1.5=0.667=67%)



For example:
For a motor with a rated current of 870A motor, a 950A starter will be selected to operate In-Line. For Inside Delta ISA-D, we calculate (870 x 67% = 580A) and select a 580A starter.

•

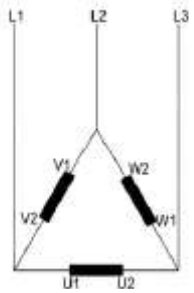
5-3 Standard Motor Connecting Terminal Plate

Notes on Inside Delta Connection
• Inside Delta requires 6-wires to the motor.
• **Wrong motor connection might cause serious damage to the motor windings**.
• When installing the ISA-D Inside Delta it is highly recommended to use a contactor in series to the ISA-D or upstream (after motor protection) in order to avoid a damage to the motor if the ISA-D short circuits.• The sinusoidal shape of the current might be imperfect. As a result, higher harmonic content is incurred (THD), which may be twice the THD value as in the standard In-Line connection. • Motor heat may increase (due to the higher THD).
• Phase sequence to the input of the ISA-D (L1, L2 & L3 terminals) must be correct. Otherwise, PHASE SEQUENCE fault will trip the ISA-D immediately.
• Higher torque can not be obtained.

• The following factory preset features and functions are **not active** when Inside Delta mode is configured:
o PULSE START
o Curve selection (CURVE 0 !! only).
o EN. SAVE and SL. SPD (energy save and slow speed)
o PHASE SEQUENCE in off mode
• When using INSIDE DELTA configuration, current wave shape is different than that in LINE configuration. This difference casus the current RMS value of the INSIDE DELTA configuration to be lower than that of LINE configuration assuming both have the same amplitude. In order to best protect the SCRs in the INSIDE DELTA we do not allow the amplitude of the current to be higher than that in LINE connection. Therefore the current RMS value expected for the same setting of the CURRENT LIMIT is lower by 10 ~ 30% than that in LINE connection.

Note :
For a high starting torque process, it is recommended to use the ISA-D in the In Line connection.

When using Inside Delta connection:
• It is highly recommended to use a line contactor in order to avoid possible damage of the motor if the SCR is short circuited in the ISA.D.
• If the ISA-D is connected Inside the Delta, motor terminals are "live" (full voltage) even when the contactor is open.



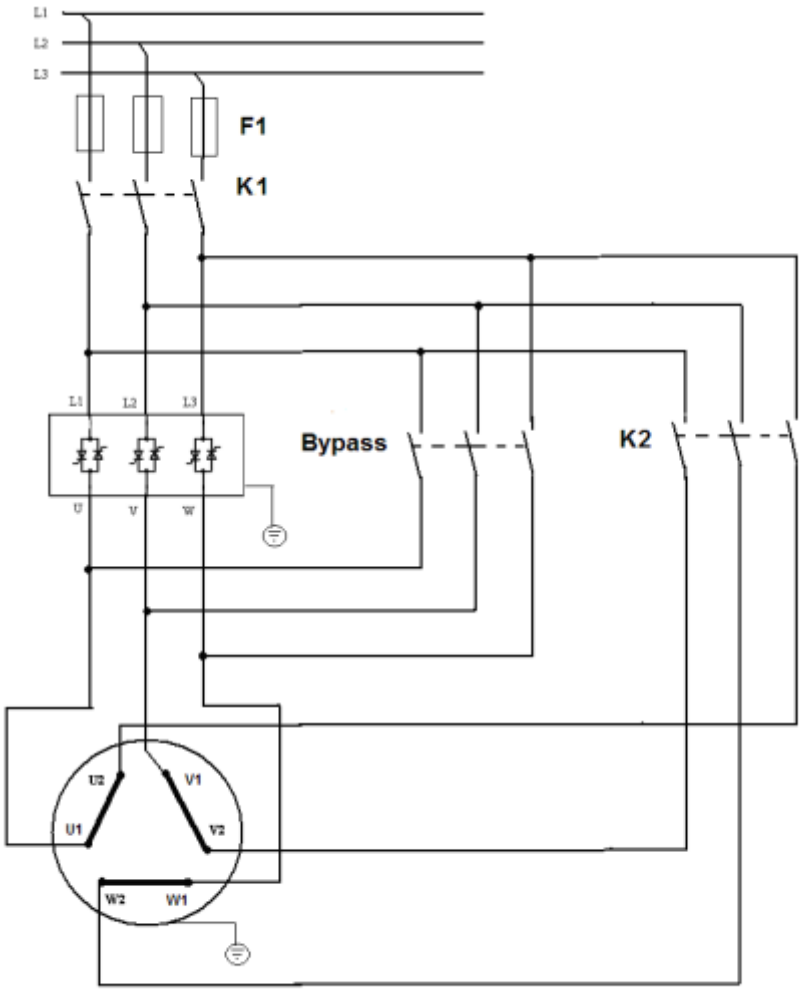
Motor connection in Delta mode without ISA-D

Motor Connections:

ASA (USA)	BS	VDE	IEC
T1 – T4	A2 – A1	U – X	U1 – U2
T2 – T5	B2 – B1	V – Y	V1 – V2
T3 – T6	C2 – C1	W – Z	W1 – W2

5.4 Inside Delta Connection with by-pass - right-hand rotation

Right-hand Rotation



5-4 Inside Delta with right-hand by-pass

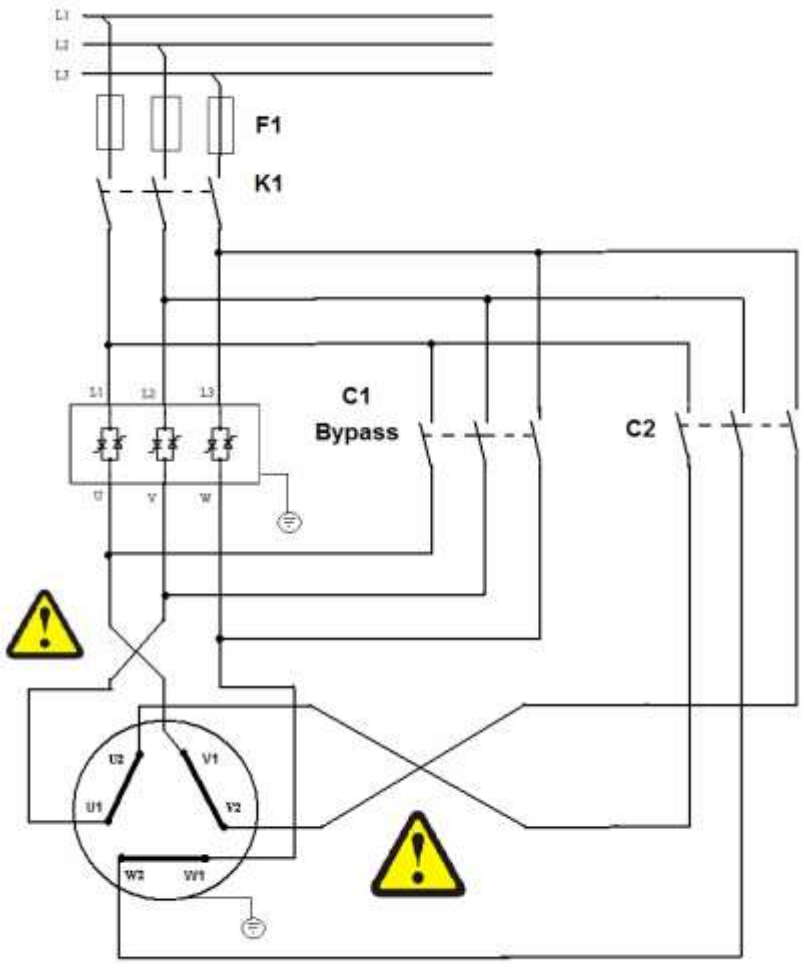
WARNING!

False connection of the motor or soft starter may cause considerable damages of the motor and the soft starter!

5.5 Inside Delta Connection – Alternation of Motor Rotation

The line connections L1, L2, L3 cannot change the direction of motor rotation. In case of Inside Delta Connection the protection function „Phase Sequence”can not be switched off. A change of motor rotation can only be realised as follows:
(Exchange motor windings U1 for V1 and motor windings U2 for V2.)

Left-hand Rotation



5-5 Inside Delta Connection – Alternation of Motor Rotation – Left-Hand Rotation

WARNUNG!

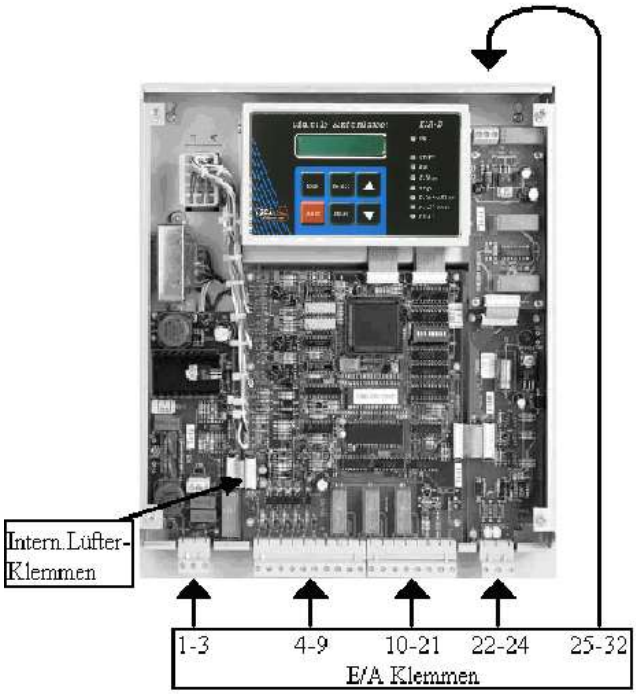
False connection of the motor or soft starter may cause considerable damages to the motor and the soft starter!

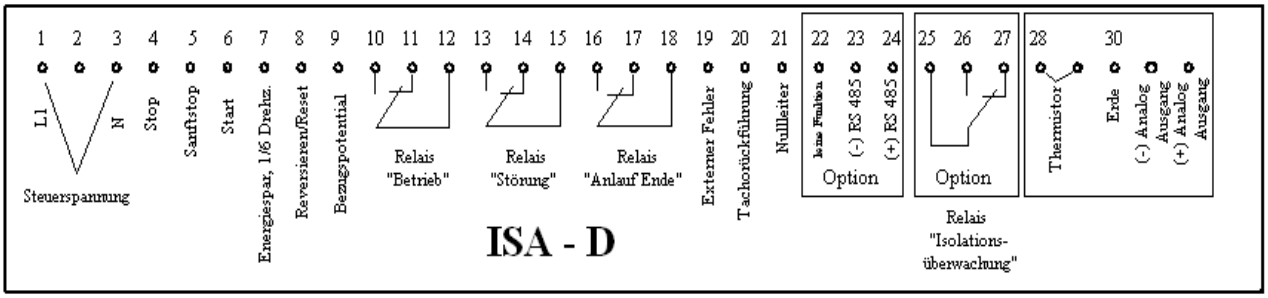
The soft starter should always be selected according to the motor's FLA and start procedure. For the Inside Delta Connection in series connection power will be multiplied by 1,5.

Soft Starter Type	max. rated motor current	motor KW 400V (line connection)	motor KW 400V (Inside Delta Connection)
ISA-D 8	8	4	6
ISA-D 17	17	7,5	11
ISA-D 31	31	15	22,5
ISA-D 44	44	22	33
ISA-D 58	58	30	45
ISA-D 72	72	37	55,5
ISA-D 85	85	45	67,5
ISA-D 105	105	55	82,5
ISA-D 145	145	75	112,5
ISA-D 170	170	90	120
ISA-D 210	210	110	165
ISA-D 310	310	160	240
ISA-D 390	390	200	300
ISA-D 460	460	250	375
ISA-D 580	580	315	472,5
ISA-D 650	650	350	525
ISA-D 820	820	450	675
ISA-D 950	950	525	787
ISA-D 1100	1100	630	945
ISA-D 1400	1400	800	1200
ISA-D 1800	1800	950	1425
ISA-D 2150	2150	1250	1875
ISA-D 2400	2400	1350	2025
ISD-D 2700	2700	1750	2625
ISA-D 3000	3000	1850	2775
ISA-D 3500	3500	2000	3000

5-6 Power Steps Line/Inside Delta Connection

5.6 Control Wiring



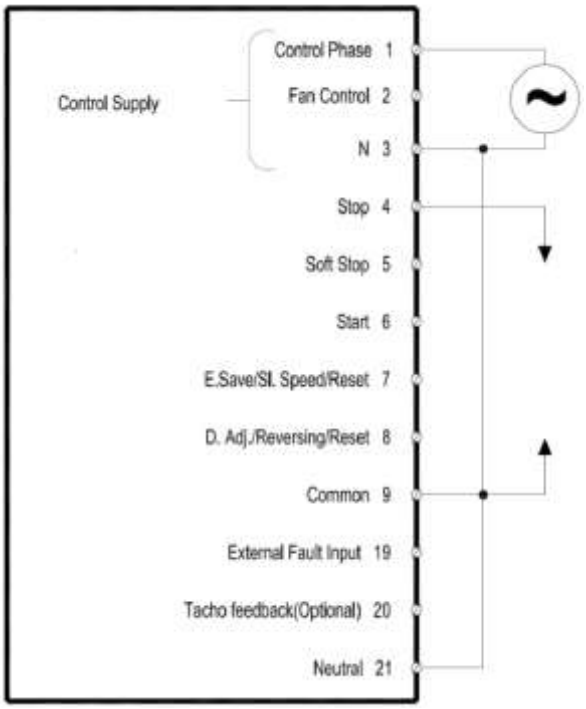


5-7 Terminal Overview

Control Voltage **Terminals 1 – 3**

110 – 120 V or 220 – 240 V, 50 / 60 Hz (as indicated on nameplate) are required to power the incorporated control and by-pass contacts. This voltage can be from a grounded line, control transformer or a “Trenntrafo”.
Upon DIP-switch the voltage steps 110 V/ 220 V can be changed.
110V/DC can be supplied by special order for starter sizes B-F.

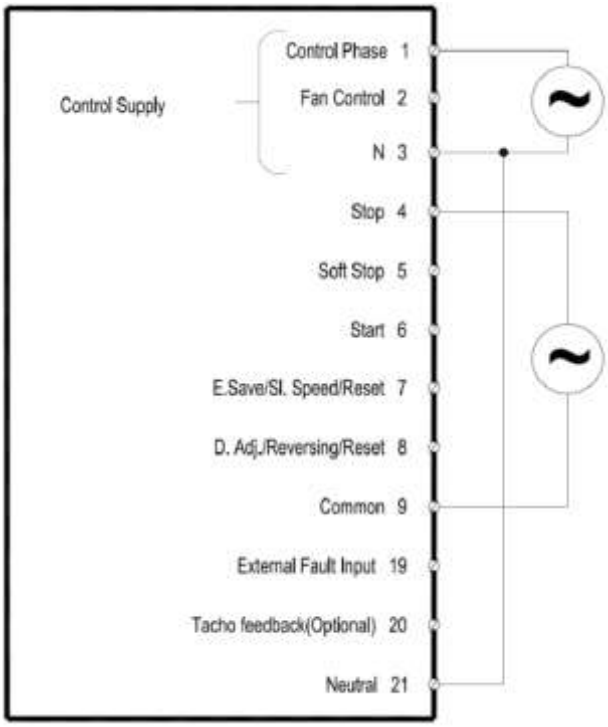
Note: It is recommended that terminals 1 – 3 be always connected to the control supply.



Control voltage and control inputs from the same source.

Note:
Control supply must be protected by 6A fuse.

5-8 Control voltage and control inputs from the same source



Seperate sources for control voltage and control input.

Note:
Control supply must be protected by 6A fuse.

5-9 Control voltage and Control Inputs from the same source

Fan's Supply Voltage **Terminal 2**

An internal junper, connected between terminal 2 and fan enables three modes of operation. Fro fan power consumption, see technical specification.

Continuous mode (factory set) – Fan operates as long as control supply is connected to terminals 1 and 3.

External control mode – Fan operates as long as control voltage of terminal 1 is connected to terminal 2.

Automatic mode – Fan begins operation when start signal is iniated and stops approximately 5 minutes after start signal. When stop respectivel soft stop signal is initiated the fan begins operation and stops after 5 minutes. Connect internal jumper right position of terminal J1 (C).

Warning
Automatic mode may be used only if by-pass contactor is directly controlled by the ISA-D end of acceleration contact.

Control Inputs

Incorporating opto-couplers to isolate the microprocessor circuitry
The standard soft starter is supplied for 220-240 V, 50/60 Hz, Control Supply and Control Input voltage. By special order Control Inputs may be supplied for voltage levels of 24-240 V AC or DC.

Stop **Terminal 4**

Input from one normal close (N.C.) contact. To stop the motor disconnect control voltage from terminal 4 for at least 250 msecs.

Soft Stop **Terminal 5**

Input from one normal close (N.C.) contact. To soft Stopp the motor disconnect control voltage from terminal 5 for at least 250 msecs.

Note: If soft stop is not required, connect a jumper between terminals 4 and 5.

Start **Terminal 6**

Input from one N.O. contact. To start the motor connect control voltage to terminal 6 for at least 250msecs.

Note:

1. Motor will start only if terminals 4 and 5 are connected to control voltage.
2. Reset after fault is not possible as long as a start signal is present.

Energy Saving / 1/6 of Nominal Speed / Reset **Terminal 7**

Input from a N.O. contact - selection between above functions is made from the keypad or through the communication (Modbus or Profibus).
When ENERGY SAVE function is selected - connect terminal 7 to control input voltage by a jumper for automatic operation, upon load decrease.
When connected through a N.O. contact, closing the contact operates Energy Save.
When SLOW SPEED function is selected - connect control input voltage to terminal 7 before starting. When start command is initiated motor will run at 1/6 nominal speed for 30 seconds maximum. Closing terminal 7 while motor is running will not have any effect.
When RESET function is selected - connect terminal 7 to control input voltage (use a N.O. momentary contact) to reset the ISA-D.

Dual Adjust / Reverse/ Reset **Terminal 8**

Input from a N.O. contact. Selection between above functions is made from operating board or communication (see I/O Programming)

When DUAL ADJUSTMENT function is selected - connect terminal 8 to Control Input voltage to operate the ISA-D with the DUAL ADJUSTMENT characteristic. DUAL ADJUSTMENT characteristic is programmed. You can switch between the primary and DUAL ADJUSTMENT settings before and/or during starting.
When dip switch #3 is set to on, DUAL ADJUSTMENT operates as D.ADJ.:GENERATOR PARAMETERS. Use this mode if the normal starting process fails, i.e., SHORTED SCR or WRONG CONNECTION faults occur and, after testing, operator is sure that SCRs, motor and motor connections are not faulty.

> **Attention:** When starting motor from Diesel generator or weak power set DIP Switch #3 „On“. Connect terminal 8 to control voltage to operate starter with generator parameters.

When SLOW SPEED REVERSE function is selected - connect Control Input voltage to terminal 8 to reverse direction. In order to operate in SLOW SPEED REVERSE, terminal 7 must be programmed as SLOW SPEED and Control Input voltage must be connected to terminal 7 as well. You can give the reverse command before the motor is started or during operation at SLOW SPEED. Connecting Control Input voltage to terminal 8 before motor is started, starts the motor in reverse direction. Connecting Control Input voltage while motor is running at SLOW SPEED stops the motor for 0.6 – 2 sec (according to motor size) before reversing its direction.

Control voltage neutral **Terminal 9**
Common for terminals 4, 5, 6, 7, 8.

Note: When control supply and control input voltage are from the same source, connect a jumper between terminals 3 and 9.

Immediate/Shear-pin Relay **Terminals 10-11-12**
Voltage free (Ausgeführt als Wechsler) 8A, 250V/AC, 2000VA max.
Selection between functions is made through communication (siehe I/O Programming).

Programmable functions:

1. **Immediate relay**, changes it's position upon start signal and in case of motor stop (end of soft stop process).

When immediate relay is selected, the contact changes its position upon Start signal. The contact returns to its original position on Stop signal, in case of fault or upon control supply outage. When soft stop is operated, the contact returns to the original position at the end of the soft stop process. The immediate contact incorporates ON & OFF delays from 0 – 60 secs. each.

The immediate contact con be used:
- To release a motor break.
- For interlocking with other systems.
- For signaling.
- To switch from standard to dual adjustment settings with a time of delay from start signal

2. **Shear-pin / O/C relay**, changes position upon shear-pin detection

When O/C shear-pin relay is selected, the contact changes position upon shear-pin detection. Starters trip can be dalyed 0 – 5 secs.

The O/C Shear-Pin contact can be used:
- For interlocking with other systems
- For signaling.
- with delay for operating a reversing combination. When shear-pin is detected thus allowing clearing a jam condition for e.g. for a shredder.

Fault Relay **Terminals 13-14-15**
Voltage free 8A, 250V/AC, 2000VA max. , selection between functions is made through communication (see I/O Programming). The relay changes its position on fault when internal protection functions or external fault occur.

The relay is programmable to the following functions:
1. Standard Relay
Upon alarm the relay is energized upon fault. The contact returns to its original position after fault has been removed and starter was reset.
2. 0-Voltage save relays (Trip-fail safe) relay
The relay is energized immediately when control supply is connected and de-energizes upon fault or disconnection of control voltage.

End of Acceleration – Contact **Terminals 16-17-18**

Voltage free 8A, 250V/AC, 2000VA max. changes its position at the end of acceleration, after an adjustable time delay, 0 – 120 secs..
The contact returns to its original position when Energy saver is operated, stop- or soft stop signals, on fault condition, return to 1/6 RPM or upon voltage outage.
The end of Acceleration contact can be used for:

- Closing a by-pass contactor (see 3.3 By-pass)
- Activating a valve after compressor has reached full speed.
- Loading a conveyor after motor reached full speed.

External Fault **Terminal 19**

.

Attention
Only potential free contacts, connected between terminals 19 and 21.
Don not connect any voltage to terminal 19. Any connection of voltage to this terminal may cause soft starter damage respectively an uncontrolled motor start-up.

Note:

- Wires connecting terminals 19 and 21 should not exceed 1 meter in length.
- External fault only can be used when terminal 21 is connected to neutral or ground.
- Do not use external fault while using option #4 – isolation test.

Tacho Generator – Optional **Terminal 20**

Provides linear acceleration and deceleration.• Requires high quality tacho generator on motor shaft, output voltage 0-10VDC, linear speed/voltage ratio. Consult factory for further information before using the tacho feedback feature.

Neutral **Terminal 21**

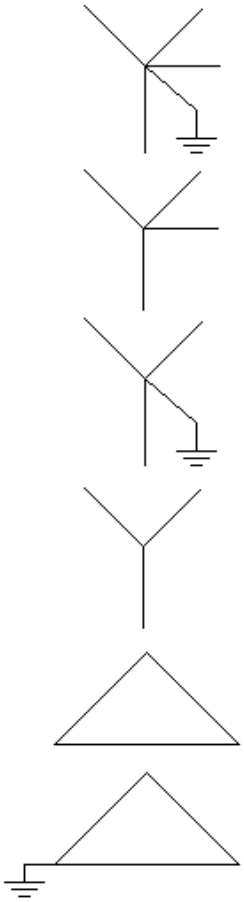
When Neutral wire is available, connect terminal 21 to Neutral or Ground.

Warning
Only potential free contacts, connected between terminals 19 and 21.
Don not connect any voltage to terminal 19. Any connection of voltage to this terminal may cause soft starter damage respectively an uncontrolled motor start-up.

Note:

Only potential free contacts may be connected to terminal 21! Do not connect any voltage to terminal 21! Any connection of voltage to terminal 21 may disrupt ISA-D operation, and cause damage to the ISA-D or the motor!

Terminal 21 – Connections with various network



3P + N + GR terminal 21 with neutral

Connect 3P N terminal 21 with

Connect 3P GR terminal 21 to the

Let 3P terminal 21 is not connected

Let 3P terminal 21 is not connected

Let 3P + GP terminal 21 is not

5-10 Terminal 21 – Connections with various network

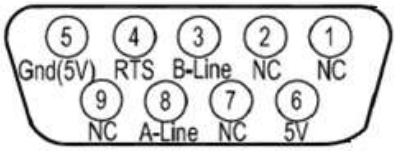
5.7 Control Wiring with options

RS-485 Communication (option #3M) **Terminals 23-24**

Terminals: 23 (-),24 (+)
Standard RS-485, Half Duplex with MODBUS Protocol, boud rate 1200, 2400, 4800, 9600 BPS. For the bus connection only twisted shielded wire should be used. Connect shield at PC/computer side.
The terminals 4 & 5 must be wired to control supply for start/stop–function in communication mode.
Up 32 units can be connected for Modbus RS485 communication. For reliable communication, units should be installed in the vicinity of 200m maximum, from the first to the last unit.

Profi process field bus communication (option #3P) **Profi process field bus plug**

- Profibus DPV0 and DPV1, up to 12 MBPS.
- D type 9 pin connector is applied.
- Control, monitoring and setting parameters can be achieved via the Profibus connection.
- Setting is possible only when DPV1 is implemented.
- Refer to the Profibus manual



5-11 connectors Profibus

Isolation Alarm (option #4) **Terminals 25-26-27**

Voltage free 8A, 250 V/AC, 2000 VA.
The relay status changes its position when motor isolation level decreases below isolation alarm level. It is a deviation alarm which does not prevent the motor from starting. The contact returns to its original position, after fault has been removed and starter reset or upon Control Supply disconnection or when insulation level increase above Alarm setpoint for more than 60 sec.

Note:

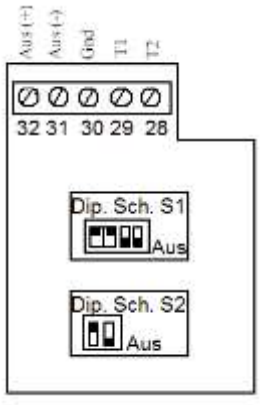
1. Do not use external fault while using option #4 - Isolation Alarm.
2. Isolation test can be performed only when line voltage is not connected to the soft starter. For correct operation of isolation test, it is important that the soft starter is properly ground and that the control modul is propverly fastened to the power section.

3.

Analogue Input/Output (option #5) **Terminals 28-32**

The analogue card incorporates 2 functions:

- Thermistor – Input
- Analog Output



5-12 Terminal Overview 28-32

Thermistor Input **Terminals 28-29**

- Programmable as PTC or NTC thermistor.
- Trip value is adjustable between 1 – 10 kΩ.
- Internal delay of 2 sec.

Ground Terminal (GND) **Terminal 30**

Für Kabelschirmung (Gerät muss sicher geerdet sein).

Analogue Output **Terminals 31, 32**

Terminal: 31 (-), 32 (+)
Dip switches allow selection between:

0- 10 V/DC 0- 20 mA 4- 20 mA

The analogue output value is related to motor current (starter FLC). It can be programmed to normal oer inverted output (Starting position = Normal). Maximum value (20 mA or 10 V/DC) is related to twice the soft starter current; 2 x I_N of ISA-D (Starter FLC).

Please note, that the Display starts at 10% of the ISA rated current on account of the accurancy.

Dip No.	4 – 20 mA*	0 – 20 mA	0 – 10 VDC
Dip-Sw..S1 #1	ON	ON	OFF
Dip-Sw..S1 #2	ON	ON	OFF
Dip-Sw..S1 #3	OFF	OFF	ON
Dip-Sw..S1 #4	OFF	OFF	ON
Dip-Sw..S2 #1	ON	OFF	OFF
Dip-Sw..S2 #2	---	---	---

* Standard setting

5-2 Analogue Output

Note:

1. It is important that the ISA-D is properly grounded, and control module is tightly fastened to the power section.
2. The options #4 and #5 (Isolation Alarm and Analogue Input/Output) may not be incorporated together in the control board.
3. Use shielded twisted cable for the connection of analogue input- and output signals.

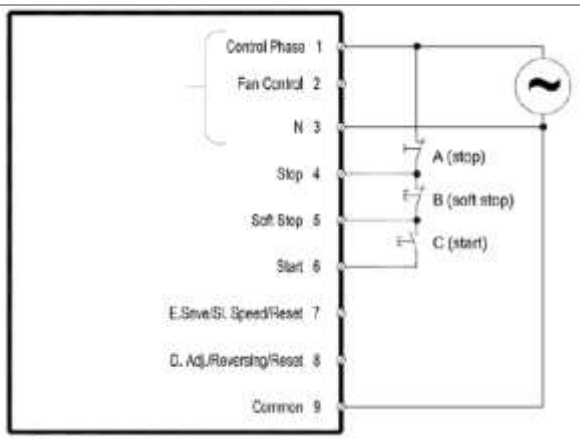
Terminal		Function
	1	Control Voltage N
	2	
	3	
	4	Stop
	5	Soft stop
	6	Start
	7	Energy saving function 1/6 RPM
	8	Reserve / Reset
	9	Bezugspotential
	10	Relay „Operation“
	11	
	12	
	13	Relay „Alarm“
	14	
	15	
	16	Relay „End of Acceleration“
	17	
	18	
	19	External Fault
	20	Tacho Feedback
	21	Nullleiter
Option #3	22	No function
	23	(-) RS 485
	24	(+) RS 485
Option #4	25	Relay „Isolation Alarm“
	26	
	27	
Option #5	28	Thermistor
	29	
	30	Ground (-) Analog Output (+) Analog Output
	31	
	32	

Warning
Any false connection to terminal 19 and 21 may cause soft starter damage respectively an uncontrolled motor start-up.

Warning
Do not use fault contact to trip off an upstream contactor. When Start / Stop input will maintain, thus resetting the starter and the motor will restart immediately upon voltage restoration.

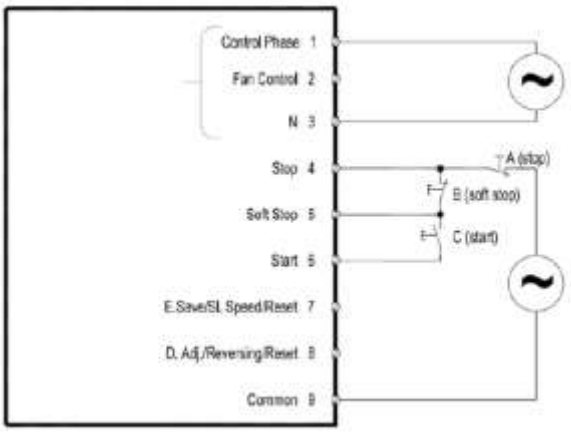
Attention
Start / Stop with a maintained contact!
When the line contactor is operated by a maintained contact in case of line failure, the motor will automatically restart upon voltage restoration. When resetting after a fault with Reset button the motor will restart immediately. It is therefore recommended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

1. Start-, Soft Stop- and Stop Button, Control Voltage and Control Inputs have a single supply source. If soft Stopp is not used connect a jumper between terminals 4 – 5, Stopp contact between 1 and 4.



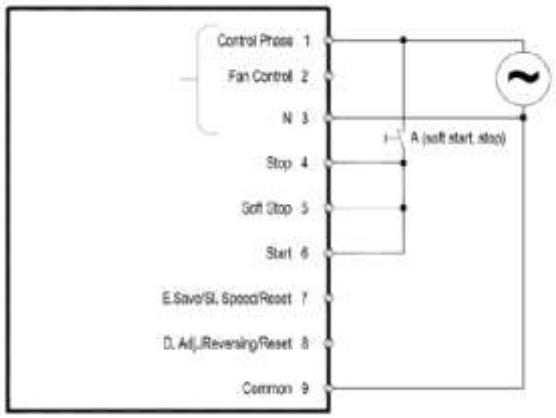
5-13 Control Wiring Exp. 1

2. Start-, Soft Stop- and Stop button, Control Voltage and Control Inputs have separate supply sources. If soft stop is not used connect a jumper between terminal 4 – 5.



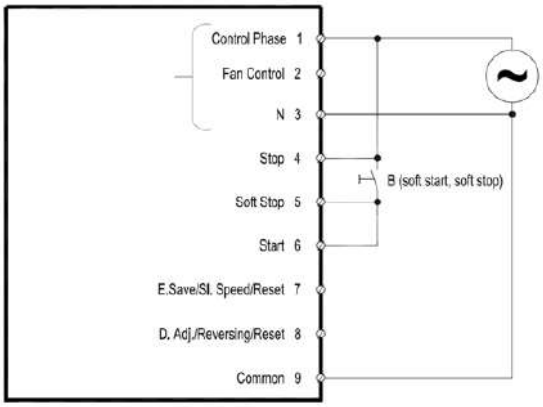
5-14 Control Wiring Exp. 2

3. Motor will soft start when A closes and stops immediately when A opens.



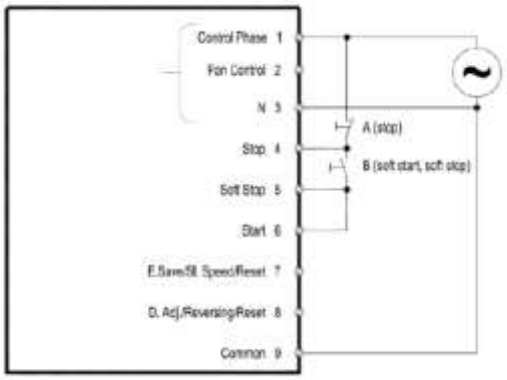
5-15 Control Wiring Exp. 3

4. Motor will soft start when B closes and soft stops when B opens.



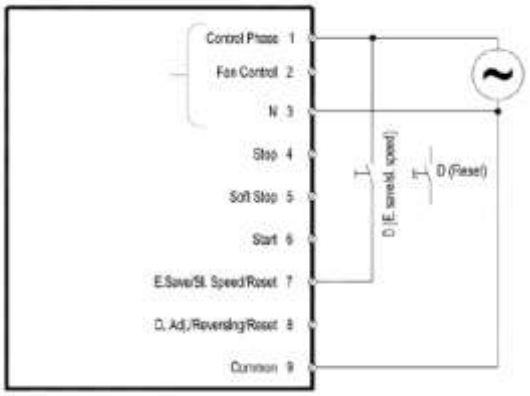
5-16 Control Wiring Exp. 4

5. Motor will soft start and stop with contact C. Contact C1 will operate immediate stop (emergency stop).



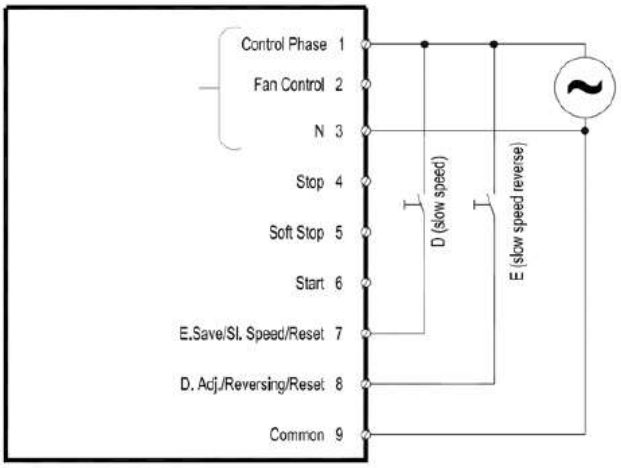
5-17 Control Wiring Exp. 5

6. Close C to operate energy saving, 1/6 RPM or Reset (as selected).



5-18 Control Wiring Exp. 6

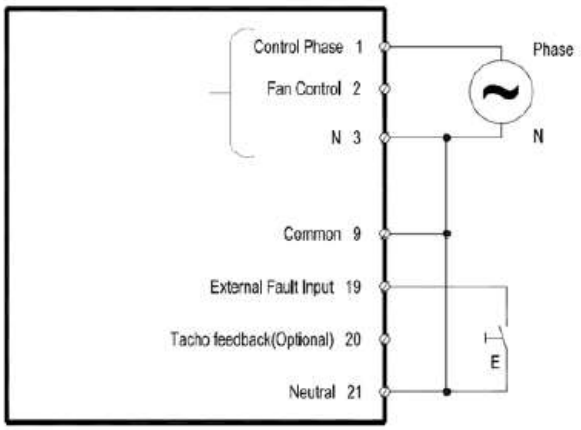
7. Close C to operate Dual Adjustment, Reversing or Reset (as selected).



5-19 Control Wiring Exp. 7

* C must be of momentary type when used as Reset.

8. External Fault Contact. The motor will Stopp 2 sec. after contact C closes.



5-20 Control Wiring Exp. 8

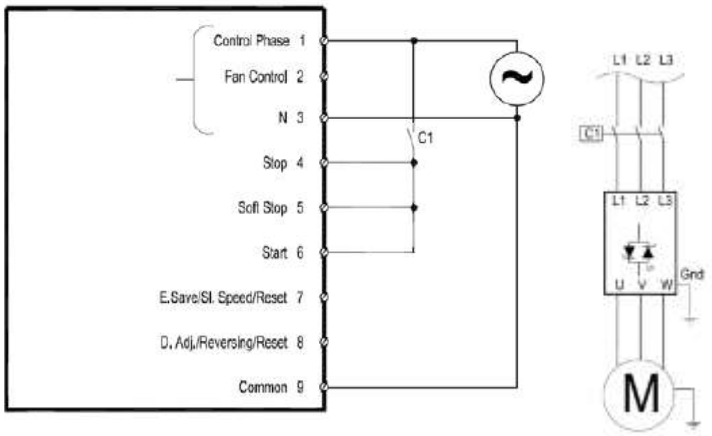
Must no be used when 21 is not connected to neutral/ground or when isolation test is used.

Note: 1. Terminal 21 may be connected to terminal 3 only if terminal 3 is at neutral or and ground potential.
2. Resetting is possible only after start signal is removed.

Start with Line Contactor

This system is mainly used when the ISA-D is retrofitted into an existing system.
Line power and start signal are switched on the soft starter upon closure of the line contactor.
The line contactor will have control function. The soft starter will operate as long as the line contactor is closed.

Control Voltage obtained from one phase of line voltage and neutral must match starters control supply voltage indicated on the nameplate.



5-21 Control Wiring with Line Contactor

Anmerkung:

1. It is recommended that terminals 1 and 3 be always connected to control voltage. Otherwise fault may not been shown.
2. Soft stop can not be applied for this wiring diagram. If soft stop is required, the line contactor can be held by the immediate relay contacts because the relay is de-energized only at the end of the soft stop.
3. Use also the immediate relay contact if you do not use the soft stop function. If it open before „Under Voltage/Phase Loss“ fault will occur. It is recommended to use a time delay timer to prevent possible faults.
4. Ensure that auxiliary contact C1 closes after the main contactor. The soft starter provides a 500 msec. delay for the start signal. If it closes before „Under Voltage/Phase Loss“ fault will occur. It is recommended to use a time delay timer to prevent possible faults.

By-pass Contactor

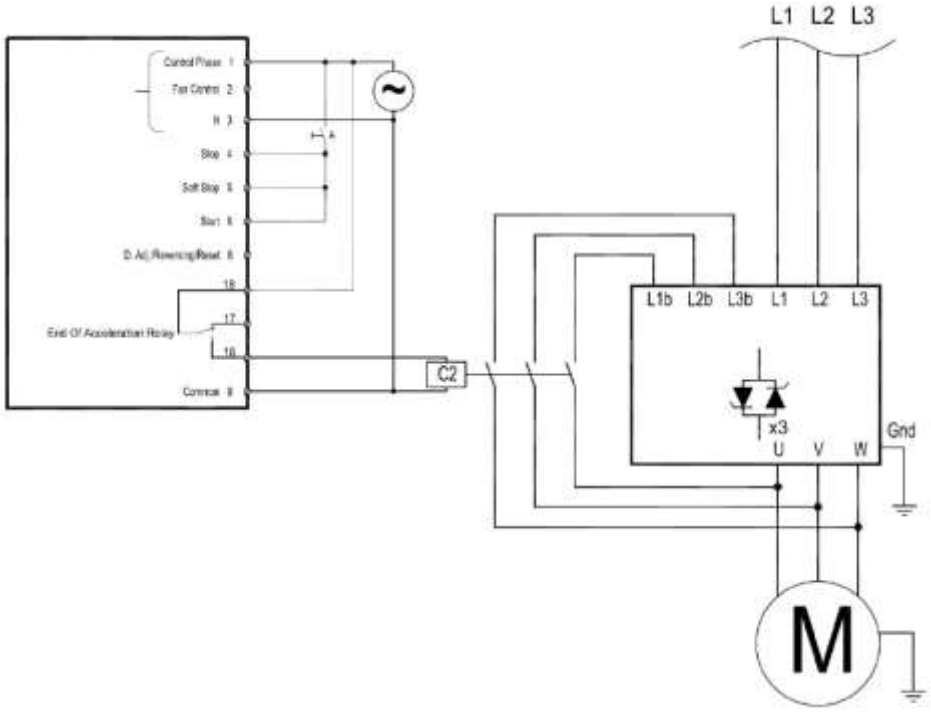
End of Acceleration contact is activated after an adjustable time delay closing the by-pass contactor.

The contact will return to ist original position when:

- Stop-, Soft Stop or Alarm Signal (Fault Signal) are initiated
- Energy Saving function is initiated
- 1/6 Round per Minuted is initiated
- Switch-off of Control Voltage

When closing the by-pass contactor the motor current will flow through the contactor and not through the thyristors.

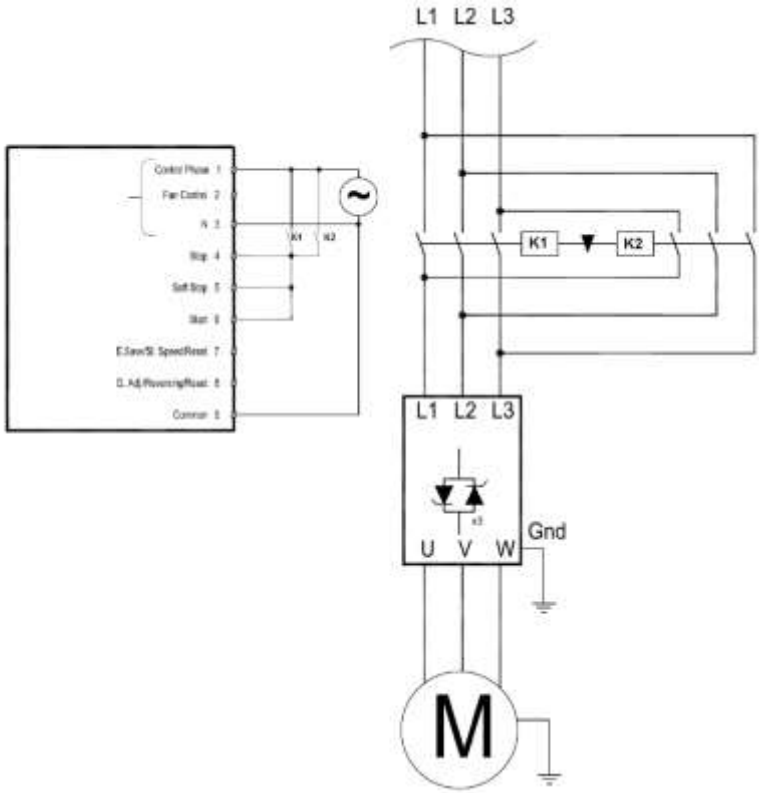
Note: When a by-pass contactor is used it is recommended to order the soft starter with option 9, so that the current proctections are operative for motor protection. When a Soft Stop signal is given by-pass contactor opens. Thereafter the thyristor is taking over the load and the voltage will gradually ramp down to zero, soft stopping the motor.



5-22 Control Wiring By-Pass Contactor

Reversing with 2 series contactor

A normally open auxiliary contact in each of the two reverse contactors K1 & K2 controls the Start / Stop command. The soft starter provides a 500 msec. delay for the start signal. If it closes before „Under Voltage/Phase Loss“ fault will occur. It is recommended to use a time delay timer to prevent possible faults.
Closure of either contactor will supply main power and a start signal to the ISA-D.
It is recommended to employ a mechanical interlock between the forward and reverse contactors. It is required to delay the transfer between opening of one contactor and closing of second contactor.
Phase Sequence fault must be disabled to operate reversing contactors at the line input of the ISA-D



5-23 Control Wiring with Reversing Contactors

Note:

1. It is recommended to employ a mechanical interlock between the Reverse Contactors.
2. It is required to delay the transfer between opening of one contactor and closing of a second contactor through an external time delay relay.
3. Phase sequence fault must be disabled to operate.

Two Speed Motor

Used for Two Speed Motor:
When soft start is required during transfer from low to high speed the ISA-D should be installed downstream to the high speed contactor (position 1) and operated by its auxiliary contact (13/14) for high speed. When soft start is required for both low and high speeds, the ISA-D should be mounted before both contactors (position 2) and operated by an auxiliary switch each of the downstream contactors (13/14).

Note:
If two different motor ratings are required the soft starter should be adjusted to highest motor speed. In case of different motor speed and start-up conditions use the Dual Adjustment feature which allows two different settings.

The following settings may be adjusted:

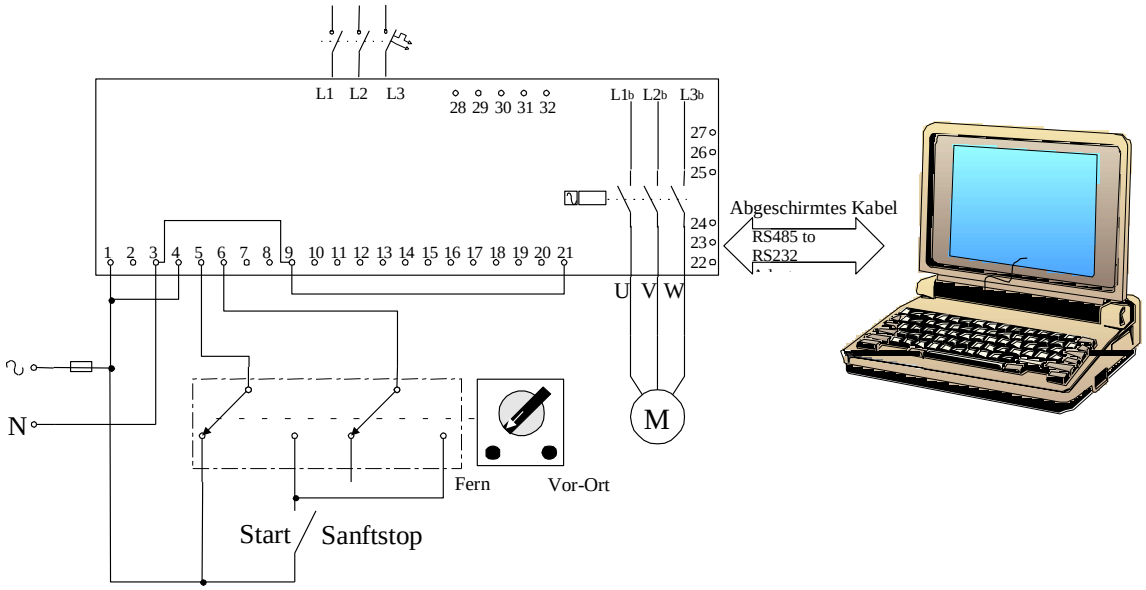
- Initial Voltage (Initial Motor Torque)
- Starting Current Limit
- Acceleration Time
- Deccelartion Time
- Motor Full Load Ampere

Using two starting characteristics, the ISA-D will accelerate using standard characteristics. After speeds up the first step connect voltage to input terminal 8 is switched on using the Dual adjustment for the second step to complete acceleration. If the Motor is smaller than ½ the soft starter you have to use an external motor protection relay.

Wiring Diagrams – Communication
Operationg via communication link with Local / Remote selector switch

*Remote: via Communication link
*Local: Soft start / Soft stop by maintained contact

The communication enables remote parameter settings and reading. For start, Stopp, soft stop, dual adjusts, etc., terminals 4 and 5 must be wired as shown.



5-24 Wiring Diagram with Communication Remote/Local Start/Stop

Soft Sart und Soft Stop

- Program the „Serial Link Number“ in the communication page to a number between 1–247.
- Disconnect control supply, so the new information will be loaded on the next time you turn it on.
- Connect a communication line (twisted, shielded cable) with its (+) to ISA-D terminal 24 and – to terminal 23, connect the other end to your computer containing RS 485 communication port with MODBUS protocol.
- Connect other ISA-D terminals as follows:
  1. Terminal 1 and 3 with control supply
  2. Terminal 4 to control voltage phase
  3. Terminal 9 to Neutral (or the Common for terminals 4,5 and 6).
  4. During operation via communication link, terminal 5 is connected through selector switch to control supply. Start und Soft Stop commands are controlled through the communication port. During operation in local mode the terminals 5 and 6 are connected to control supply through the start/stop toggle switch.
  5. Terminal 21 should be connected to neutral or ground.

Warnung:
The computer must be grounded when communicating with ISA-D. (unless using a Lap-Top Computer)

Operation via communication link Local/Remote selector switch

- Remote: via communication link
- Local: Soft Start / Soft Stop by maintaining contact

Soft Start and Soft Stop

Same as the wiring for soft start and soft stop except point 4:
4. During operation via communication link the terminals 4 and 5 are connected through the selector switch with the control supply. Start and Stop commands are controlled through the communication port. During operation in local mode the terminals 4,5 and 6 are connected to Control Supply through the Start/Stop toggle switch.

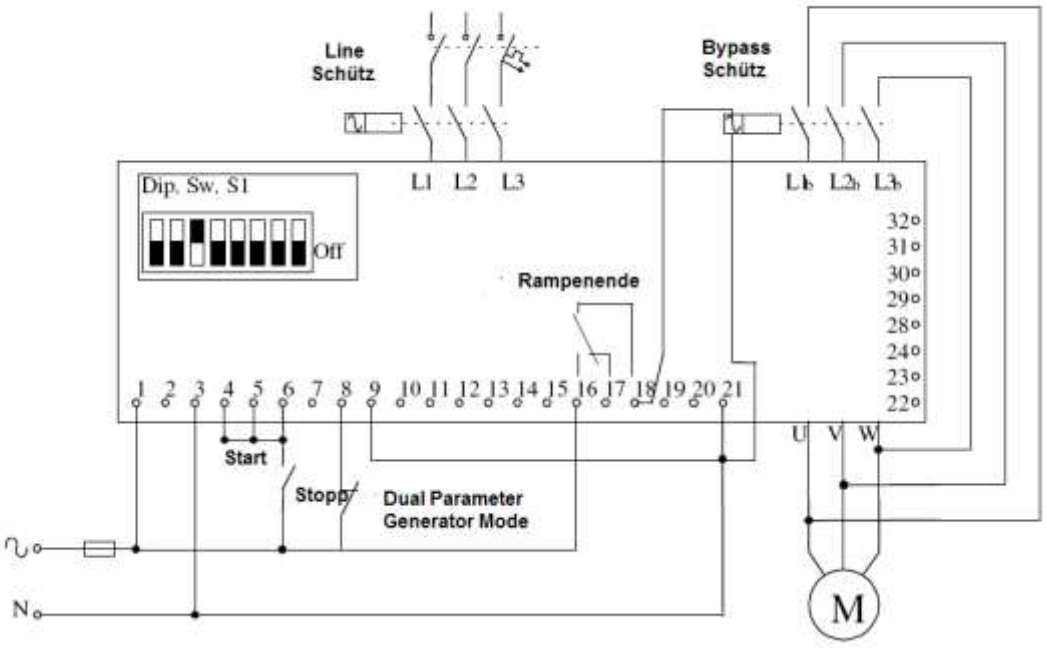
Operation via communication link with momentary contacts (Push-Buttons) for soft start, immediate stop, soft stop

Soft Start, Soft Stop and Immediate Stop

Same as the wiring for Soft Start and Soft Stop except for the points 2 and 4:
2. Connect Terminal 4 as described under point 4.
4. During normal operation mode terminals 4 and 5 are connected to control supply through the immediate stop and soft stop push buttons (each normal opening closer). During local operation the functions will be initiated by pressing the start, soft stop and immediate stop push button.

Note: The communication (data retrieval and statistics) is active at all times! When control signals (start, stop, etc.) are required, terminals 4 and 5, have to be wired in accordance with the appropriate wiring diagram:

1. Maintained soft start and stop
2. Maintained soft start and immediate stop
3. Soft start/Stopp and immediate Stopp via push-button control



5-25 Wiring Examples – Diesel-Generator

Start with Diesel-Generator

1. When starting from a Diesel-Generator, its voltage regulator (especially older type regulators) may be affected during starting process, causing rapid voltage fluctuations (~350V bis ~500V in 400V systems). In these rare cases, the voltage regulator must be upgraded. Please consult your Diesel-Generator or regulator supplier.
2. In most cases where voltage, current or frequency is unstable a special routine may be applied to overcome the starting difficulty. Use the procedure below:
   a) Set dip switch 3 to position „ON“ (as shown above).
   b) Insert a contact (or jumper) between control supply and terminal 8 (Dual Adjustment Terminal). Close the contact to operate in Generator mode. Dual Adjustment LED will light when operating in Generator Mode.
   c) Set Dual Adjustment Parameters to the values necessary for the application (e.g. faster acceleration, lower current limit).

When operating from line or Diesel-Generator set normal parameter for starting characteristics for line and suitable for Diesel-Generator on Dual Adjustment setting. When starting from line the standard settings will be operative. Upon starting from Generator, close contact between Control Supply and Terminal 8 to operate on Generator Mode.

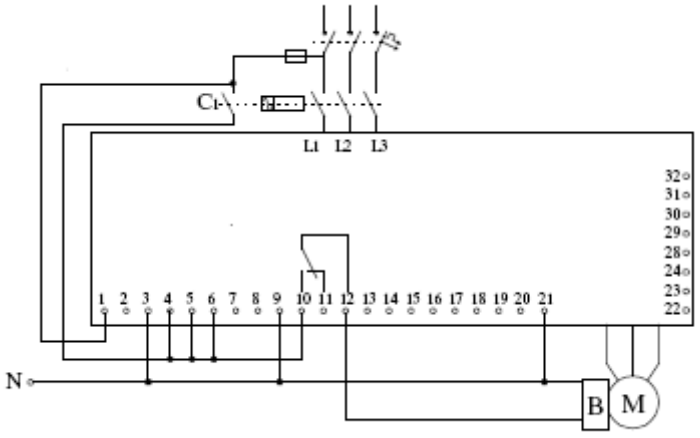
Note: The Diesel Generator should be sufficiently sized depending on the Engine and Alternator. Normally the recommendations are from 0.27 to 0.65 times DOL Start KVA. The Diesel Generator Supplier must be consulted. This is only IGEL Suggestions from various field applications.

Warnung:

1. Motor can not run no-load. Otherwise vibrations may occur during soft starting and soft stopping.
2. When using extended range of parameters, use maximum precaution to avoid motor and soft starter burn out.
3. Disconnect all other loads before starting for the first time to prevent damages due to voltage fluctuations.
4. Disconnect all Power Factor Capacitors when operating with Diesel-Generator.
5. Connect terminal 21 only to terminal 3 and 9 when these terminals are connected to neutral at ground potential.
6. The external „Fault input“ (Fault Alarm) only can be used when terminal 21 is connected to neutral or to ground potential. Do not connect any voltage to terminal 21. Any connection of voltage to this terminal may cause soft starter and motor damages.

Brake Motor

Upon starting signal the immediate contact is activated releasing the break. The immediate contact will operate without delay as long as Immediate Relay ON is set to 0. Upon stopping or at the end of acceleration process the contact returns to its original position and the break will be voltage free.



5-26 Wiring Examples – Brake Motor

Note: Use an interposing relay when:

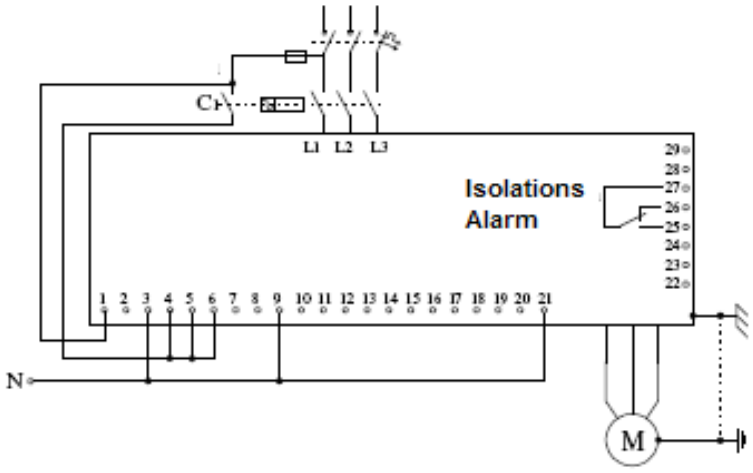
1. Brake Voltage is different from starter’s control input voltage or is greater than 230 V.
2. Break current is greater than relay’s maximum current (8A).

Attention: It is not allowed to use soft starters in vertical hoist applications.

Isolation Test Wiring

The following conditions must exist for the isolation circuitry to operate. These are the following points:

1. „ON“ and „Stop“ LED must be ON
2. The series contactor has to be open.
3. Motor und Soft Starter must be properly grounded.
4. External Fault must not be used.



5-27 Wiring Examples – Isolation Test

Note: The isolation circuitry begins operation after 120 sec after motor stop.

5.8 Options

Options (See Odering Information)	
Option # 3	Communication
Option # 4	Isolation Alarm
Option # 5	Analogue Thermistor Input / Current Output
Option # 8	Type for hazardous areas
Option # 9	Type for By-pass-Contactor
Option # A	Special Width for Size C-D
Option # B	Line und motor connections on the ground (only for special made orders, sizes C and D)
Option # D	Remote Display
Option # L	LCD lights
Option # M	Lloyds Register ENV-1, ENV-2 approval
Option # U	UL & cUL approvals

5-4 Options

5-28 Info Option D

5.9 UL, cUL Installation Instructions

Max Motor FLA [A]	Min. Cross Section of Copper Cable [mm²]	Screws Size (Connection Terminal)	Mechanichal Torque [Nm]
8	4 x 1.5 N2uv	M5	3
17	4 x 2.5 N2uv	M5	3
31	4 x 4 N2uv	M5	3
44	4 x 10 N2uv	M6	4,5
58	4 x 16 N2uv	M6	4,5
72	4 x 16 N2uv	M6	4,5
85	4 x 25 N2uv	M8	15
105	4 x 35 N2uv	M8	15
145	3 x 50 H 25 N2uv	M8	15
170	3 x 70 H 35 N2uv	M8	30
210	3 x 95 H 50 N2uv	M10	30
310	3 x 150 H 70 N2uv	M12	60
390	3 x 185 H 95 N2uv	M12	60
460	3 x 240 H 120 N2uv	M12	60
580	2 x (3 x 150H70) N2uv	M12	60
820	3 x (3 x 185H95) N2uv	M12	60
950	3 x (3 x 240H120) N2uv	M12	60
1100	4 x (3 x 240H120) N2uv	M12	60
1400	5 x (3 x 240H120) N2uv	M12	60
1800	8 x (3 x 240H120) N2uv	M12	60
2500	8 x (3 x 300H150) N2uv	M16	120

5-5 Power Selection for UL Restrictions

6 Parameter Settings

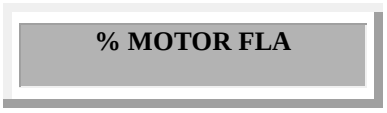
6.1 Menu Description (Overview)

Reviewing and modifiying parameters

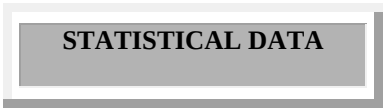
1. Press mode button several times until you reach the required Mode page.
2. Press Select button to review parameters of this Mode.
3. When reaching the required parameter, modifying its values with ▲ and ▼ buttons.
4. To store the new parameters press „Select“ until „Store Enable“ appears and then press Store button.

Note: Press Mode or Select buttons continuously increase parameter change speed.

Mode Pages
Upon initiation of the soft starter the LCD displays motor’s operating current:



By pressing the Mode button all pages can be reviewed.
When DIP- Switch 1 is set to ON, all Mode pages appear.
When DIP-Switch is set to OFF, the following Mode pages marked ** will not appear.



Gerneral note: If you are not sure what the parameter says, please leave factory setting.

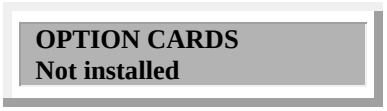
Display Mode – Page 0

In this mode, parameters cannot be adjusted.

Displays operating current as a percentage of motor FLA.

Note:
This is standard display. After pressing Mode or Select, a time delay is initiated. Following the delay, the LCD returns back to display „ % Motor FLA".

When option cards are not incorporated, the LCD shows:



This concludes the display mode.
Pressing „Select" at this point returns to the first display.

%MOTOR FLA	MAIN PARAMETERS	START PARAMETERS	STOP PARAMETERS	DUAL ADJUSTMENT PARAMETERS
AMP. VOLT 0 0	ISA FLC 105 AMP	SOFT START CURVE 0 (STANDARD)	SOFT STOP CURVE 0 (STANDARD)	DA: INITIAL VOLTAGE 30 %
MOTOR ISOLATION 52.8 Mohm	MOTOR FLA 105 AMP	ON TACHO GAIN 0 (MIN.GAIN)	STOP TACHO GAIN 0 (MIN.GAIN)	DA:GENERATOR PARAMETERS
Thermistor Resistance 3,1 ohm	Rated current 45 kw	PULSE TIME 0 SEC	DECCELARATIN TIME 0 SEC	DA:CURRENT LIMIT 400% MOTOR CURRENT
No option card available	Anschlussart LINE	INITIAL VOLTAGE 30%	FINAL TORQUE 10 SEC	DA:ACCELERATION TIME 10 SEC
Power	MINIMUM CURRENT 0% MOTOR FLA	CURRENT LIMIT 400 %	STORE ENABLE MAIN PARAMETERS	DA:DECCELARATION TIME 0 SEC
Power Factor	MINIMUM CURRENT DELAY 10 SEC	ACCELERATION TIME 10 SEC		DA:MOTOR FLA 105 AMP
	MAX. OVER CURRENT 850 % MOTOR FLA	MAXIMUM ACCELERATION TIME 30 SEC		STORE ENABLE DUAL ADJUSTMENT PARAMETERS
	OVER LOAD 115% MOTOR FLA	NUMBER OF STARTS 10		
	OVERLOAD DELAY 4 SEC AT 5 X IN	START PERIOD 30 MIN		
	UNDERVOLTAGE 300 V	START INHIBIT 15 MIN		
	UNDERVOLTAGED ELAY 5 SEC	RUN CONTACT DELAY 5 SEC		
	UNDERVOLTAGE 480 V	STORE ENABLE MAIN PARAMETERS		
	OVERVOLTAGE DELAY 2 SEC			
	STORE ENABLE MAIN PARAMTERS			

ENERGY SAVING&1/6 RPM PARAMETERS	FAULT PARAMETERS	I/O PROGRAMING PARAMETERS	COMMUNICATION PARAMTERS	STATISTICAL DATA
SAVING ADJUST 0(MIN)	PHASEN SEQUENCE Y/N NO	PROG. INPUT 7 ENERGY SAVER	Comm. Protocol Modbus	TOTAL ENERGY KWH
1 / 6 RPM TORQUE 8	ISOLATION ALARM OFF	PROG. INPUT 8 DUAL ADJUSTMENT	BAUD RATE 9600	LAST STRT PERIOD NO DATA
1 / 6RPM MAXIMUM TIME 30 SEC	ISOLATION TRIP OFF	FAULT RELAY TYPE STANDARD RELAY	PARITY CHECK EVEN	LAST START MAX I NO DATA
STORE ENABLE SPECIAL FEATURES	AUTO RESET NO	IMM/S.PIN RELAY IMMEDIATE	SERIAL LINK NO. 248 (OFF)	TOTAL RUN TIME 0 HOURS
	THERMISTOR TYPE PTC	RELAY ON DELAY 0 SEC		TOTAL # OFF START 0
	THERMISTOR TRIPP OFF	RELAY OFF DELAY 0 SEC	STORE	LAST TRIP NO DATA
	ENABLE STORE FAULT PARAMETERS	ANALOGUE OUTPUT NORMAL	MODBUS: ▲ PROFIBUS: ▼	LAST CURRENT 0 % OF FLA
		STORE ENABLE I/O PROGRAMING PARAMETERS	COMM. PROTOCOL PROFIBUS	TOTAL # OF TRIPS 0
			NO. OF IN BYTES 2	PREVIOUS TRIP 2-9
			NO. OF OUT BYTE 1	
			SERIAL ADDRESS 127 (off)	
			STORE ENABLE COMM. PARAMETERS	

6-1 Parameter Menu Description

6.2 Parameter Description

%MOTOR FLA	Description
AMP. VOLTAGE 0 0	Displays current motor current and current motor voltage as percentage.
THERMISTOR RESISTANCE 3.1 Kohm	When analogue card is incorporated displays thermistor resistance.
MOTOR INSULATION 52,8 Mohm	Displays motors winding insulation level (only when option is incorporated)
NO OPTION CARD	When option card is not incorporated.
POWER	Displays current power (not yet available)
POWER FACTOR	Displays current power factor (not yet available)

6-2 Motor FLA Parameters Description

MAIN PARAMETER	DESCRIPTION
ISA FLC 105 AMP	Displays rated starter current (ampere) on the nameplate.
MOTOR FLA 105 AMP	Displays reated motor current (ampere) on the nameplate.
Rated Power 30kW	Press to set the rated motor current.
Way of Connection LINE	Press to set the way of connection. Either in line connection or in inside delta connection
CURRENT MINIMUM 0% MOTOR FLA	Press to set current minimum (0=Off, 20-90% MNS).
CURRENT MINIMUM DELAY 10 SEC	Press to set current minimum delay (range: 1 – 40 sec) at under voltage.
MAXIMUM OVER CURRENT 850 % MOTOR FLA	Press to set the maximum over current (Shear- Pin), range 200-850% **MNS**.
MAXIMUM OVERLOAD DELAY 1.5 SEC	Displays maximum overload delay, range 0.5-5sec.
OVERLOAD TRIP 115% MOTOR FLA	Here the overload setting is set to 75-150 % of the MNS in the area.
OVERLOAD DELAY 4 SEC AT 5 X IN	Press to set Overload Delay at 500% Motor FLA, range: 1-10sec.
UNDER VOLTAGE TRIP 300 V	Press to set under voltage trip.
UNDER VOLTAGE DELAY 5 SEC	Press to set under voltage trip delay in seconds.
OVER VOLTAGE TRIP 480 V	Press to set over voltage trip.
OVER VOLTAGE DELAY 2 SEC	Press to set over voltage trip delay in seconds.

ENABLE STORE MAIN PARAMTERS	To store selected parameters press Store button. Storing can not be done when Soft Start or Soft Stop is activated. When parameters are correctly stored, the LCD will read.: „**DATA SAVED OK**“ This concludes the **Main Parameter** settings. Pressing „Select“ after „**DATA SAVED OK**“ returns to the first display in this mode. In case of a failure in parameter setting the LCD displays: „**STORAGE ERROR**“: Press Select button again until „**STORE ENABLE MAIN PARAMETERS**“. Then press Store button until **„DATA SAVED OK“** appears.

6-3 Main Parameters Description

START PARAMETERS	DESCRIPTION
SOFT START CURVE 0 (STANDARD)	Press to set Soft Start Curve. The ISA-D incorporates 4 different starting curves. Select the most suitable torque curve for the motor.
START TACHO GAIN 0 (MIN.GAIN)	When setting DIP- Switch 2 in position ON (Tacho Mode) press Select button, curve message changes to 0= minimum gain tacho control, range 1-5= different levels tacho feedback. Tacho Feedback is operational in its basic form. The correct tacho selection according to application and additional curves are optional.
PULE START TIME 0 SEC	Press to select Pulse Start time. Range: 0-1 sec. (Pulse Level at 80% Un).
INITIAL VOLTAGE 30%	Press to select initial voltage, range: 10 – 50% of Un (extensible up to 10-80%). This adjustment determines the starting torque of the motor (torque is directly proportional to the square of the voltage). This adjustment also determines the inrush current and the mechanical shock. Too high of a setting may cause a high mechanical shock and high inrush current upon starting (also when current limit is set to a minimum, as starting torque overrides the current limit setting). Setting initial voltage to more than 50% (=maximum value), the display will show **„Current Limit”**
CURRENT LIMIT 400 %	Press to select current limit, range: 100 – 400% (extensible up to 100-500%). Determines motor’s highest current during starting. A too high of a setting will allow high currents to be drawn from the line, resulting in a faster acceleration. Too low of a setting may prevent the motor from completion the acceleration process and reaching full speed. Generally, this parameter should be set to lowest acceptable value avoiding a motor stop. Current limit is not operational during normal operation (Run) and soft stop.
ACCELERATION TIME 10 SEC	Press to select acceleration time in seconds, range 1 – 30 sec (extensible up to 1-90 sec.). Determines motor’s voltage ramp-up time from initial to full voltage. It is recommended to set ramp-up time to the lowest acceptable value (approx. 5 sec). Since current limit overrides acceleration time, when current limit is set low, starting time will be longer than the preset acceleration time. When motor reaches full speed before voltage reaches nominal, ramp-up time adjustment is overridden, causing voltage quickly ramp up to nominal. Using starting curves 1, 2, 3 prevents quick ramp-up.
MAXIMUM START TIME 30 SEC	Press to select maximum start time in seconds, range 1-30 sec (extensible up to 1-250 sec). Determines motor’s maximum allowable start time from start signal to end of acceleration. If voltage does not reach full voltage during this time (e.g. because of too low current limit) respectively motor does not reach nominal the starter trips the motor. LCD Display shows **„Long Start Time“**
NUMBER OF STARTS 10	Press to set number of starts permitted (range: 1 – 10, OFF). Determines number of

	operations during within an adjustable period of time. Combines three parameters:
STARTPERIODE 30 MIN	Press to set number of starts, time period range: 1 – 60 min
START LOCKED 15 MIN	Press to set start inhibit period, range: 1 – 60 min. The motor can not be startet before start inhibit period. When starting the motor during inhibit period the LCD displays: „**TIME__MIN**“.
Ramp Contact Distorted. 5 SEC	Press to set time delay for end of acceleration contact, range 0-120 sec.
ENABLE STORE START PARAMETERS	To store selected parameters press Store button. When parameters are correctly stored the LCD displays: „D**ATA SAVE OK**“ This concludes the Start Parameter setting.

6-4 Starting Parameter Description

STOP PARAMETERS	Description
SOFT STOP CURVE 0 (STANDARD)	Press to set Soft Stop Curve (0-4). The ISA-D incorporates 4 stop curves to select correct soft stop curve torque.
STOP TACHO GAIN 0 (MIN.GAIN)	When setting DIP- Switch 2 in position ON (Tacho Mode) press Select button, curve message changes to 0= minimum gain tacho control, range 1-5= different levels tacho feedback. Tacho Feedback is operational in its basic form. The correct tacho selection according to application and additional curves are optional.
DECCELERATION TIME 0 SEC	Press to set decceleration time, range 1 – 30 sec (extensible to 1-90sec). Decceleration time limit.
FINAL TORQUE 10 SEC	Press to set final torque during soft stop , range: 0 – 10; 0=minimum, 10=maximum. Regelt das Moment am Ende der Stopprampe. Falls nach sanfter Reduzierung der Drehzahl bis auf null noch Strom fließt, erhöhen Sie das Ausschaltmoment.
STORE ENABLE STOP PARAMETERS	To store selected parameters press Store button. When parameters are correctly stored the LCD displays: „D**ATA SAVE OK**“ This concludes the Stop Parameter setting.

6-5 Stop Parameter Description

DUAL ADJUSTMENT PARAMETERS	Description
DA:INITIAL VOLTAGE 30 %	Press to set Initial voltage (10 – 50%) (not extensible)
DA: GENERATOR PARAMETERS	Generator Mode, when DIP- Switch 3 in position ON.
DA:CURRENT LIMIT. 400% MOTOR CURRENT	Press to set current limit (100 – 400%).
DA:ACCELERATIONT 10 SEC	Press to set acceleration time (1 – 30 sec).
DE:STOPRAMPZEIT 0 SEC	Press to set decceleration time (1 – 30 sec). (not extensible)
DE:MOTORNENNSTR 105 AMP	Press to set Motor FLA. (50 – 100%)

SPEICHERN DER DUAL PARAMETER	To store selected parameters press Store button. When parameters are correctly stored the LCD displays: „D**ATA SAVE OK**“ This concludes the Dual Adjustment Parameter setting.

6-6 Dual Parameter Description

ENERY SAVE & 1/6 RPM PARAMETER	Description
SAVING ADJUSTMENT 0(MIN)	Press to set slow speed torque and energy saving level (0 – 10; 0= minimum, 10= maximum).
1 / 6 RPM TORQUE 8	Press to set 1/6 Round Per Meter. (1-10, 1=minimum, 10=maximum)
MAXIMUM 1/6 RPM 30 SEC	Press to set maximum slow speed time (1 – 30 sec).
STORE ENABLE SPECIAL FEATURES	To store selected parameters press Store button. When parameters are correctly stored the LCD displays: „D**ATA SAVE OK**“ This concludes the Special Feature Parameter setting

6-7 Special Features Parameter Description

Attention

For activation of an extended range of parameters, please consult factory. A modification of the parameters without consulting factory in advance will void manufacturer’s warranty. A modification of the standard parameters may cause overload and damage of the soft starter.

FAULT PARAMETER	Description
PHASE SEQUENCE Y/N NO	Press to select phase sequence trip (Yes/No).
INSULATION ALARM OFF	Press to select insulation alarm (OFF, 0.2 – 5 MΩ).
INSULATION TRIP OFF	Press to select inuslatin trip (OFF, 0.2 – 5 MΩ).
AUTO RESET NO	Press to set Automatic Reset. (Yes/No). The soft starter will reset itself after 60 sec.
THERMISTOR TYPE PTC	Press to select thermistor type (PTC, NTC).
THERMISTOR TRIP OFF	Press to select thermistor trip level (OFF, 0.1 – 10 KΩ, step: 0.1 KΩ).
STORE ENABLE FAULT PARAMETERS	To store selected parameters press Store button. When parameters are correctly stored the LCD displays: „D**ATA SAVE OK**“ This concludes the Fault Parameter setting.

6-8 Fault Parameter Description

I/O PROGRAMMING PARAMETERS	Description
PROG. INPUT No. 7 ENERGY SAVING	Press to set terminal 7 function. Range: Energy saving, 1/6 RPM, Reset
PROG. INPUT No. 8 DUAL ADJUSTMENT	Press to set terminl 8 function. Range: Dual Adjustments, 1/6 RPM Revers., Reset
FAULT RELAY TYPE STANDARD RELAY	Press to set Fault Relay function. (Standard Relay, 0-Voltage insurance)
IMM/S.PIN RELAY IMMEDIATE	Press to set immediate relay function. (Immediate, Shear- Pin, Overload)
BET REL EIN VERZ 0 SEC	Press to set immediate/shear pin relay ON delay. (Immediate 0-60sec / Shear- Pin 0-5 sec.)
BET REL AUS VERZ 0 SEC	Press to set immediate/shear pin relay OFF delay. (Immediate 0-60sec / Shear- Pin 0-5 sec.)
ANALOG OUTPUT NORMAL	Press to set analogue output. (Normal, Inverted)
STORE ENABLE I/O PROGR:PARAM	To store selected parameters press Store button. When parameters are correctly stored the LCD displays: „D**ATA SAVE OK**“ This concludes the I/O Parameter setting.

6-9 I/O Parameter Description

COMMUNICATION PARAMTERS	Description
DRIVE NUMBER 0	Press to set the drive number. This number does not influence soft starter’s operation and is incorporated for identification (customer convenience). (Range: 0-999)
BAUD RATE 9600	Press to set communication Baud Rate eingestellt. (Range: 1200 – 9600 bps)
PARITY CHECK EVEN	Press to set communication parity check. (Odd, Even, No)
SERIAL LINK NO. 248 (OFF)	Press to set communication serial link number (1 – 248; up to 32 soft starters on one twisted pair). If communication is not used, serial link number must be set to 248.
STORE ENABLE COMMUNICATION PARAMETERS	To store selected parameters press Store button. When parameters are correctly stored the LCD displays: „D**ATA SAVE OK**“ This concludes the Communication Parameter setting.
Note: When using communication and local commands, the last command determines the function.	

6-10 Communication Parameter Description Modbus

COMMUNICATION PARAMTERS	Description
Communication Protocoll	Displays whether communication Profibus or Modbus is used.
No. Of IN Bytes	Press to set IN Bytes, range 2-32
No. Of OUT Bytes	Press to set Out Bytes, range 1-2
Serial Link Number	Press to set serial link number. (range: 1 – 127; up to 32 soft starters on one twisted pair)
STORE ENABLE COMMUNICATION PARAMETERS	To store selected parameters press Store button. When parameters are correctly stored the LCD displays: „D**ATA SAVE OK**“ This concludes the Communication Parameter setting.
Note: When using communication and local commands, the last command determines the function..	

6-11 Communication Parameter Description Profibus

STATISTISTICAL DATA	Description
TOTAL ENERGY KWh	Displays the total energy in kilowatt per hour; since commissioning or after last elimination of the statistical data.
LAST START PERIOD NO DATA	Displays last starting time in seconds (Time duration until motor’s current reached nominal).
LAST START CURRENT NO DATA	Displays maximum current at last start.
TOTAL RUN TIME 0 HOURS	Displays motor’s hour since commissioning or since „Statistical Data“ was last reset.
TOTAL No. OF STARTS 0	Displays total number of starts since commissioning or since „Statistical Data“ was reset.
LAST TRIP NO DATA	Describes last fault.
TRIP CURRENT 0% MOTOR FLA	Displays the current at the last fault.
TOTAL No. OF TRIPS 0	Describes fault before last trip.
FAULT PARAMETETERS 1-9	Describes the last 9 faults.

6-12 Statistical Data Description

Adjustment of starting curves

6.3 Selection of a pump control start curve (centrifugal pump)

Starting Curve

1. Adjustment of soft starter's main parameters.
2. The adjustment of the starting parameters.

%MOTOR FLA	MAIN PARAMETERS	START PARAMETERS	STOP PARAMETERS
		SOFT START 0 (STANDARD)	
		PULSE START 0 SEC	
		INITIAL VOLTAGE 10%	
		STARTING CURRENT LIMIT 200 %	
		ACCELERATION TIME 10 SEC	
		MAXIMMUM ACCELERATION TIME 30 SEC	
		NUMBER OF STARTS 10	
		STARTING PERIOD 30 MIN	
		START INHIBIT 15 MIN	
		STORE ENABLE START PARAMETERS	

3. During acceleration control manometer. If peak torque is higher than the maximum pressure proceed to a pump curve reducing peak torque. (Pump curve 1)
4. Select pump curve 1, adjust ramp-up time to 15 seconds and current limit to 350%. During acceleration control manometer.
5. In many applications the peak torque is now reduced. If peak torque is still too high proceed to prolong acceleration time to 25 sec (control motor dates) and start again.
6. If peak torque is still produced, proceed to pump curves 2 or 3 providing the above-mentioned criteria. A higher pump curve provides reduced peak torque and pressure, but motor stress increases.

Stop Curve

1. Adjustment of soft starter's main parameters.
2. Adjustment of stop parameters:

%MOTOR FLA	MAIN PARAMETERS	START PARAMETERS	STOP PARAMETERS
			SOFT STOP 0 (STANDARD)
			DECCELERATION TIME 0 SEC
			STOP TORQUE 10 SEC
			STORE ENABLE PARAMETERS

3. Select stop function and control manometer as well as check valve. Consider negative torques („water hammer") which will abruptly stop the pump. If the pump will abruptly stop please select a pump curve.
4. Select pump curve 1, adjust deceleration time to 15 seconds. Start soft stop function and control manometer as well as check valve movements. Abrupt stall of pump and motor, thus, the check valve may cause noise.
5. In many pump applications the „water hammer „ are reduced but still occur. Prolong deceleration time to 25 seconds (control motor dates) and proceed as mentioned before.
6. If water hammer still occur proceed to pump curves 2 or 3 providing the above-mentioned criteria. Je höher die Pumpenkurve, desto sicherer wird ein vorzeitiges Stoppen der Pumpe verhindert.

Final Torque during a pump soft stop

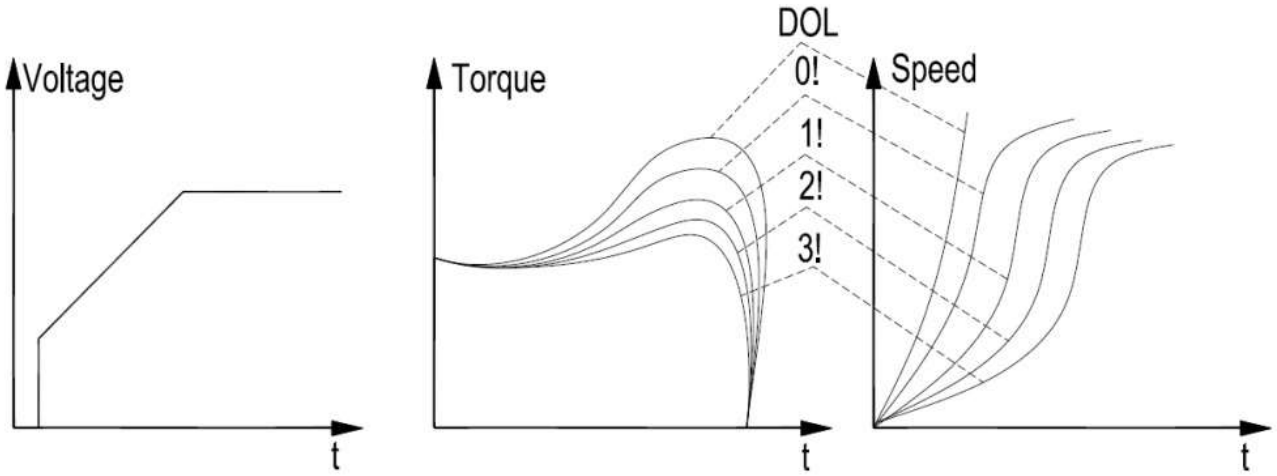
1. While decceleration, the check valve may clause before decceleration time has elapsed. Thus allowing current to flow through motor stator winding and causing unnecessary heat. Select final torque sensivity to 1 and stop the motor again. Confirm that the soft starter switches off shortly after the check valve closed.
2. If current still flows more than 3 sec after check valve closure, increase , increase final torque up to 10 in order to stop current flow immediately after check valve closure.

Pump Software – Start Curves

Upon start the torque of a 3-phase-asynchronous motor can increase up to 300% of nominal. Thus causing torque peaks and can damage the pipe system. The ISA-D disposes of 4 different start curves:

Start Curve 0 – (Factory set)
This start is the most suitable soft start for standard asynchronous motors, preventing from prolonged starting and motor overheating.

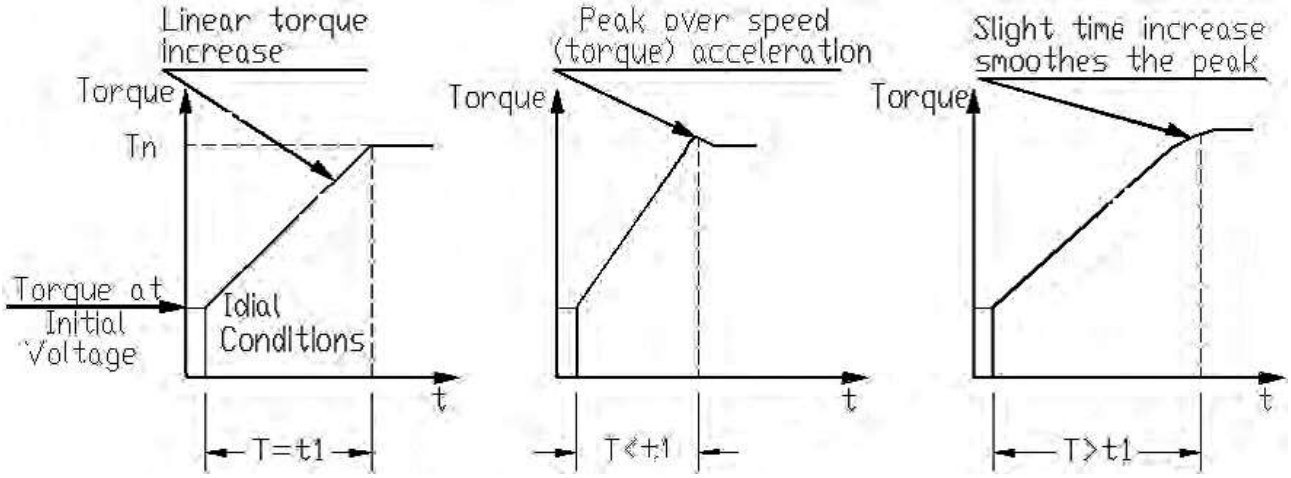
Start Curves 1, 2, 3 – During acceleration, before reaching peak torque, the Pump Control Program automatically controls the voltage ramp-up, reducing peak torque, preventing high pressures in the pipe systems.



7-1 Choice of 4 pump control acceleration curves 0, 1, 2, 3

Note: Upon putting into operation always start with start curve 0. If towards end of acceleration, peak torque is too high (too high pressure), proceed to curve 1, then 2 or 3 if necessary.

Start Curve (Torque)



7-2 Start Curve 4 (Torque)

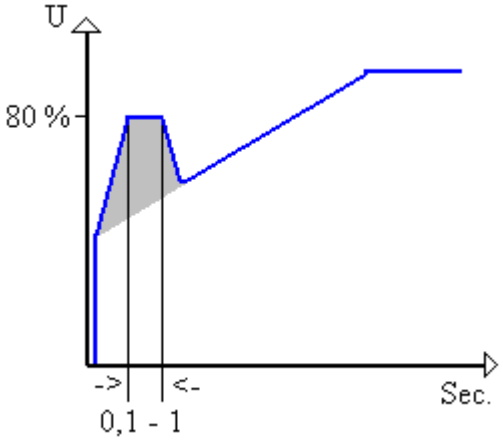
Tacho Feedback, 0-10V/DC

Provides linear acceleration and deceleration according to rpm tacho feedback. 12 tacho gain levels can be selected for starting and stopping.

Note: Consult factory for additional information.

Pulse Start

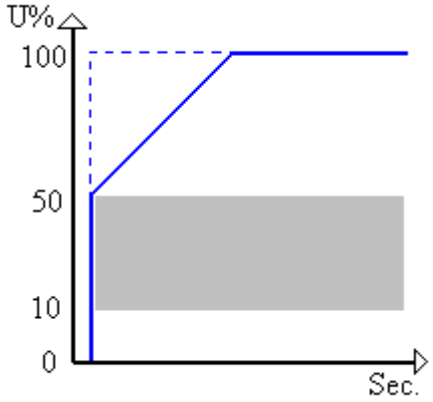
Pulse Start is available when intended to start high friction loads requiring high starting torque for short time. Pulse duration is adjustable at 0,1…1 sec.. A pulse of 80 % Un determines terminal voltage to 80 % of nominal voltage. After this pulse the voltage ramps up to according to Start Parameters settings.



7-3 Pulse Start

Initial Voltage

The initial voltage determines motor's initial starting torque, range 10 % and 50 % Un.
Die Initialspannung soll so eingestellt werden, dass beim Startbefehl sofortige Wellenrotation am Motor beginnt
The adjustment also determines the inrush current and the mechanical stress. A setting that is too high may cause high inrush current and high initial mechanical shock. Even if current limit setting is too low, as **the Initial Voltage setting overrides the Current Limit setting).**
A setting that is to low long may result in prolonged time until the motor begins to turn and overheating of the motor. The optimal setting ensures that the motor begins turning immediately after start signal.

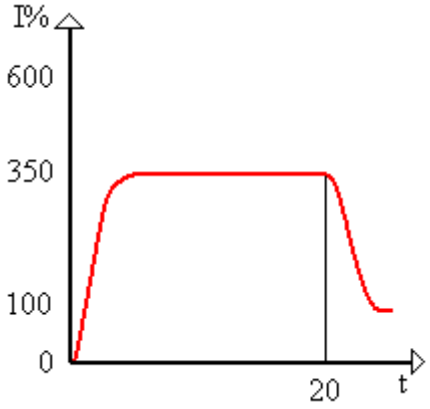


7-4 Initial Voltage

Current Limit

The current limit determines highest current during starting, range 100 % - 400 % of motor FLA setting. A very high setting will cause greater current drawn from line and faster acceleration. A setting that is too low may prevent motor from completion acceleration process and reaching full speed.

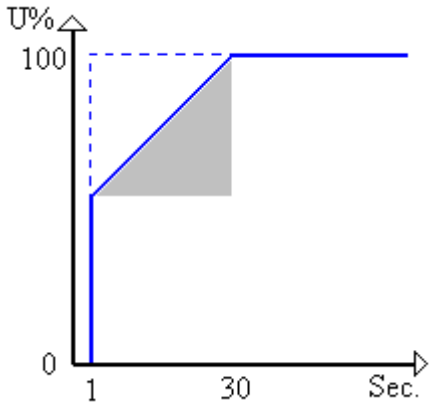
Note: Current limit is not operation during soft stop.



7-5 Current Limit

Acceleration Time

Determines acceleration time from initial to full voltage, range 1 – 30 sec. It is recommended to set acceleration time to the minimum acceptable value, especially upon current limit setting.



7-6 Acceleration time

Note:

1. Since current limit overrides acceleration time, when current limit is set low, starting time will be longer than the preset acceleration time.
2. When motor reaches full speed before end of acceleration time, causing voltage to quickly ramp-up to nominal.
3. Using starting curves 1, 2 and 3 prevents quick ramp up.

Maximum Start Time

The maximum allowable starts time, from start signal to full speed is adjustable at range 1 – 30 seconds. If motor does not reach full speed during this time the start will be stopped and the LCD displays „Long start time“.

Contact Delay

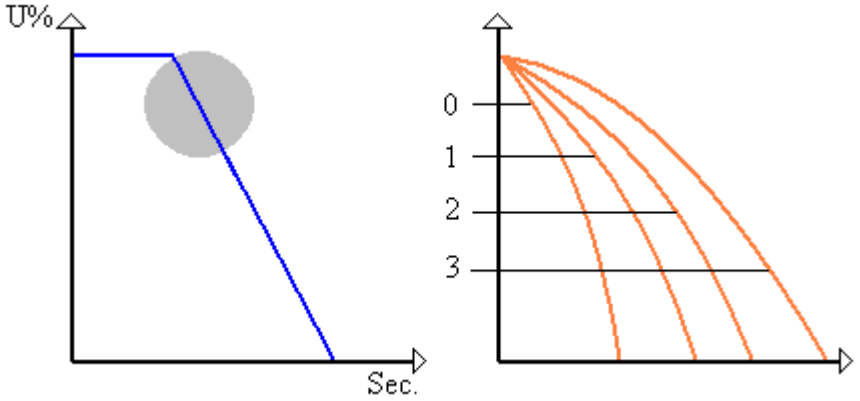
Time delay for End of Acceleration Contact, after completion of starting process. Range: 0 – 120 seconds.

Soft Stop (Pump Control - Soft Stop)

Reducing motor voltage will reduce motor torque. Because of the reverse torque reduces motor rpm and the motor will smoothly decelerate to a Stop. To adjust the different reveres torque, particularly by pumping application, the ISA-D incorporates 4 soft stop curves:

Stop curve 0 – (factory set) – Voltage is linearly reduced from nominal to zero.

Stop curves 1, 2, 3 (Pump-Soft Stop) – For pump applications with high level differences, the water column occurs as constant load, not possible to reduce using speed modifications.
Thus causing an abrupt stopping instead of a soft stopping of the motor.



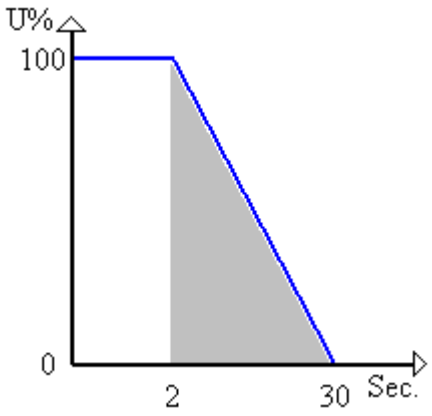
7-7 Stop Curves

Curves 1, 2 and 3 are designed to prevent stall during soft stop.

Note: Always use soft stop curve 0. If motor stalls quickly instead of slowly decreasing its speed, select stop curve 1, then 2, 3 or 4 if necessary.

Deceleration Time – Soft Stop

Determines motor's voltage ramp down time, range: 1 – 30 seconds. Connecting terminal 5, motor voltage reduces to adjusted stop torque.



7-8 Deceleration time

Note: When the starter operates with a by-pass contactor, soft stop initiation opens the end of acceleration contact, tripping open the by-pass contactor. Load will then be transferred to the ISA-D and voltage begins ramping down.

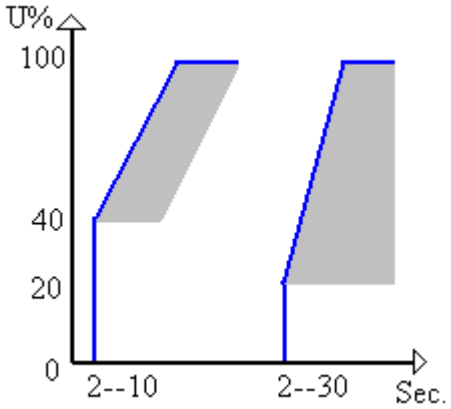
Final Torque

Determines torque towards end of soft stop. If current is softly reduced to zero, increase final torque setting.

Dual Adjustment

A secondary set of parameters, used for varying loads (2-Speed-Motors, conveyor belts empty/loaded etc.) connecting control supply to terminal 8 makes transfer to dual adjustment settings:

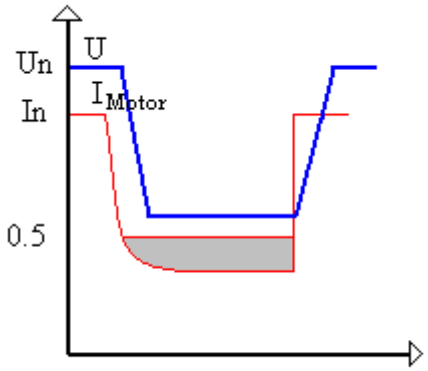
IV – Initial Voltage 10 – 50% Un
CL – Current Limit 100-400% of motor's FLA
AT – Acceleration Time 1-30 sec.
DT – Deceleration Time 1-30 sec.
FLA – Motor Full Load Ampere (4-2500A)



7-9 Dual Adjustment

Energy Save

Connect terminal 7 in order to activate energy save function, range: 1 to 10. During this mode, motor voltage will be according to motor load, thus, reducing the reactive current and copper/iron losses.



7-10 Energy Save

Note: When using Energy Save system, harmonics should be taken into consideration. At maximum Energy Save settings, the 5th harmonic may exceed 30% of the motor current value.

Attention
To meet CE standards while Energy Save mode, the user may be required to employ additional mitigation methods.

Slow Speed Torque

Determines the torque while motor is operating at 1/6 of nominal speed. Range: 1 – 10.

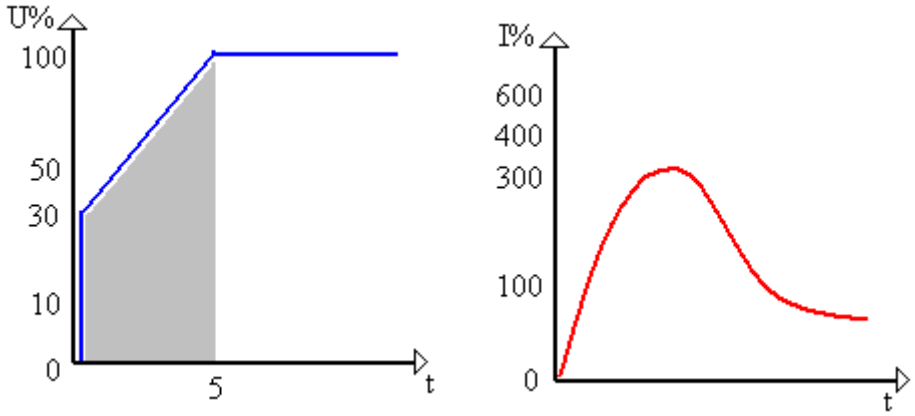
Maximum Slow Speed Time

Determines the maximum allowable operation time at slow speed. Range: 1 – 30 sec.

Warning
Operating current while motor is running at slow speed is much higher than nominal current and motor ventilation is much weaker. Special precaution must be taken to prevent overheating when running the motor at slow speed for long periods of time.

6.4 Start Curve Examples

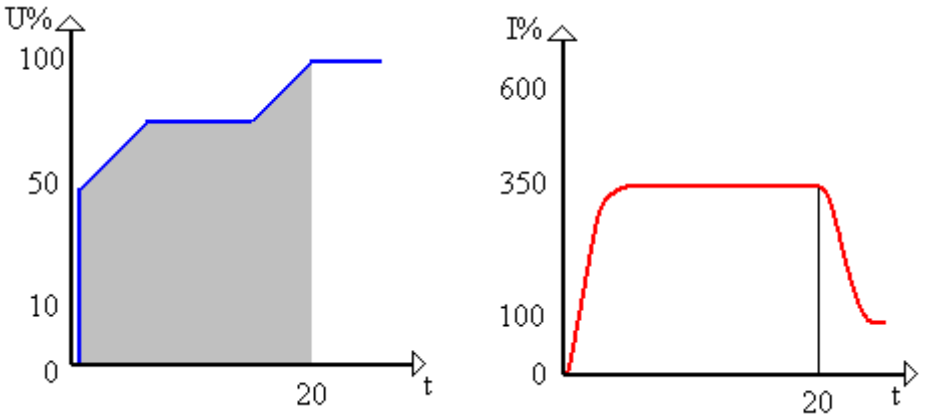
Light Loads	- Pumps, Fans etc.
Starting current	- approx. 300%
Starting Torque	- approx. 30%
Ramp-up time	- approx. 5 sec



7-11 Start Curves examples 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.

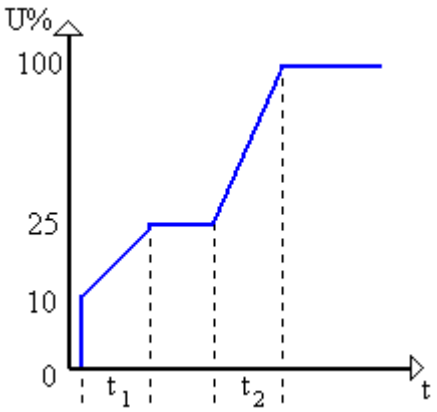
Duty Loads	- Conveyors, rock crushers etc.
Starting Current	- ca. 350%
Starting Torque	- ca. 50%
Ramp-up time	- ca. 5 sec



7-12 Start Curve examples 2

Upon start the voltage quickly increase to 50 % U and than the voltage and current simultaneously reaches current limit value.
The voltage remains at this value until motor nearly 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.

Example for spezial start with Dual Adjustment



7-13 Start Curve examples 3

	Dual Adjustment	Standard Parameters
Initial Voltage	10%	25%
Acceleration time	t_1	t_2
Starting Current Limit	200%	300-400%
Operation Relay - Delay	Tx= 1-60 sec	---

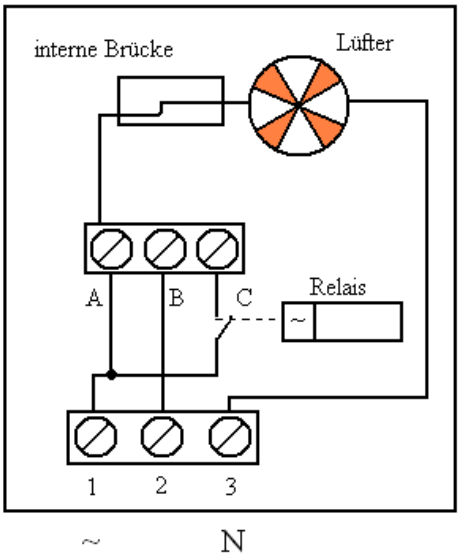
7-1 Settings

6.5 Internal Settings

7-14 Internal Settings

6.6 Fan Control

Please choice with Terminal 2 between 3 different types of fan functions.



7-15 Voltage Control

Continues operation (Factory setting)

Fans will operate continuously as long as control supply is connected to terminals 1 and 3. Connect jumper to terminal J1A, in left position.

External Control

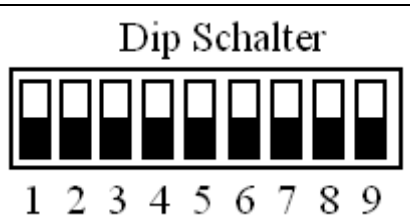
The fan will work till Terminal 2 is energized. (setting middle position Terminal J1 B klemmen.

Automatic Operation

D The fan starts with the start signal and is about 5 min to run after. Use the stop or soft stop signal , the fan starts again for a time period of about 5 min. Bridge terminals in right position J1 C.

Warnung:
The starter is supplied with the internal jumper connected to terminal A for continuous operation. If changed connection to terminal B, it is the customers's responsibility to operate the fans.
Automatic operation only when by-pass contactor is utilized.

6.7 Dip Switch Setting

The Dip Switch, containing 8 seperate switches is located on the Control Module. Using size A the operating unit and the display have to be carefully removed, for other sizes carefully open the front panel.	

When necessary, carefully open the front panel and set the switches as required.

Note: All switches are factory set in „OFF“ position.

Nr.	Switch Functions	Switch Off	Switch On
1	Display format	Minimized	Maximized
2	Tacho feedback	Disabled	Enabled
3	Main / Generator	Main	Generator
4	Service Switch	Must be off!	Must be off!
5-6	LCD- language selection	See table	
7	Special Settings – see enclosure	Disabled	Enabled
8	Parameter (Software) Lock	Open	Locked

7-2 Switch Functions

Switch #1 – Display Modes

For operation convenience, there are two display modes:
Maximized – Display of all possible parameters.
Minimized – Display of preselected parameters.
Switch #1 to „Off“ will minimize the LCD display.

Maximized Switch #1 – On	**Minimized** Switch #1 – Off
Display only Main Parameters Start Parameters Stop Parameters Dual Adjustment Energy Save Parameters Slow Speed Parameters Fault Parameters I/O Programming Communication Parameters Statistical Data	Display only Main Parameters Start Parameters Stop Parameters Statistical Data

7-3 Display Modes

Switch #2 – Tacho feedback (0 – 10 V/DC)

Set Dip switch #2 On, when using tacho feedback.

Note: To set Start/Stop mode when operating tacho feedback, consult factory for special settings for each application.

Switch #3 – Main / Generator Control

When starting from a diesel- generator supply, starting process can sometimes terminate due to instability of the supply system.
Set DIP Switch #3 to ON, special start characteristics suitable for Diesel-Generator-Supply – unstable voltage and frequency becomes operative.
Closure of Dual Adjustment contact (terminal 8) operates the special starting characteristics.
When operation form main- and alternatively from diesel generator, set normal starting characteristics for Main and suitable starting parameters for the Diesel Generator (for example faster acceleration, lower current limiting, etc.) on Dual Adjustment setting.

Warning:
When operating in Generator Mode, motor must be loaded, otherwise, vibration may occur during starting and stopping.

Switch #5 and #6 – Language Selection

Language	Switch #5	Switch #6
English	OFF	OFF
French	OFF	ON
German	ON	OFF
Spanish	ON	ON

Swich #7 – Special Parameters

Parameter	Dip Switch #7 off	Dip Switch #7 on
Initial Voltage	10-50%	5-80%
Acceleration time	1-30 seconds	1-90 seconds
Current Limit	100-400%	100-500%
Deceleration time	1-0 seconds	1-0 seconds
Max Start time	1-30 seconds	1-90 seconds
Phaseloss Y/N	Yes	Yes/No
Max Slow Speed time	1-30 seconds	1-250 seconds
O/C or WRONG CON protection n Inside Delta mode.	Protection active in normal set	Protection active in high set
Overload Trip	Overload trip will be active after Run LED is Lit	Overload Trip will be active after Max Start time has elapsed

7-4 special Parameter setting

Warning:
When using extended Soft Starter range, apply maximum precautions to avoid motor or soft starter damage.

Swich #8 – Parameter Lock

The software lock prevents undesired parameter modification.
When locked upon pressing buttons, the LCD displays „Unauthorized Access“.

7 Examples of Applications with Parameters

Application	Starting Ramp [sec.]		Initial Voltage [%]		Current Limit [%]		Stopping Ramp [sec.]		Curve form	
Operation Supply	M	G	M	G	M	G	M	G	M	G
Pump	3-8	5-15	20-30	10-20	300-400	300-400	5-10	2-5	0	0
Bow thruster	3-8	5-15	20-30	10-20	250-300	350-300	0	0	0	0
Unloaded Motor	3-8	5-15	20-30	10-20	200-250	200-250	0	0	0	0
Screw Compressor	3-8	5-15	30-40	20-30	350-400	350-400	0	0	0	0
Mixer	3-8	5-15	40-50	30-40	400-500	400-500	0	0	0	0
Piston Compressor	3-8	5-15	20-30	10-20	350-400	350-400	0	0	0	0
Stirrer	3-8	5-15	40-50	30-45	400-450	400-450	0	0	0	0
Centrifugal Fan	3-8	5-15	20-30	10-20	350-400	350-400	0	0	0	0
Screw Conveyor	3-8	5-15	30-40	20-30	350-400	350-400	3-8	2-6	0/4	0/4
Centrifugal Pump	3-8	5-15	20-30	10-30	300-350	300-350	5-10	4-8	0-3	0-3
Hydraulic Pump	3-8	5-15	20-30	10-20	300-350	300-350	0	0	0-3	0-3
Centrifuge	3-8	5-15	30-40	20-30	350-400	350-400	0	0	0/4	0/4
Scraper	3-8	5-15	30-40	20-30	400-450	400-450	3-8	2-6	0	0
Conveyor Belt	3-8	5-15	30-40	20-30	350-400	350-400	3-8	2-6	0/4	0/4
Crusher	3-8	5-15	40-50	30-40	400-450	400-450	0	0	0	0
Escalator	3-8	5-15	20-30	20-30	300-350	300-350	0	0	0	0
Heat Pump	3-8	5-15	20-30	10-20	300-350	300-350	5-10	4-8	0-3	0-3
Lifting Equipment	3-8	5-15	40-50	30-40	350-400	350-400	3-8	2-6	0	0

M = Main Opertaion
G = Generator Operation

8 Start-Up Procedure

Note: It is necessary to connect a motor to load terminals otherwise „Wrong Connection" Protection is activated. Other loads such as light bulbs, resistors etc. may also cause „Wrong Connection" Fault.

Start-up Procedure with Start/Stop buttons

1. Connect Control Supply. On- LED will lit.
2. Review all parameters with „Mode" and „Select" buttons. Set parameters as required.
3. If necessary, return to factory set parameters.
4. Connect main voltage to starter's line terminals.
5. Set LCD to show „Motor FLA" (% of motor FLA).
6. Press Start. If motor starts to turn shortly after Start Signal, proceed to point 7. If not increase "Initial Voltage" setting and start again. When, upon starting, initial inrush current and mechanical shock are too high decrease "Initial Voltage" settings and proceed to paragraph 7.
7. Motor starts to turn. If speed accelerates smoothly to nominal, proceed to paragraph 8. When current during acceleration is too high, decrease „Current Limit" setting and proceed to paragraph 8. If motor does not accelerate smoothly to nominal increase "Current Limit" setting.
8. Press „Stop" and wait until motor stops.
9. Slightly increase initial voltage and Current Limit to allow for load changes.
10. Press Start and see that motor's acceleration time to full speed is as required.
11. If acceleration time is too short, increase "Acceleration Time" setting.
12. Check total starting time and maximum starting time (approx. 5 sec longer than the starting time required to complete the starting process).

9 Trouble Shooting

Upon fault – motor stops, Fault LED lights and Fault Relay operates. The LCD shows Trip (Switch Off) and a fault description (e.g. „**SWITCHOFF:UNDERCURRENT")**

INSULATIONALARM (Optional) Alarms when motor insulation level decreases below set level. Alarm ceases automatically 60 sec after resistance able set level. Check cable and motor insulation.

INSULATION TRIP (Optional) Trips the motor motor insulation level decreases below set level. Check cable and motor insulation.

THERMISTOR Trip (Optional) Alarms when thermistor resistance decreases below set level. Check thermistor- and resistance respectively motor temperature.

TOO MANY STARTS Trips the starter if number of starts during „Start Period" exceeds the preset number. Wait until motor and starter cool down according to "Start inhibit" setting.

MAXIMUM START TIME Trips the starter if motor voltage does not reach nominal at the present maximum start time. Check FLA, FLC and Max Start Time settings. Increase Initial Voltage, Current Limit & maximum start time or decrease acceleration time as necessary.

SHORT CIRCUIT resp. (O/C-SHEAR PIN) Trips the starter when:

1. Instantaneously when current exceeds 850% starter FLC.
2. During starting when current exceeds 850% the Motor FLA.
3. During operation when current exceeds 200 – 850%.
   O/C Shear PIN= „Predetermined Breaking Point" has a programmable delay of 0-5 sec where the starter detects the fault and does not trip. (Delay is override when current reaches 850 %)
   Check that motor ist not jammed. Check motor and cable connections. Perform a „Megger" to test and verify motor's and cable's condition.

Warning
Check that „Megger" maximum voltage is not more than 500 V.
Disconnect Terminal 21 before performing a „Megger" test..
Check that motor is not jammed. Check motor and cable connections. Perform a „Megger" to test and verify motor's and cable's condition.

OVERLOAD	Trips the starter when current exceed the overload trip level and thermal register has filled up. Check FLA, FLC and overload settings. Check motor current, wait 15 minutes to let motor and starter cool down before restarting.
CURRENT MINIMUM	Trips the starter when motor current drops below the preset level for the preset time. Check “Current Minimum” and “Time Delay” settings. Check motor current and verify the fault when inrush current is too low(v-belt disruption, pump dry run etc.).
UNDER VOLTAGE	Trips the starter when line current drops below the preset level for the preset time. Check “Under Current Trip” and “Time Delay“ settings as well as the line voltage. When voltage drops to 0V, the starter trips immediately with no delay.
OVER VOLTAGE	Trips the starter when line current increases above preset level for a preset time. Check “Over Voltage Trip” and “Time Delay” settings as well as line voltage.
PHASE LOSS	Trips the starter when 1 or 2 phases are missing. Check line voltage and line frequency (40-65 Hz) as well as terminal 21.
PHASE SEQUENCE	Trips the starter if line sequence is wrong. Check line phase sequence and if wrong, swap two wires on line side. If motor rotates in wrong direction, swap two wires on load side.
MAXIMUM SLOW SPEED TIME	Trips the starter when operating at slow speed for extended period of time. Check “Max Slow Speed Time“ setting and operation time at slow speed. **Note:** Motor und soft starter may be overheated when operating at slow speed for an extended period.
WRONG CONNECTION	Trips the starter when one or more motor phases are not properly connected to starter’s load terminals or in case of an internal disconnection in motor winding. If required , the control function may be eliminated by wiring the soft starter in generator mode* (DIP-Switch 3 and Input 8). Programming Dual Adjustment start parameters.

THYRISTOR-FAULT	Trips the starter and prevents starting when one or more thyristors is short circuited or when motor windings are shorted. Check with an ohnmeter between L1-U, L2-V, L3-W; resistance >20 KΩ. Check for no voltage on terminals U,V, W. Thyristors may fail due to: High Voltage Spikes (not protected by proper external varistors) and frequent starting at fault conditions..
OVER TEMPERATURE	Trips the starter when heatsink temperature rises above 85°C. Check and – if necessary - improve cooling or use a by-pass control. Check that motor starting is not too frequent.
EXTERNAL FAULT	Trips the starter when a contact between terminals 19 and 21 closes for more than 2 seconds. Check contact position and cause of closure.
WRONG PARAMETERS	Parameters not transferred correctly from RAM to EEPROM or vice versa. After replacing the EEPROMS with a new software version or after power up, press **RESET,** then **MODE** and Down button simultaneously and save the default parameters by pressing **Store** and **Mode** simultaneously. (If red Fault LED is on, press **RESET** after store parameters.)
OVR/UNDER FREQUENCY	Trips the starter when the line frequency is below 45 Hz or exceeds 65 Hz.
***Note:**	When operating in generator mode, thyristor and wrong connection faults are not active.

10 Motor and Starter Protection

Motor Insulation (Option)

Operational when motor is not running. The soft starter must be disconnected from line.
Two distinct level can be set for Alarm and Trip functions:

- Alarm level, range: 0.2 – 5MΩ
- Trip level, range: 0.2 – 5MΩ

When insulation decreases below alarm level set point for more than 120 sec, the insulation alarm is activated, the fault - LED flashes and the LCD- displays alarm "INUSLATION LEVEL" and shows the resistance value in MΩ.
The motor start is stalled. Trip does not reset automatically.

Motor Thermistor (Option – Analogue Card)

Measures motor's thermistor resistance and trips the starter when level decreases below set level (PTC/NTC). Only one of optional card can be fitted in one starter, Analogue or Insulation card.
Thermistor Type: Selectable PTC or NTC.
Trip level: range: 1 to 10 kΩ
Delay: Factory preset time delay of 2 sec.

Start Frequency

Combines the following parameters:

- **Number of Starts** – Determines maximum allowable number of starts (during start period). Range: OFF, 1-10 starts
- **Start Period** – Time period during which number of starts are being counted. Range: 1-60 min
- **Start inhibit** – Determines time period during which starting is disabled after too many starts trip. Range: Bereich: 1- 60 min

Note: Motor cannot be started bevor „Start inhibit time" has been elapsed. Trying to start the motor during this time delay will result in LCD displaying "Wait Before Rst: ____ MIN.

Maximum Start Time – (Stall Protection)

Trips the starter if motor does not reach full speed during start time. Range: 1 – 30 sec.
LCD displays „Maximum Start Time".

Over Current Shear-pin
The over current shear-pin has two trip functions:
Short Circuit protection upon motor start. Trips the starter when current exceeds 850% of starters FLC setting in 1 cycle.
During run (RUN LED is lit) - Shear- Pin function trips the starter when current exceeds set level and time delay.
Range: 200 – 850% of motor FLA setting.
Delay: 0 – 5 sec (0 = 200msec)

Note: The over current shear-pin is not intended to replace the fast acting fuses, required to protect the thyristors.

Electronical Overload

Inverse time electronical overlaod becomes operational when RUN LED is lit. The ISA- D incorporates a thermal memory register calculating heating of the motor. The starter trips when the register fills up. The thermal register resets itself 15 minutes after motor Stopps.

Adjustable between 75 – 150% of motor's FLA, factory set at 115%.
Tripping time at 500% Motor FLA is adjustable between 1 – 10 sec. Allowing trip curve selection.

Attention:
Over load protection is not operational during soft-start or soft-stop.

Under Current (Current Minimum)

Operational when motor is running. Trips the starter when motor current drops below the set Under Current Trip (UCT) for a time longer than Under Current Delay (UCD).
Under Current Trip, Range: 0= OFF, 20 – 90% Motor FLA
Under Current Delay, Range: 1 – 40sec

Under voltage

Becomes operational after start signal. Trips the starter when main voltage drops below the set Under Voltage Trip (UVT) for a time longer than Under Voltage Delay (UVD).
Under Voltage, Range: 120 – 600V (phase to phase)
Under Voltage Delay, Range: 1 – 10 sec

Note:
When voltage drops to zero (voltage outage) the soft starter will trip immediately, overriding the delay.

Over Voltage

Becomes operational after start signal. Trips the starter when main voltage increases above the set Over Voltage Trip (OVT) Level for an adjustable period of time longer than Over Voltage Delay (OVD).
Over Voltage, range: 150 – 750 V(phase to phase)
Over Voltage Delay, range: 1- 10 sec

Phase loss (and Under-/Over Frequency)

Becomes operational when starter is energized and protects motor from single phasing. Trips the starter when 1 or 2 phases are missing for more than 1 second. Starter will also trip when frequency is <40 or >65 Hz.

Note: Phase loss may not be detected in lightly loaded motors.

Phase Sequence

Becomes operational when soft starter is energized, provided this protection has been activated. Trips the starter when phase sequence is wrong.

Slow Speed Time Delay

Trips the starter if motor operates at slow speed for a time longer than "Maximum Slow Speed Time"; Range: 1 – 30 sec
Note: Operate motor at slow speed for the minimum possible time. When motor operates at slow speed, it draws higher than nominal current thus, motor and starter may overheat.

Leitungsfehler

Aktiv mit dem Starbefehl. Es erfolgt eine Abschaltung, wenn der Motor nicht ordnungsgemäß mit den Ausgangsklemmen des Motorsanftanlassers verbunden oder Motorwindungen offen sind.

Thyristor Fault

Trips the starter in case one or more thyristors show a fault.

Heatsink Overtemperature

Temperature sensors are mounted on the heatsink and trip the starter when temperature rises above 85°C.

Warning:
The over temperature protection is designed to operate under normal conditions e.g. in the event of fan stoppage (insufficient ventilation), too high ambient temperature respectively extended overload.
Incorrect starter selection or operation frequents starting at max. conditions can cause thyristors to overheat and fail before the heatsink reaches 85 °C to trip the thermal sensor.

External Fault

Becomes operational when starter is energized, trips the starter when the contact between terminals 19 and 21 closes for more than 2 seconds.

Warning:
Do not use input 19 when terminal 21 is not connected to neutral or ground.

Fault and Reset

When any of the above protection functions operates, the soft starter locks in a fault condition disabling thyristors firing. Fault relay operates, fault LED lights up and the fault description is displayed on the LCD. When fault occurs, followed by a voltage outage, fault condition is stored and reappears upon voltage restoration.
For local resetting, after fault has been removed, press Reset key.
External resetting can be done through terminal 7 or 8 (see I/O Programming)
Note:
Resetting is not possible as long as start signal exists.

Auto – Reset

Under-voltage and phase loss, fault dan be set to Auto-Reset. The starter will reset itself 60 sec. After voltage was fully restored provided no start signal exists.

Note: Resetting is not possible as long as start signal exists.

Protection Function	Aktice during			
	Start	**Run**	**Stop**	**Soft Stop**
Too many starts with Start Inhibit Period	√			
Electronic Overload with Curve selection A		√		
Short Circuit Shear Pin				
Starter Protection – Trip function at 850% FLA	√	√		√
Motor Protection – Trip function				
During Start – factory set at 850% In	√			√
During Run – adjust at 200-850% In		√		
Under Current adjustable time delay		√		
Phase Loss	√	√		√
Phase Sequence	√			
Under Voltage with adjustable time delay. Will be overridden in case of voltage outage.	√	√		√
Over Voltage with adjustable time delay	√	√		√
Long start time	√			
Thyristor Short Circuit or connection fault	√			√
External Fault – Input of one NO/NC	√	√	√	√
Thyristor Protection through Metal Oxide Varistors (MOV)	√	√	√	√
Starter Over Temperature	√		√	√
Starter internal test, when LED „ON“ is lit.	√	√	√	√
Motor Insulation-test – not available			√	
Motor thermistor – not available	√	√	√	√

11 Frequently Asked Questions

Main Contactor

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

A: The soft starter does not require any main contactor but we recommend the use of one for emergency stop and/or trip of the overload relay. In some applications the Protection Load-Break switch may be used instead of the main contactor.

Ambient temperature

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

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

Thyristor shorted

Q: Is it possible to run a soft starter with one shorted thyristor?

A: Yes it is possible but not for all types of soft starters.

Soft Stop applications

Q: Which applications are suitable for a soft stop?

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

Advantages of by-pass

Q: What are the advantages of using a by-pass?

A: Reduction of power loss.

Power losses

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

A: The values can normally be found in the catalogue. For IGEL Electric soft starters then following formula can be used:
3 x current in watt
Current = Starting Current

Utilisation Category

Q: What utilisation category should be used for the main contactor and by-pass contactor?

A: Main contactor: always use AC-3. Bypass contactor: it is possible to use AC-1.

Fault indication when starting

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

A: If the main contactor is closed too late the soft starter will indicate this as under voltage fault. Delay the start signal to the soft starter by approx. 0,5 s to solve this phenomen.

Test without motor

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

A: No that is not possible since there will be no current going through the soft starter and the soft starter will also indicate that no motor is connected.

Overload relay trips during start

Q: Why does the overload relay trip during start?

A: 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
- wrong setting of the overload

Separate overload relay when using by-pass

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

A: When the current transformers of the soft-starter are installed so that the measuring can be performed when by-passed a separate relay is not required, otherwise yes and option 9 has to be ordered additionally.

Different frequency

Q: Can I use the same soft starters at both 50 as well as 60 Hz?

A: This is possible with all IGEL Electric soft starters as long as the curve is sinusoidal.

Voltage fluctuations

Q: Which voltage fluctuations are allowed for the soft starters?

A: 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

Q: Co I always have to use semi-conductor fuses?

A: When using semi-conductor fuses a type 2 co-ordination can be achieved. I is possible to use a moulded case circuit breaker or fuses but then with a type 1 co-ordination.

Derated when used 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.

Use in high altitudes

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

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

12 Technical Specifications

General Information	
Line Voltage	phase to phase 220 – 690 V (5 voltage ranges to be specified) +10% -15%
Frequency	45 – 65 Hz (Fixed or variable Frequency source)
Control Voltage	110 – 230 V (to be specified) +10% -15%
Control Inputs	Either same as control voltage or 24-230V AC/DC (to be specified)
Load	3-phase-asynchronous motor, Three-wire system
Start – Stop Parameters	
ISA-Starter FLC	Starter's Full Load Current according to Selector Guide
Motor FLA	50 – 100% of Starter FLC
Pump Control Curves	6 selectable pump curves preventing pressure peaks during start and water hammer during stop.
Pulse- Start	A pulse of 80% Un, for an adjustable time of 0,1 – 1 sec, for starting high friction
Initial Voltage	10 – 50 % Un (*10-80%)
Starting Current	100 – 400 % Motor FLA
Current Limit	100 – 400 % Motor FLA (*100-500%)
Acceleration Time	1 – 30 sec (*1-90 sec)
Decceleration Time	1 – 30 sec (*1-90 sec, nicht in Dualeinstellung)
Dual Adjustments	Secondary parameter characteristics for Motor FLA, Initial Voltage, Current Limit, Acceleration Time and Decceleration Time
Energy Saving	Energy savings for lightly loaded motors
Slow Speed	Torque while motor is running at 1/6 nominal speed.
Tacho Feedback	12 selectable curves for linear acceleration with tacho feedback.
* Consult factory for parameter setting.	

14-1 Technical Specifications

Motor Protection	
Too many starts	Maximum number of starts, range OFF or 1- 10, during a time period 1 – 60 min
Start Inhibit	Motor and starter cooling, time period 1 – 60 min during which starting is prevented, after too many starts
Maximum Start Time	Maximum allowable start time 1 – 30 sec (*1-250sec)
Short Circuit (Shear-pin)	Two operation functions: during start trips at 850 % and during running trips at 200 – 850 % In, both within one cycle
Elektronic Overload (I^2t)	Adjustable 75 – 150 % Motor FLA, adjustable trip at 500 % In of 1 – 10 sec
Under Current	Trips when current drops below 20 – 90% In, time delay 1 – 40 sec
Under Voltage**	Trips when voltage drops below 120 – 600V, time delay 1 – 10 sec
Over Voltage	Trips when voltage increases above 150 – 750% Un, time delay 1 – 10 sec
Phase Loss, Under / Over Frequency**	Trips when one or two phases are missing and frequency is <40 - >65 Hz
Phase Sequence	Trips when phase sequence is wrong.
Long slow speed time	Trips if operating at slow speed for more than 1-30 sec (*1-250 sec)
Wrong connection	Prevents starting, trips if motor is incorrectly connected, cable or turn fault occur.
Shorted Thyristor	Trips in case one or more thyristors have been shorted.
Heatsink Temperature	Trips when heatsink temperature rises above 85 °C
External Fault	Trips when external contact closes for more than 2 sec
Motor Insulation (optional)	Alarm Level Setting 0.2-5 MΩ, trips when resistance decreases below < 0.2 - 5 MΩ
Motor Thermistor (optional)	Trip Level Setting 1-10 KΩ, trips when NTC/PTC resistance decreases or increases the set level.
*Special Settings	** with optional Auto Reset

14-2 Technical Specifications 2

Control		
Displays	LCD with 4 selectable languages and 4 LEDs	
Keypad	6 buttons for easy programming	
Operation/Shear- Pin Relay	1 C/O, 8A, 250 VAC, 2000 VA	
Ramp End	1 C/O, 8A, 250 VAC, 2000 VA	
Fault Relay	1 C/O, 8A, 250 VAC, 2000 VA	
Insulation Alarm – Relay(Option)	1 C/O, 8A, 250 VAC, 2000 VA	
Communication	RS 485 MODBUS protocol, control supervision	
Temperatures		
Operating	-10 – 50 °C	
Storage	-20 – 70 °C	
Standards		
Dielectric Test	2500 VAC	
Degree of Protection	IP 20 for Size A IP 00 for Sizes B, C, D, E, F	
Pollution Degree	3	
Service Conditions		
Altitude	Up to 1000m above see-level. For equipment to be used at higher altitudes, consult factory.	
Relative Humidity	Non condensing 95% at 50°C or 98% at 45°C.	
Starter Consumption Ratings (Starter and Fan)		
Size A (8-31A)	No fan	Total Starter Consumption 150 VA
Size A (44-72A)	Fan 35 VA	Total Starter Consumption 185 VA
Size B	Fan 60 VA	Total Starter Consumption 210 VA
Size C	Fan 105 VA (35VA x 3)	Total Starter Consumption 255 VA
Size D, E, F	Fan 150 VA (50VA x 3)	Total Starter Consumption 300 VA

14-3 Technical Specifications 3

The specifications/article numbers listed in the following are referring to Siba fuses.
The figure after the point is informing about the current. Example: 20 000 13.63 means 63A

Starter Type	Maximum Motor FLA	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-D 8	8	20 000 13.20	20 000 13.25	400	20 477 20.40
ISA-D 17	17	20 000 13.40	20 000 13.50	5.000	20 209.20.100
ISA-D 31	31	20 000 13.63	20 000 13.80	10.000	20 209 20.160
ISA-D 44	44	20 000 13.80	20 000 13.100	12.000	20 209 20.160
ISA-D 58	58	20 000 13.100	20 000 13.125	15.000	20 211 20.200
ISA-D 72	72	20 001 13.125	20 001 13.160	18.000	20 211 20.200
ISA-D 85	85	20 001 13.160	20 003 13.200	50.000	20 211 20.315
ISA-D 105	105	20 003 13.200	20 003 13.250	60.000	20 212 20.350
ISA-D 145	145	20 003 13.224	20 004 13.315	100.000	20 212 20.400
ISA-D 170	170	20 004 13.315	20 004 13.400	140.000	20 213 20.450
ISA-D 210	210	20 004 13.400	20 005 13.500	200.000	20 213 20.500
ISA-D 310	310	20 005 13.500	20 005 13.630	600.000	20 213 20.710
ISA-D 390	390	20 005 13.630	20 120 13.800	700.000	20 613 32.900
ISA-D 460	460	20 120 13.800	20 120 13.1000	800.000	20 623 32.1000
ISA-D 580	580	20 120 13.1000	20 120 13.1250	1.200.000	20 623 32.1100
ISA-D 650	650	20 120 13.1100	20 120 13.1600	1.200.000	20 623 32.1250
ISA-D 820	820	20 120 13.1250	20 120 13.1600	2.000.000	20 633 32.1500
ISA-D 950	950	20 120 13.1600	2 x 20 120 13.1000	4.500.000	20 633 32.1600
ISA-D 1100	1100	2 x 20 120 13.1000	2 x 20 120 13.1250	4.500.000	20 688 32.2500
ISA-D 1400	1400	2 x 20 120 13.1250	2 x 20 120 13.1600	6.500.000	20 688 32.2500
ISA-D 1800	1800	2 x 20 120 13.1600	3 x 20 120 13.1250	12.500.000	2x20 688 32.2000
ISA-D 2150	2150	3 x 20 120 13.1250	3 x 20 120 13.1600	16.500.000	2x20 688 32.2000
ISA-D 2400	2400	3 x 20 120 13.1250	3 x 20 120 13.1600	20.000.000	2x20 688 32.2500
ISD-D 2700	2700	3 x 20 120 13.1600	4 x 20 120 13.1500	26.000.000	2x20 688 32.2500
ISA-D 3000	3000				
ISA-D 3500	3500				

14-4 Selection of normal and semi conductor fuses / Article Numbers

Maximum Motor FLA	Starter Type	Size (aluminium)	Power [kW]
8	ISA-D 8	A	4
17	ISA-D 17		7,5
31	ISA-D 31		15
44	ISA-D 44		22
58	ISA-D 58		30
72	ISA-D 72		37
85	ISA-D 85	B	45
105	ISA-D 105		55
145	ISA-D 145		75
170	ISA-D 170		90
210	ISA-D 210	C	110
310	ISA-D 310		160
390	ISA-D 390		200
460	ISA-D 460	D	250
580	ISA-D 580		315
820	ISA-D 820		450
950	ISA-D 950		530
1100	ISA-D 1100	E	630
1400*	ISA-D 1400		800
1800*	ISA-D 1800		950
2150*	ISA-D 2150	F	1250
2400*	ISA-D 2400	G	1350
2700*	ISA-D 2700		1750
3000*	ISA-D 3000		1850
3500*	ISA-D 3500		

* Using full capacity of soft starter only in case of by-pass contactor

14-5 Power Steps and Sizes

Starter Current	Size	Width	Height	Depth	Weight
8, 17	A	153	310	170	4,5
31		153	310	170	6
44, 58, 72		153	310	217	7,5
85, 105, 145, 170	B	274	385	238	14,5
210, 310, 390	C (Standard)	380	455	292	32
210, 310, 390	C (Sonderbf.)	590	500	290	44
460	D 1 (Standard)	380	555	292	39
580	D 2 (Standard)	470	655	302	48
820	D 3 (Standard)	470	710	302	54
460, 580, 820	D(Sonderbf.)	623	660	290	65
950		623	660	290	83,5
1100, 1400, 1800	E	723	1100	361	170
2150	F	750	1300	392	240
2400, 2700, 3000	G	900	1300	410	350

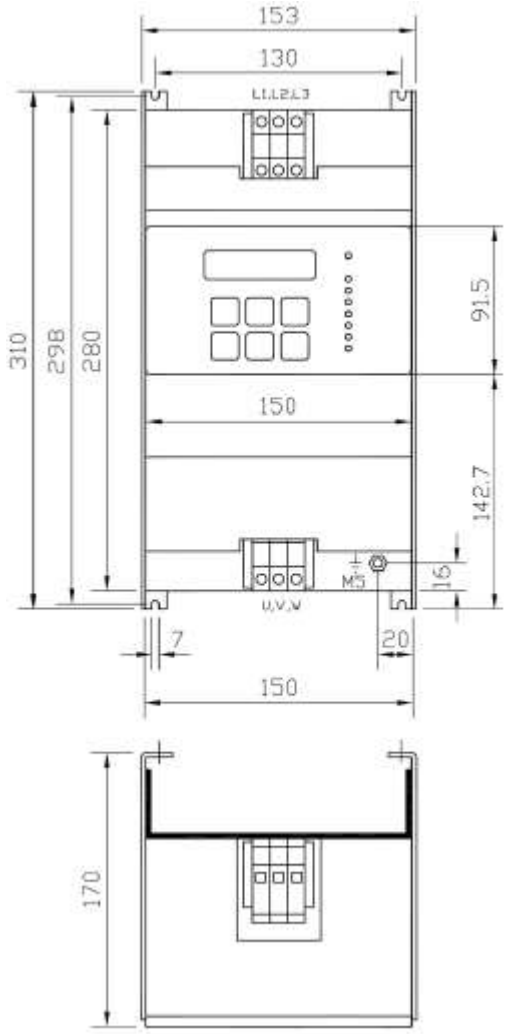
14-6 Encasing dimensions: Size (mm) & Weight (Kg)

EMC		
Emission	EN 55011	CISPR 11 Class A
Immunity	EN 55082-2	ESD 8KV Air, IEC 801-2 High Frequency Emission 10 V/m, 20-1000Mhz, IEC 801-3 rapid transients 2KV, IEC 801-4
Security	EN 600947-1	Referring to the safety guidelines.
	Developed and designed according to UL508C.	

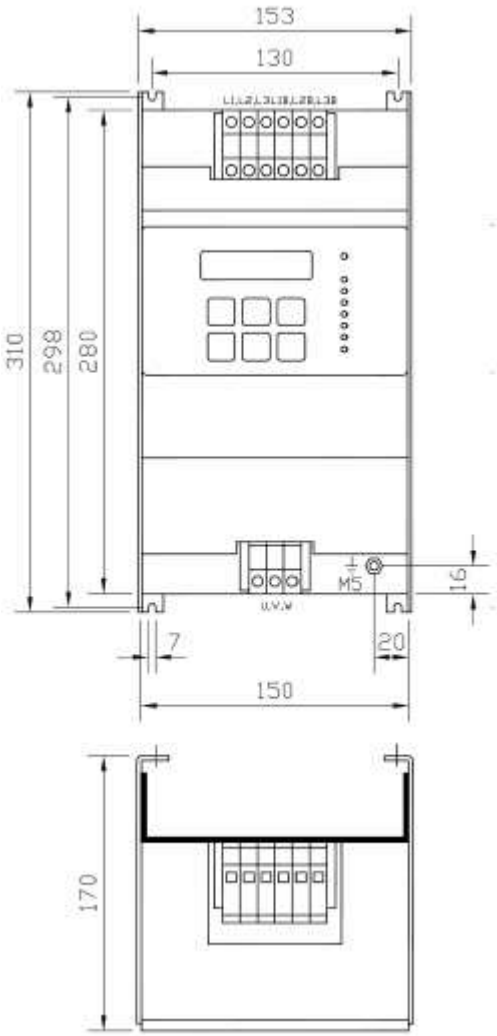
14-7 Soft Starter Standards

Size – A 8, 17 A

without by-pass preparation



with by-pass preparation

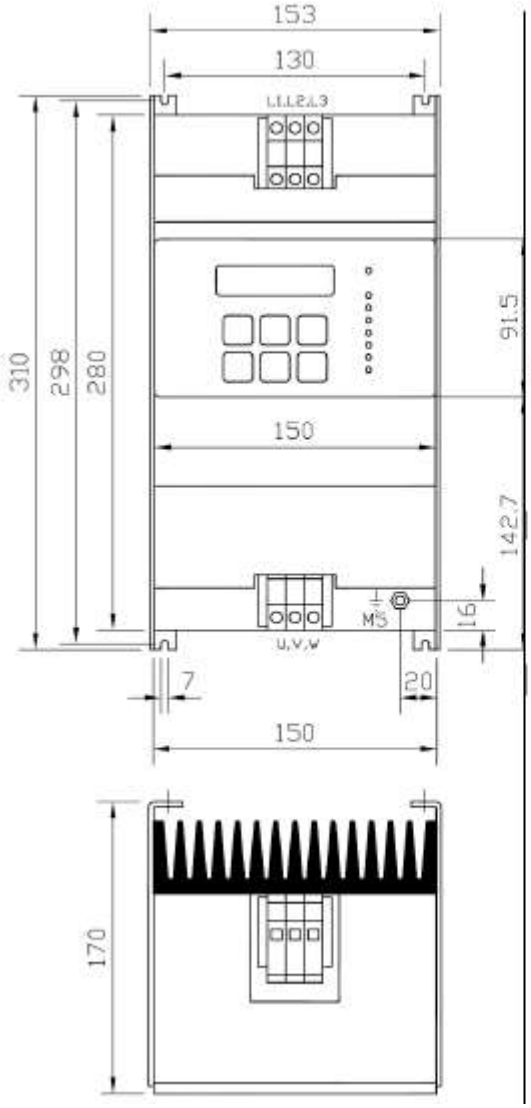


14-1 Dimension Drawings Size A

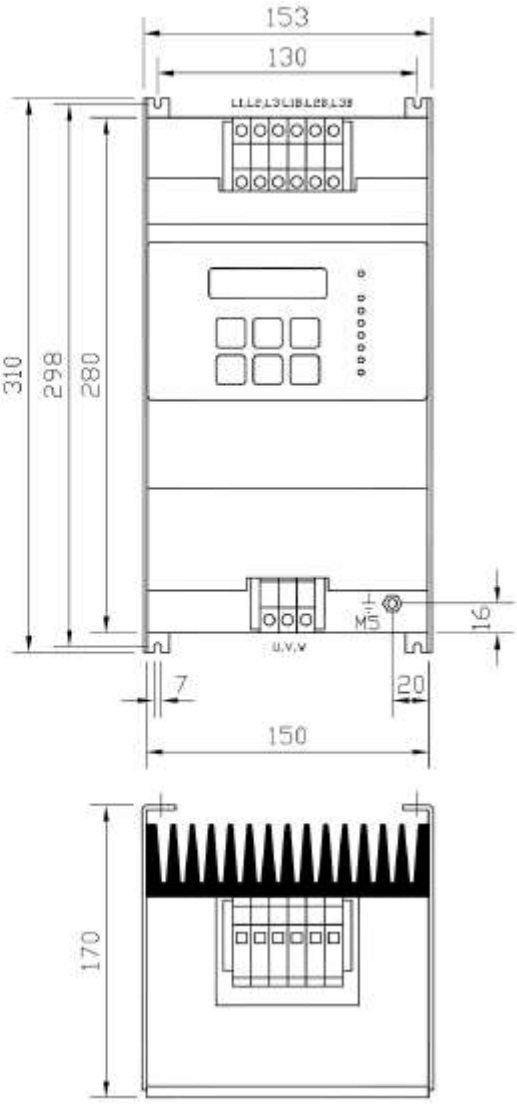
Terminals: 10mm²

Size – A 31A

without by-pass preparation



with by-pass preparation

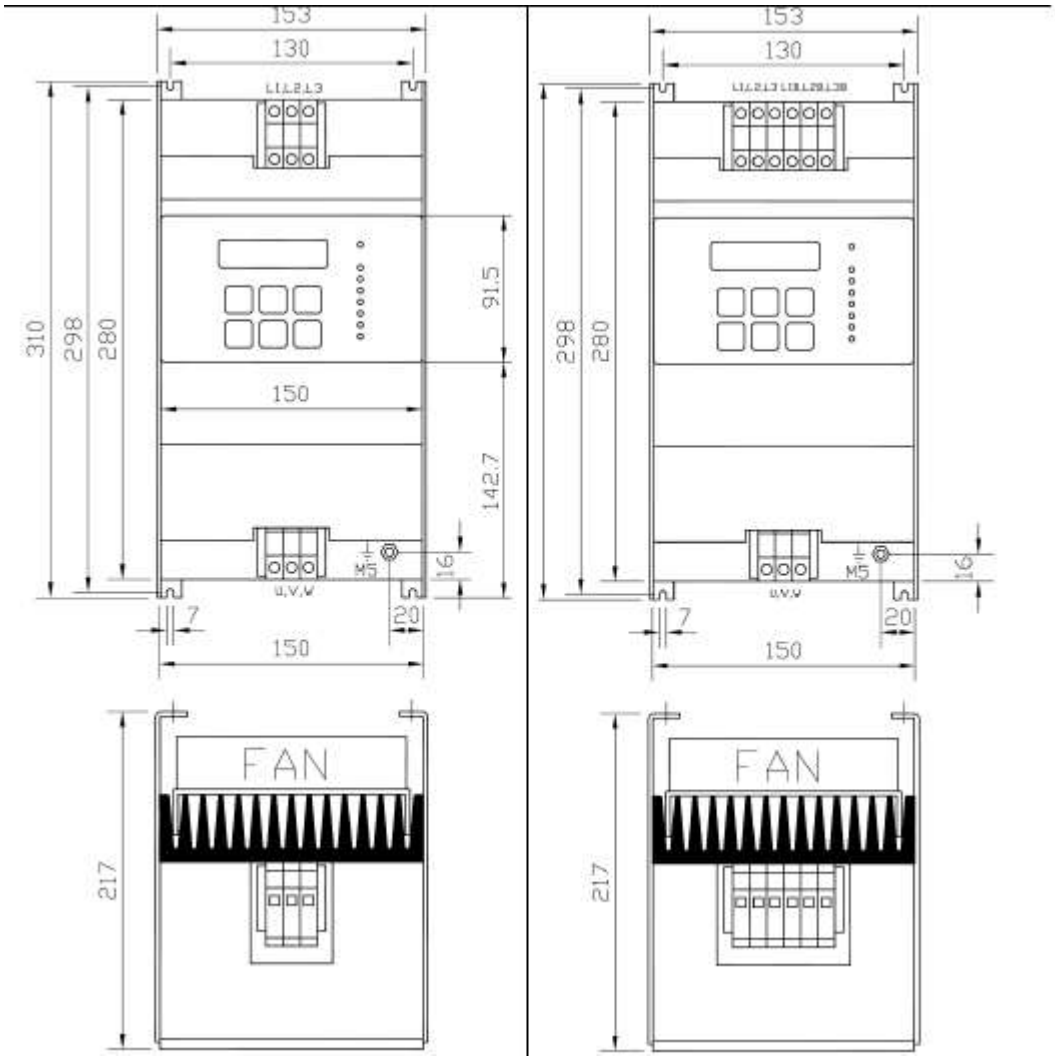


14-2 Dimension Drawings Size A

Terminals: 10mm²

Size – A 44, 58, 72A

without by-pass preparation



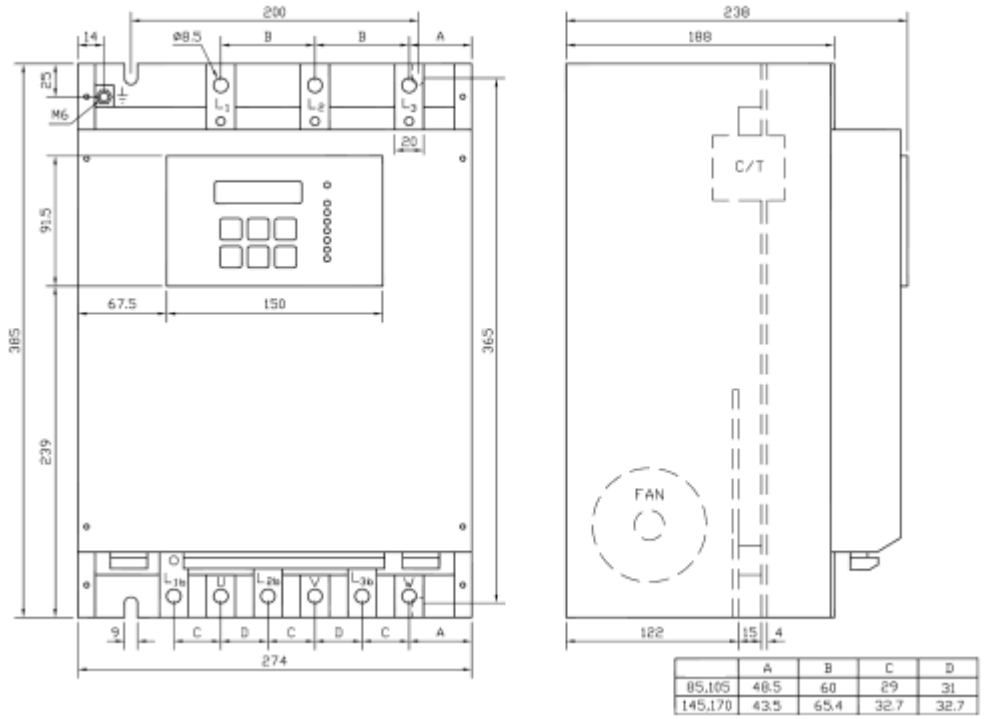
with by-pass preparation

14-3 Dimensions Drawings Size A

Terminals 44 and 58A: 10mm²
Terminals 72A: 16mm²

Size – B 85, 105, 145, 170A

(Standard by-pass preparation)

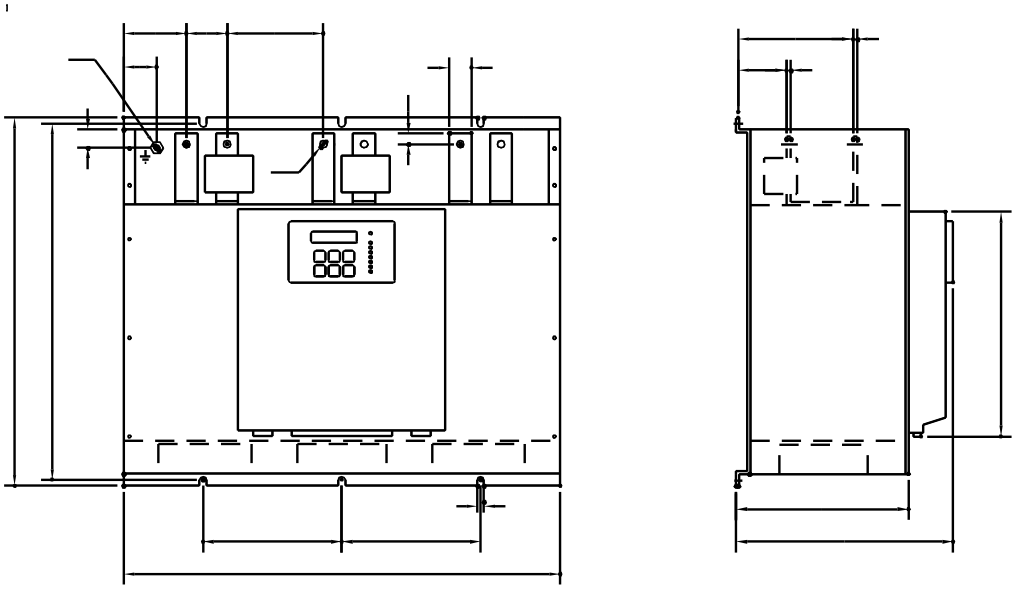


	A	B	C	D
85,105	48.5	60	29	31
145,170	43.5	65.4	32.7	32.7

14-4 Dimensions Drawing Size B

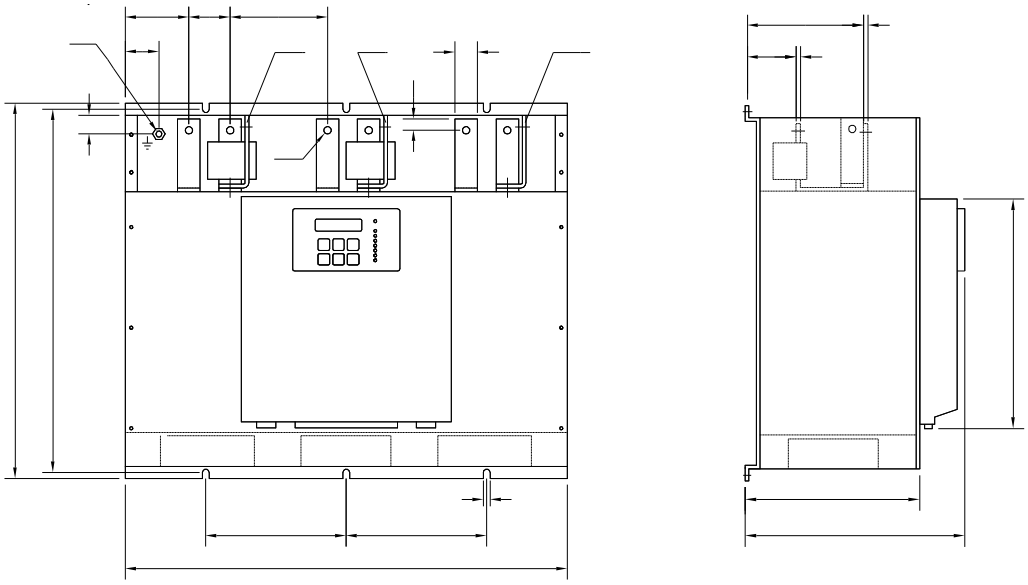
Size – C (Special Design for Marine/UL)

210, 310, 390A



14-3 Dimension Drawing Size C (Special Design for marine/UL)

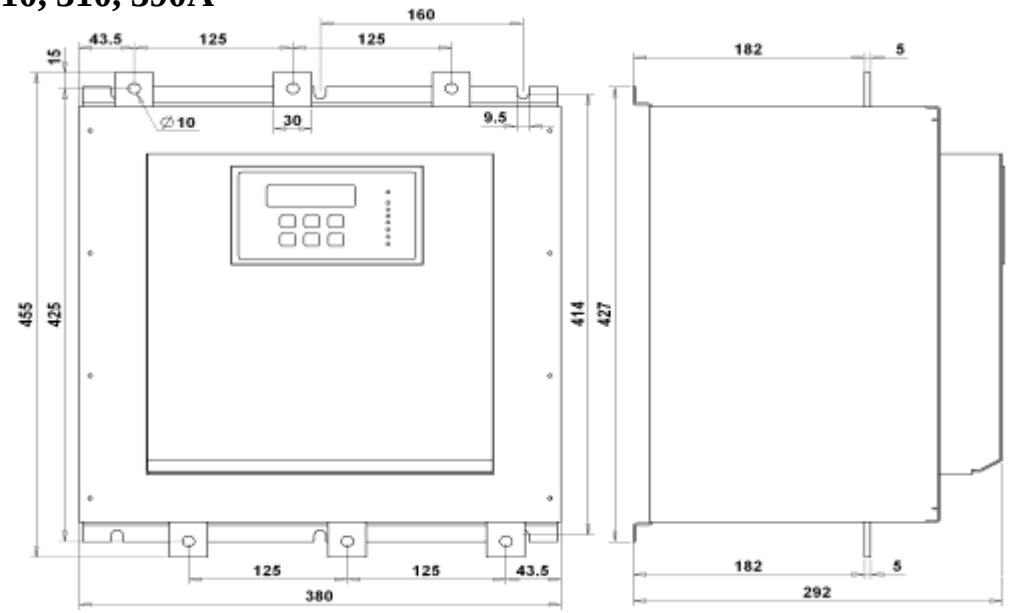
- The soft starter can be supplied with line and load connections on the backside.
- The soft starter can be supplied Der Starter kann ohne Seitenverkleidungen, mit maximaler Breite von 536 Millimeter (anstatt 590) geliefert werden



14-4 Dimension Drawing 2 Size C (Special design)

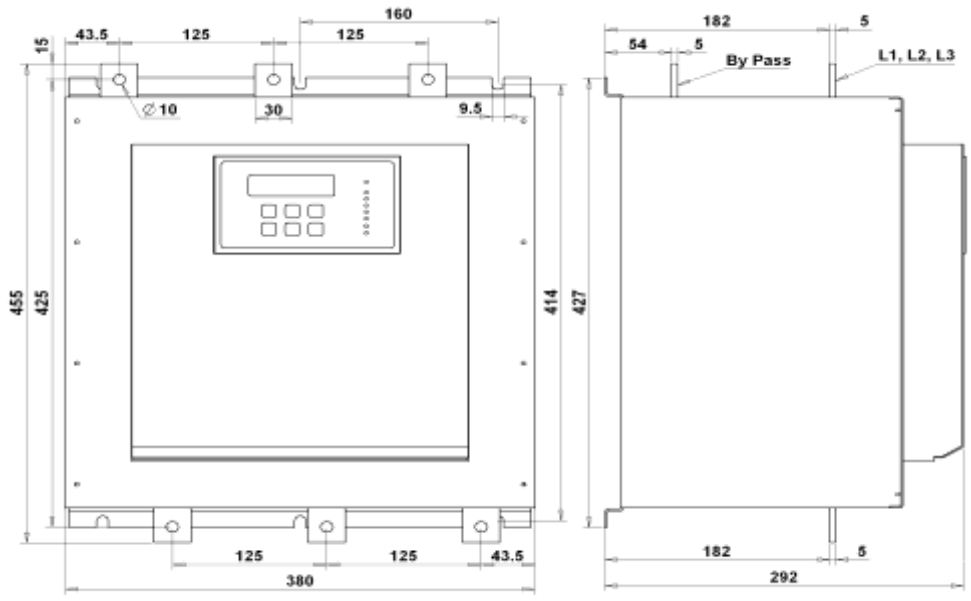
Size – C (Standard)

210, 310, 390A



14-5 Dimension Drawing Size C (Standard)

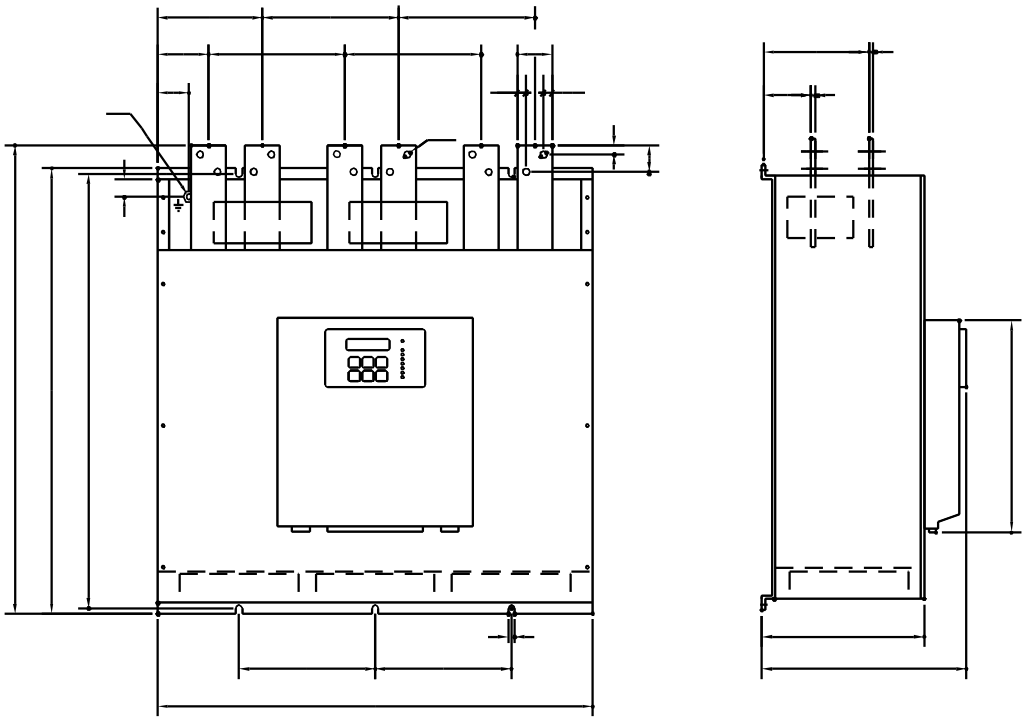
By-pass Preparation



14-6 Dimension Drawing 2 Size C (Standard)

Size – D (Special Design for Marine/UL)

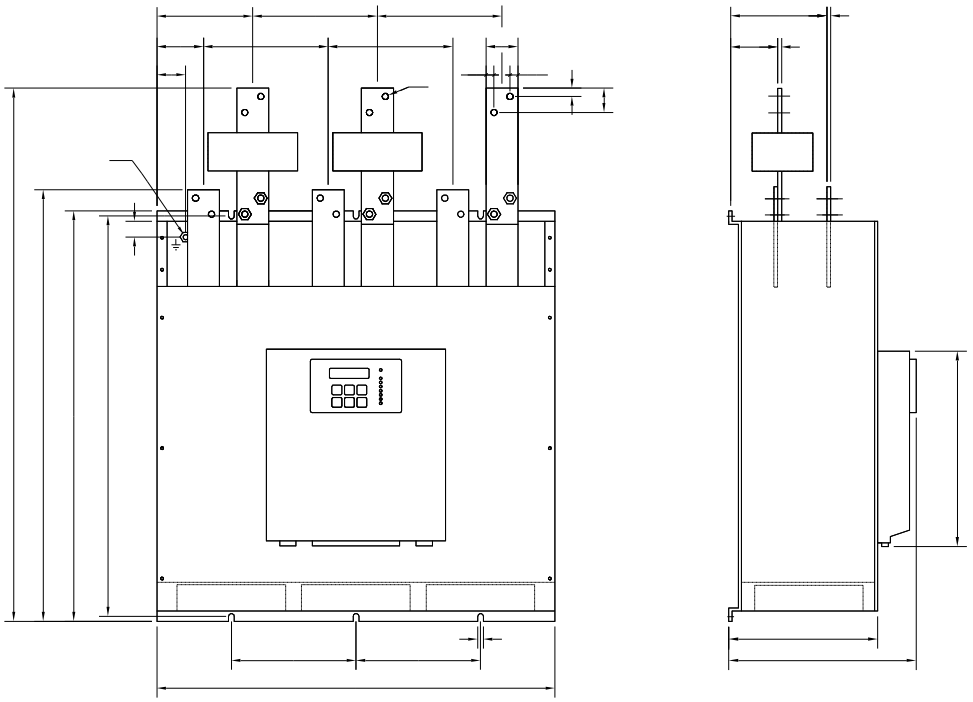
460, 580, 820A



- The soft starter can be supplied with line and load connections on the backside.

14-7 Dimension Drawing Size D (Special Design for Marine/UL)

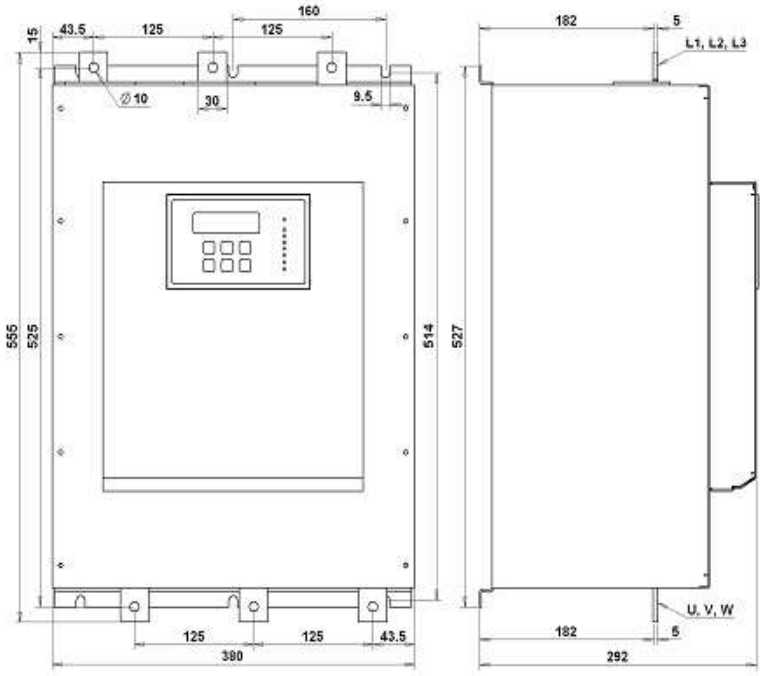
By-pass Preparation



14-8 Dimension Drawing 2 Size D (Special Design for Marine/UL)

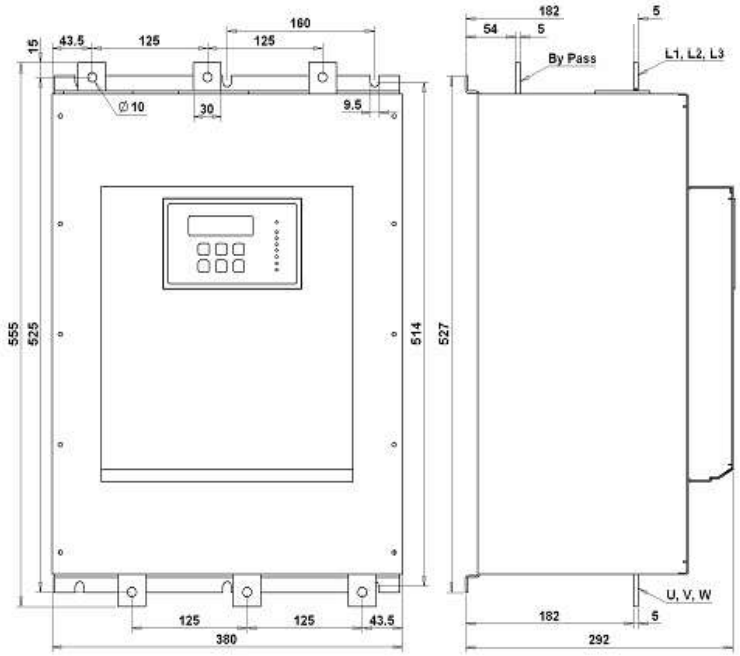
Size – D 1 (Standard)

460A



14-9 Dimension Drawing Size D (Standard)

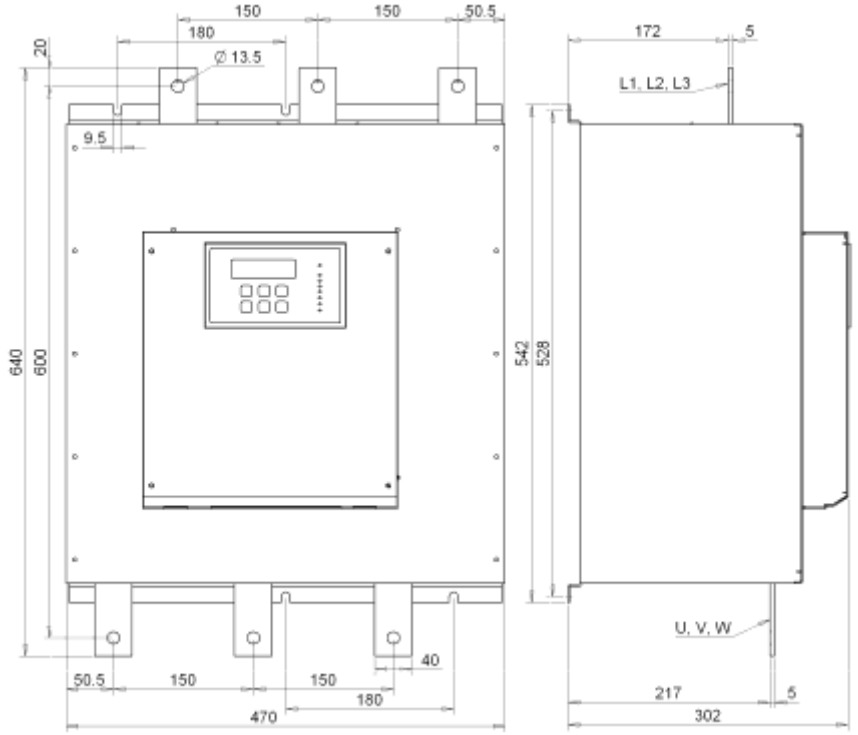
By-pass preparation



14-10 Dimension Drawing 2 Size D (Standard)

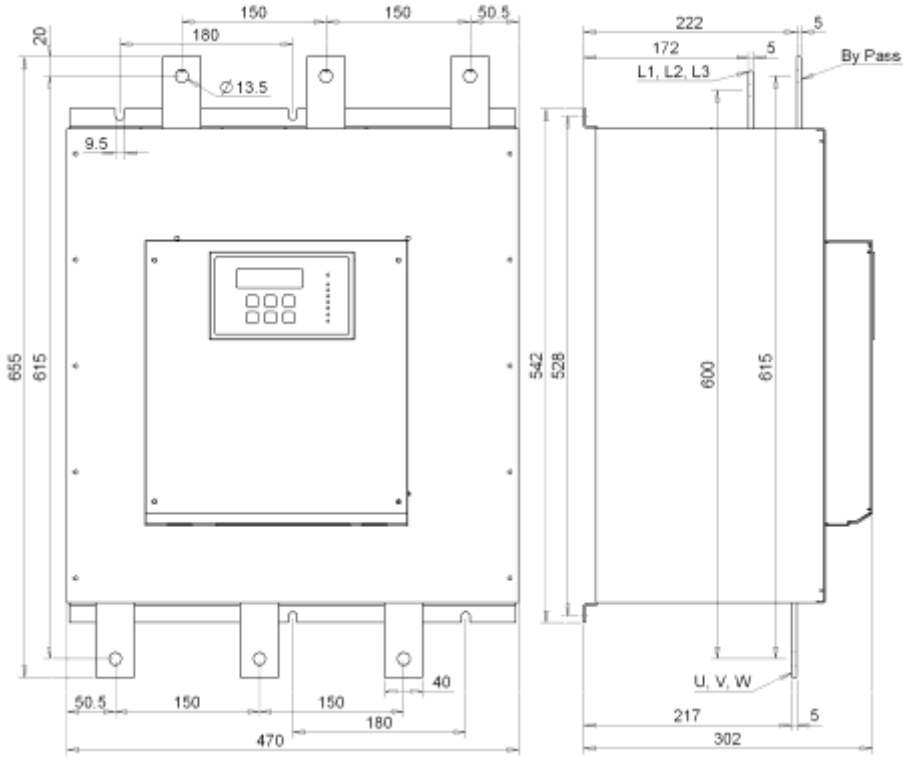
Size – D 2 (Standard)

580A



14-11 Dimension Drawing 3 Size D (Standard 580A)

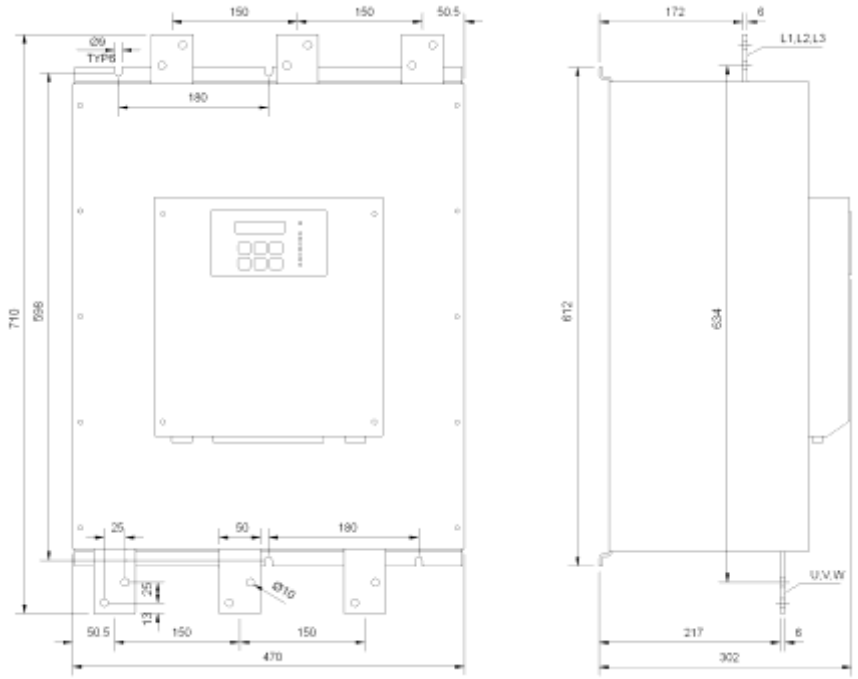
Bypass Preparation



14-12 Dimension Drawing 4 Size D (Standard)

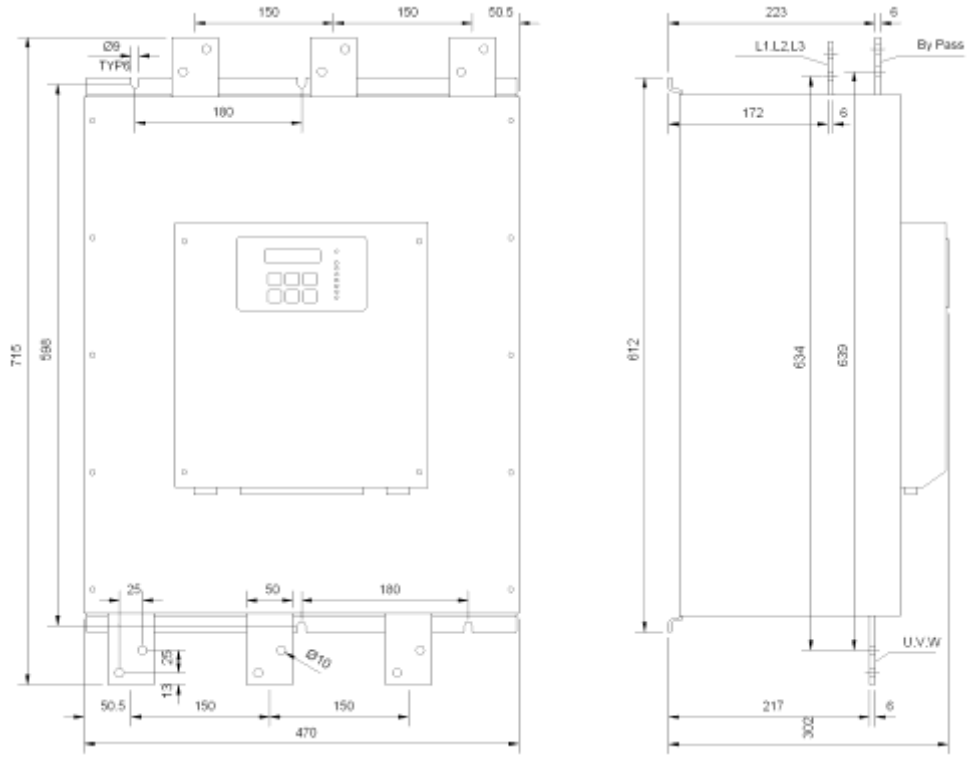
Size – D 3 (Standard)

820A



14-13 Dimension Drawing 5 Size D (Standard 820A)

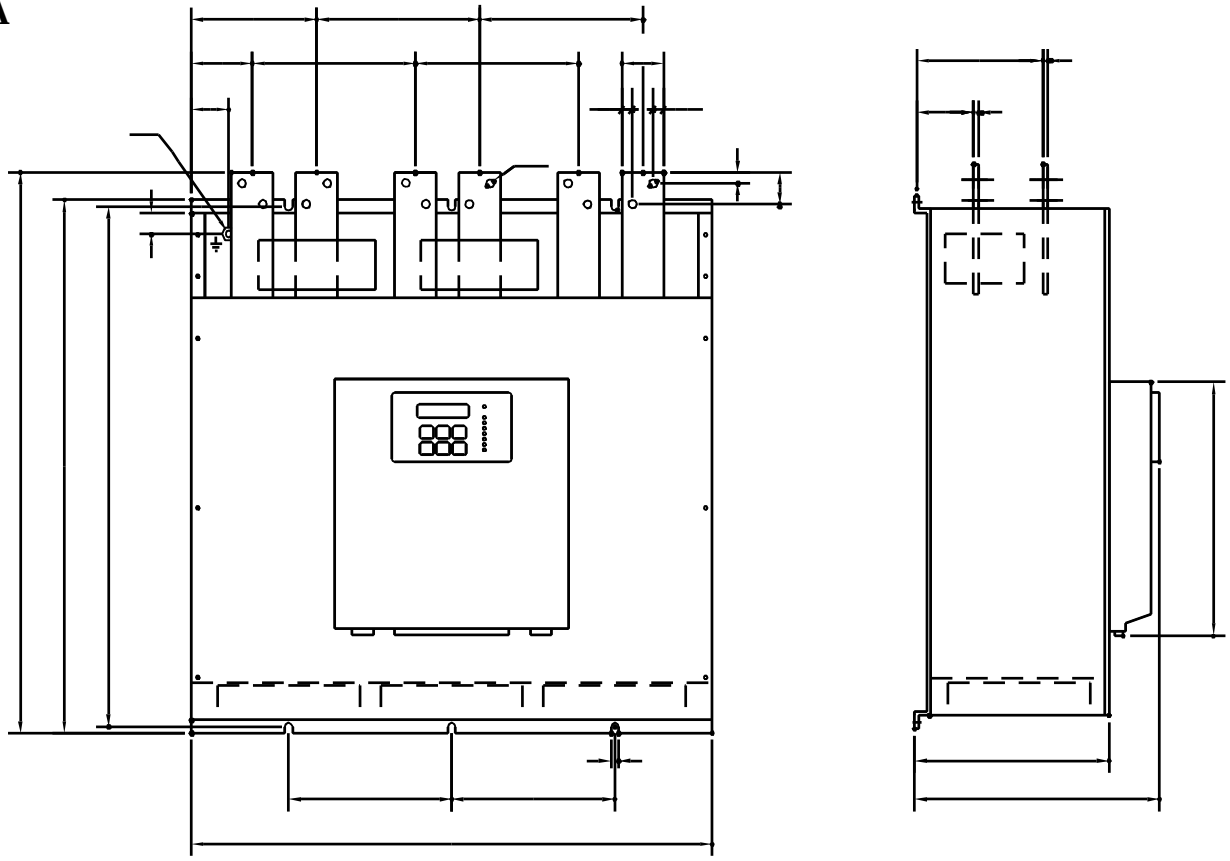
Bypass Preparation



14-14 Dimension Drawing 6 Size D (Standard 820A)

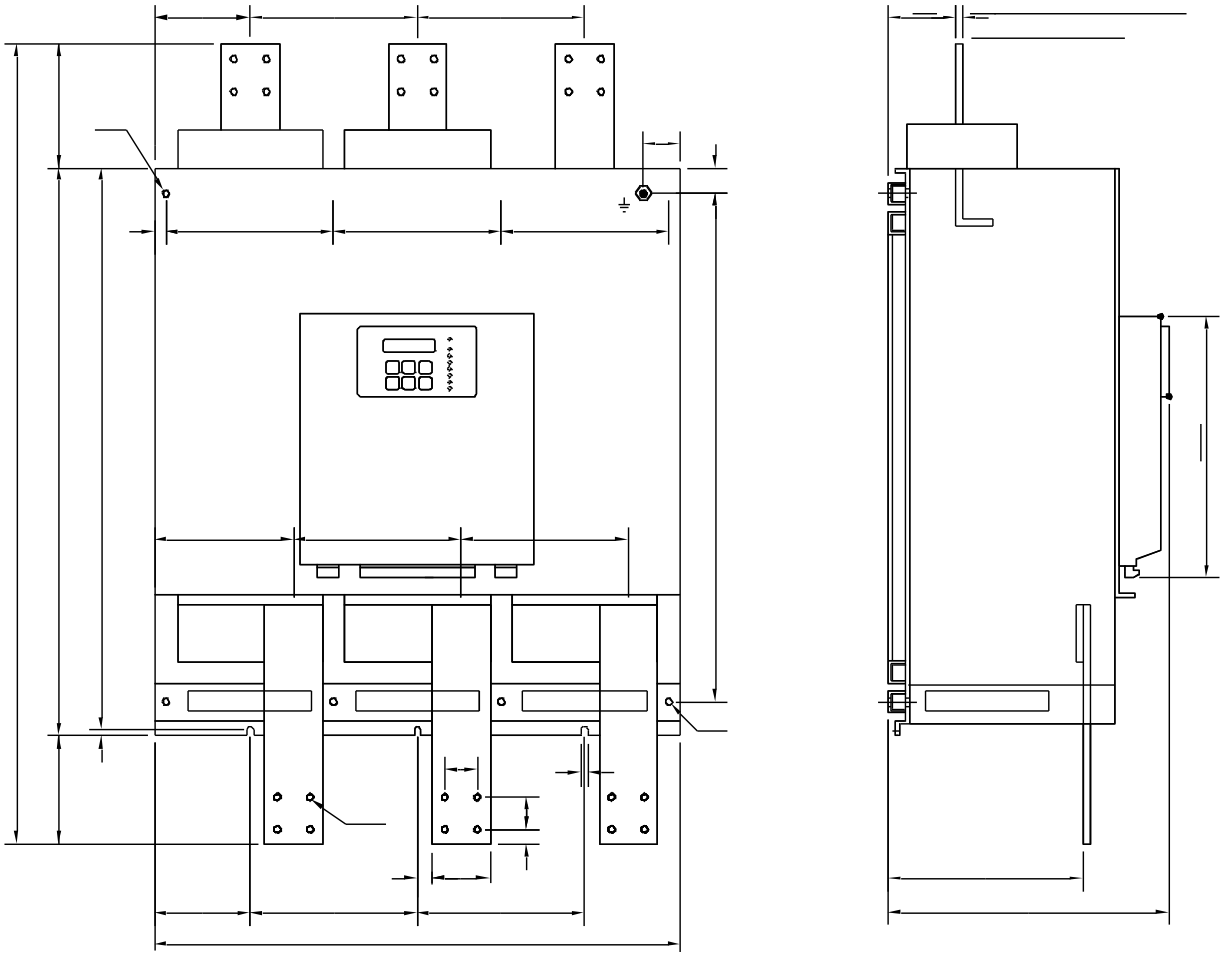
Size – D 4 (Standard)

950A



14-15 Dimension Drawing 7 Size D (Standard 950A)

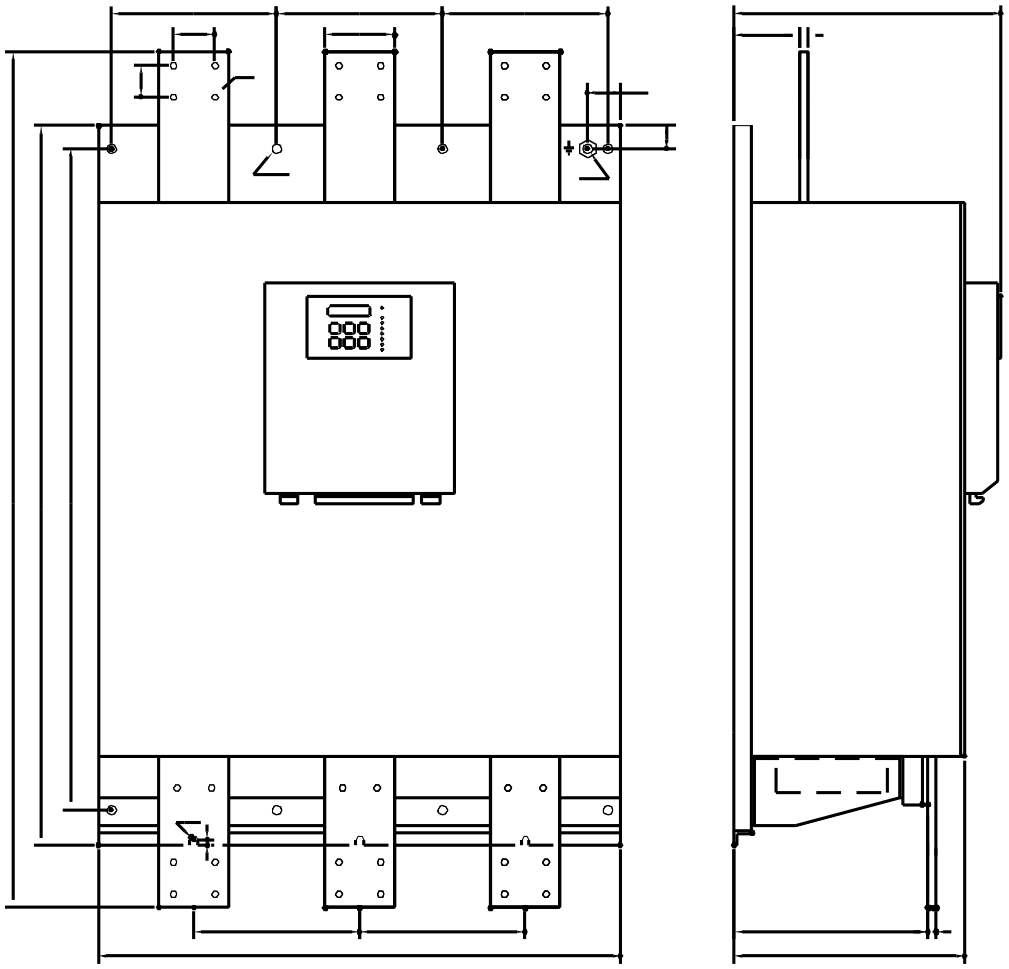
Size – E 1100, 1400, 1800A



14-16 Dimension Drawing Size E

Current Transformer - Sizes:
1100A: Width 240mm, Height 130mm, Depth 90mm
1400A: Width 270mm, Height 155mm, Depth 90mm
1800A: Width 270mm, Height 155mm, Depth 100mm

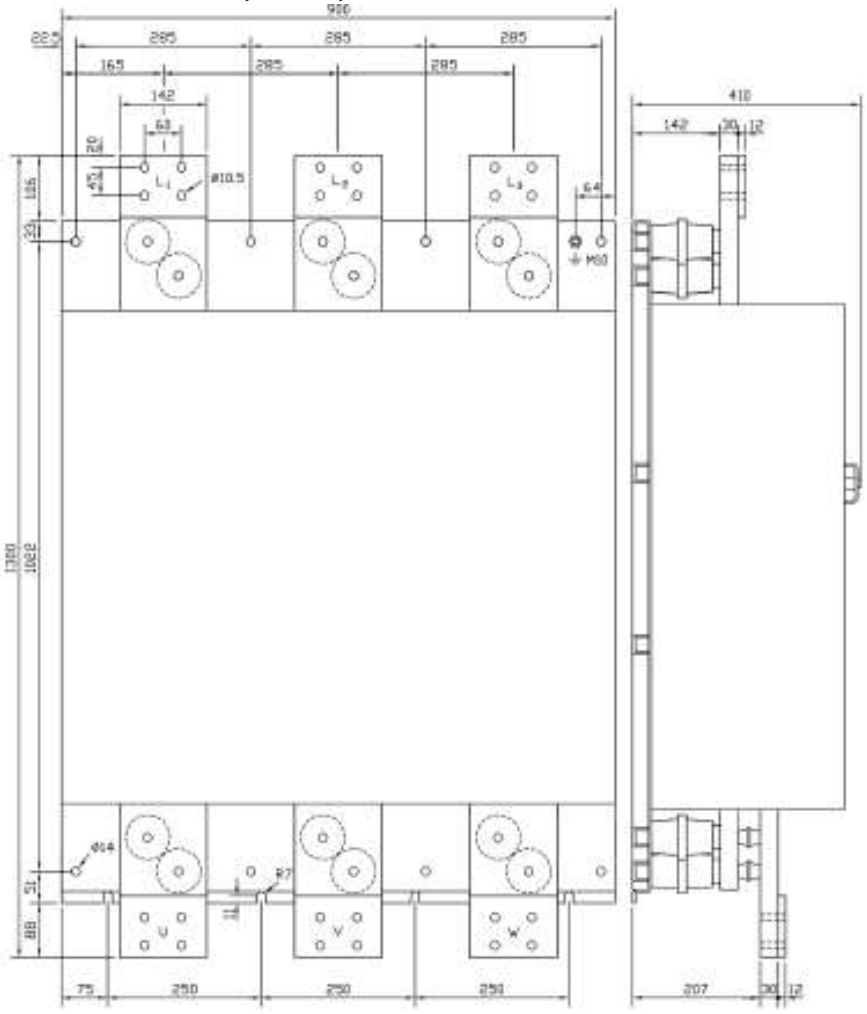
Size – F 2150A



14-17 Dimension Drawing Size F

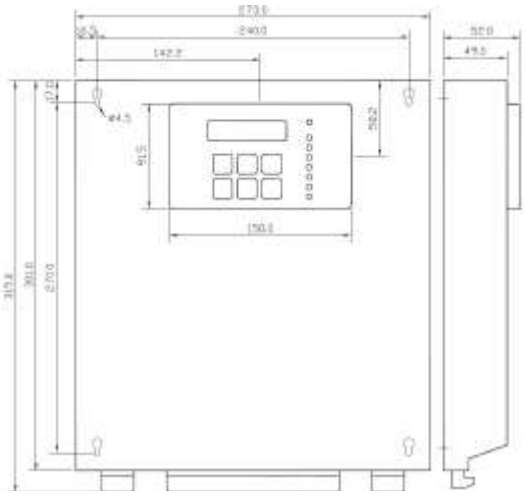
Current Transformer – Size:
1800A: Width 270mm, Height 155mm, Depth 100mm

Size – G 2400A, 2700, 3000A



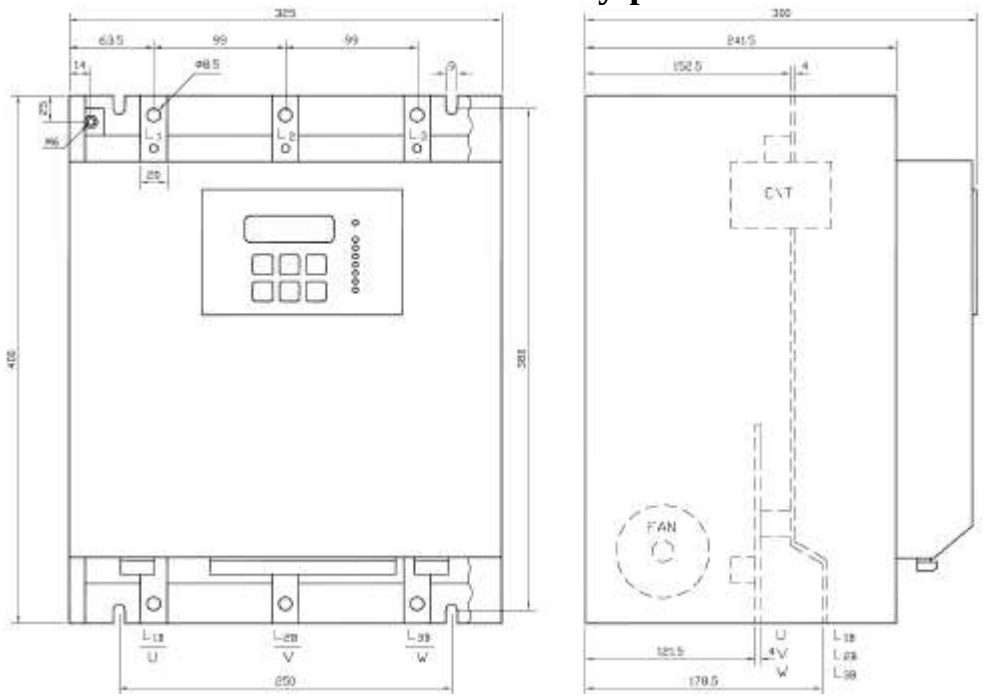
14-18 Dimension Drawing Size G

Current Transformer – Size:
Width 270mm, Height 155mm, Depth 100mm



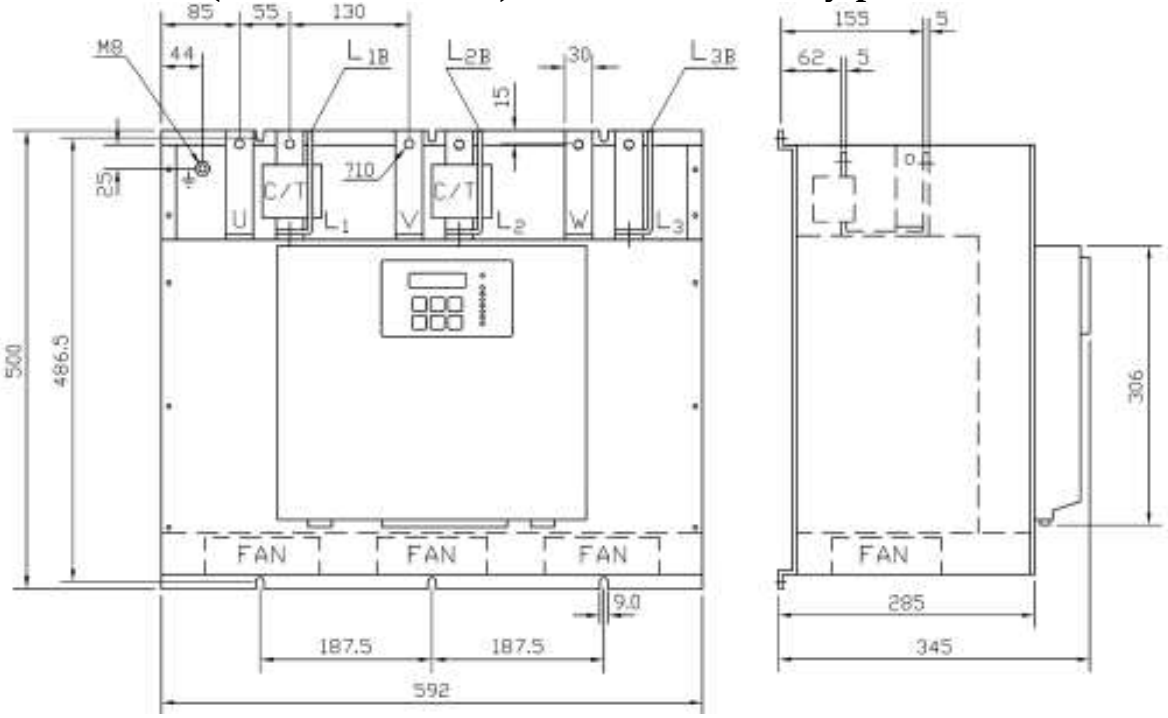
14-19 Dimension Drawing Control Board ISA-D 2400, 2700, 3000A

Size – 1000V/105A must be run with by-pass



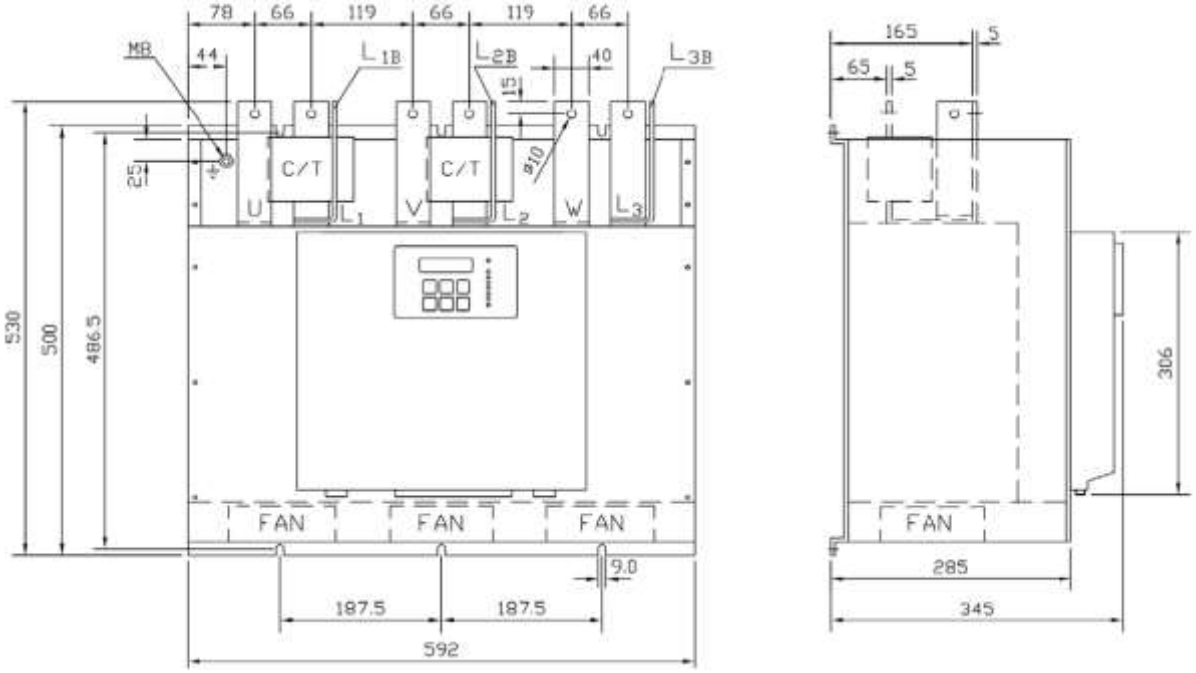
14-20 Dimension Drawing 1000V/105A

Size – 1000V/(170,210,310,390A) must be run with by-pass



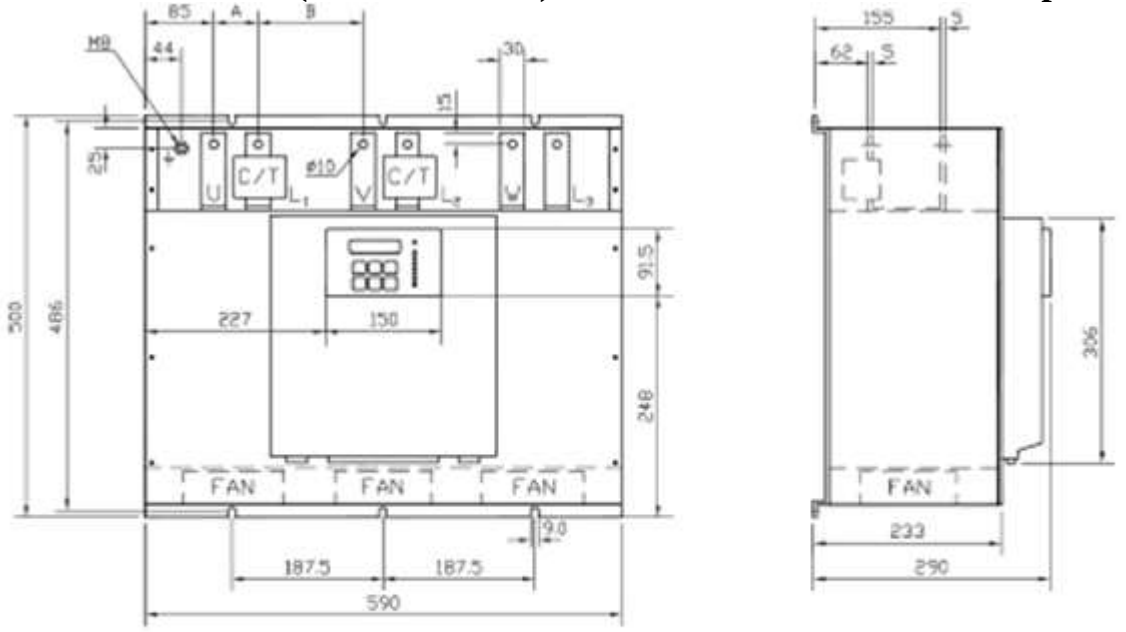
14-21 Dimension Drawing 1000V/170A, 210A, 310A, 390A

Size – 1000V/460A must be run with by-pass



14-22 Dimension Drawing 1000V/460A

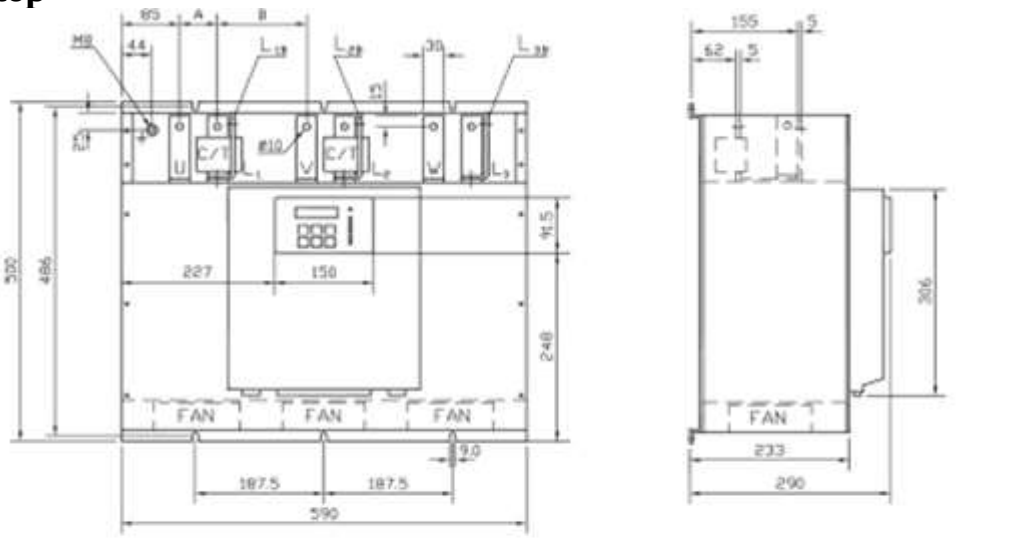
UL/Marine Model (210, 310, 390A) Busbar Connectioncs at the top



	210	310	390
A	45	45	55
B	140	135	130

14-23 Dimension Drawing UL/Marine Modell 210-390A

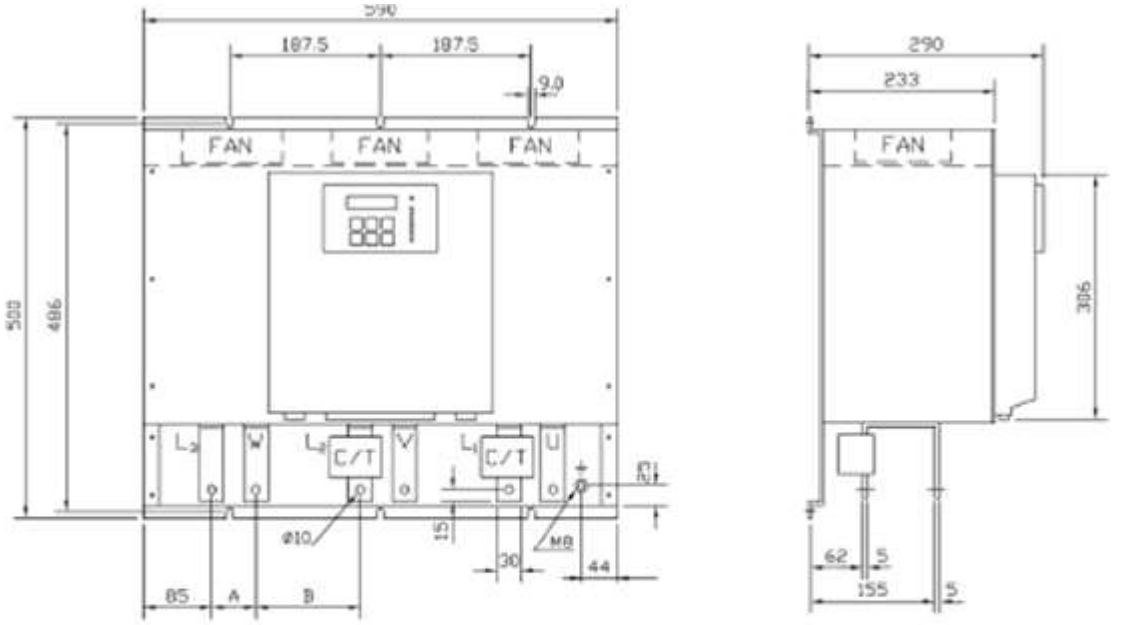
UL/Marine Model (210, 310, 390A mit Bypass) Busbar Connections from top



	210	310	390
A	45	45	55
B	140	135	130

14-24 Dimension Drawings UL/Marine Model 210-390A with by-pass

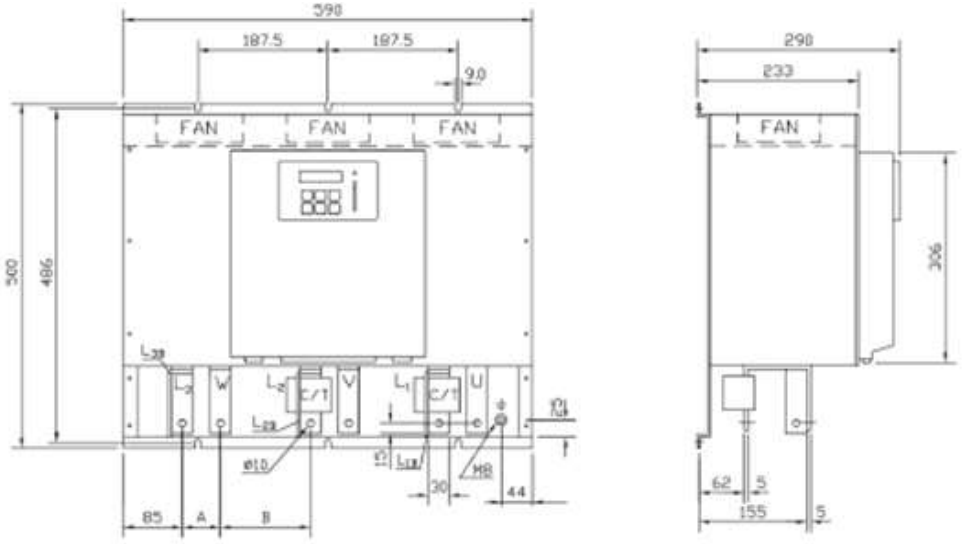
UL/Marine Model (210, 310, 390A without by-pass) busbar connections from bottom



	210	310	390
A	45	45	55
B	140	135	130

14-25 Dimension Drawings UL/Marine Model 210-390A without by-pass

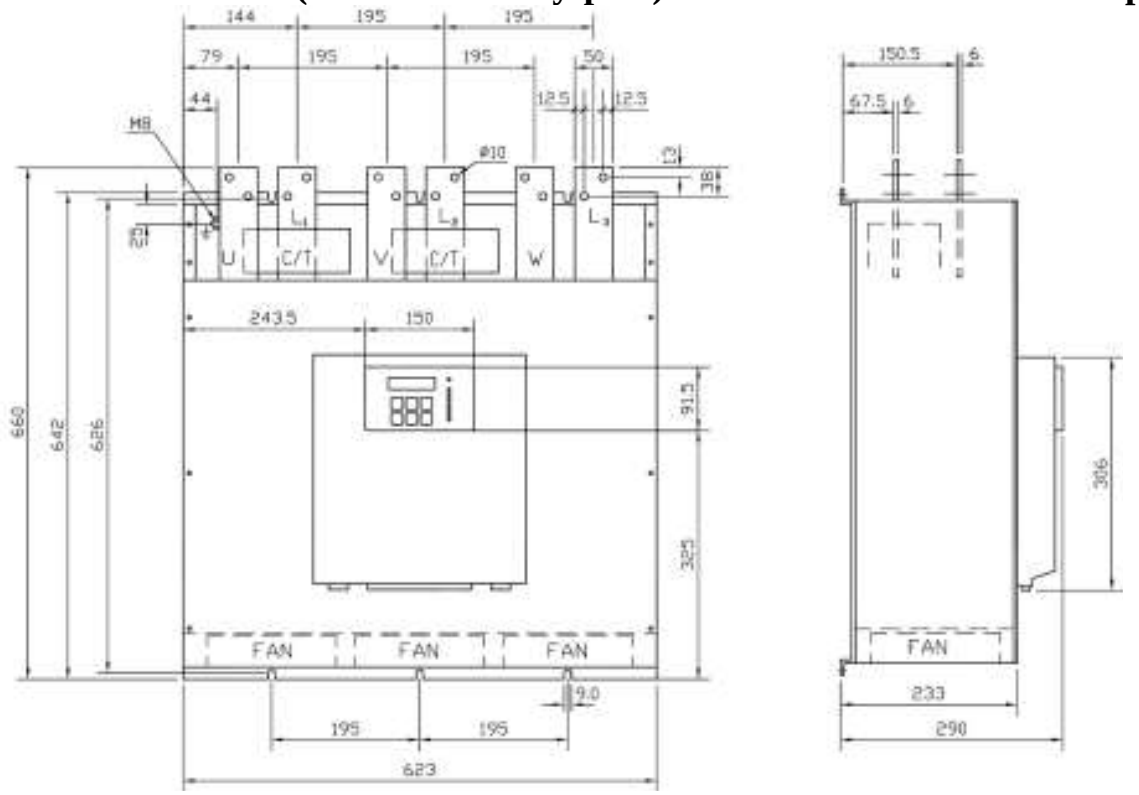
UL/Marine Model (210, 310, 390A with by-pass) busbar connections from bottom



	210	310	390
A	45	45	55
B	140	135	130

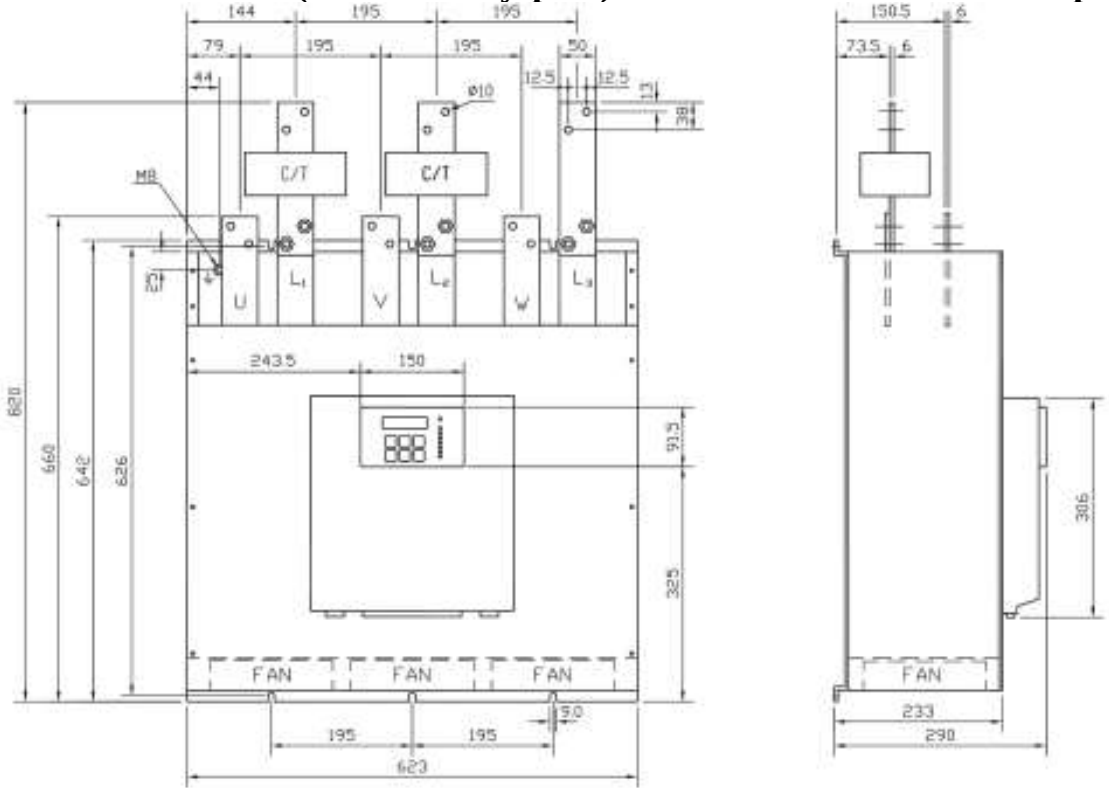
14-26 Dimension Drawings UL/Marine Model 210-390A with by-pass

UL/Marine Model (460A without by-pass) Busbar Connections from top



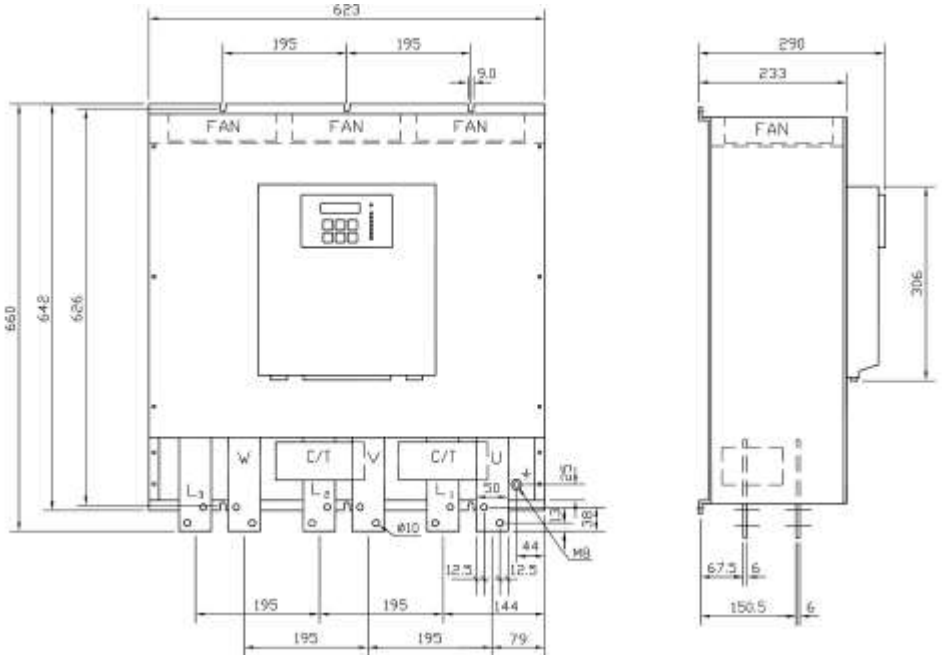
14-27 Dimension Drawings UL/Marine Model 460A without by-pass

UL/Marine Model (460A with by-pass) Busbar Connections from top



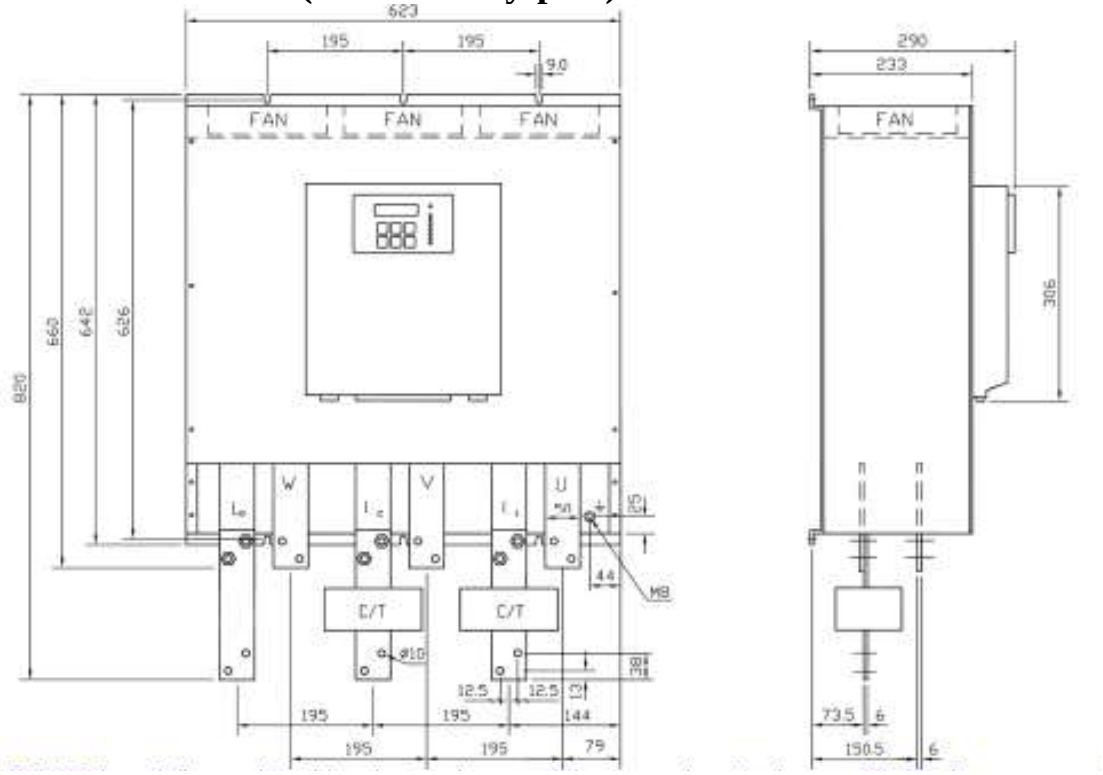
14-28 Dimension Drawings UL/Marine Model 460A with by-pass

UL/Marine Model (460A without by-pass) Busbar Connections from bottom



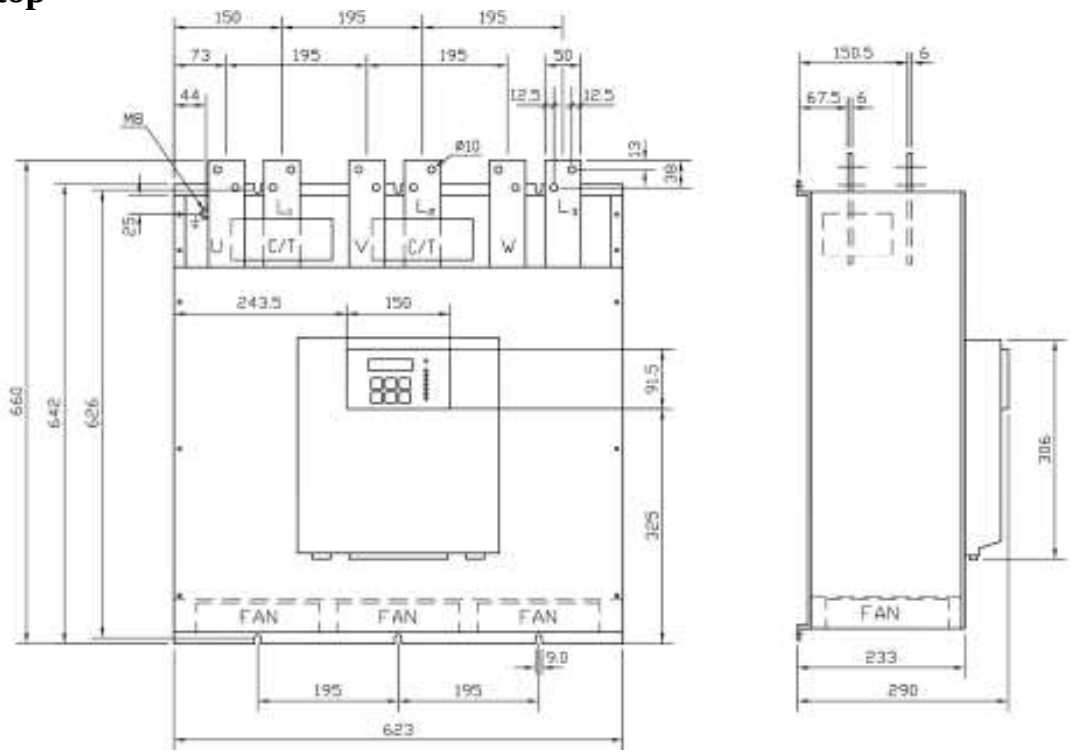
14-29 Dimension Drawing UL/Marine Model 460A without by-pass

UL/Marine Model (460A with by-pass) Busbar Connections from bottom



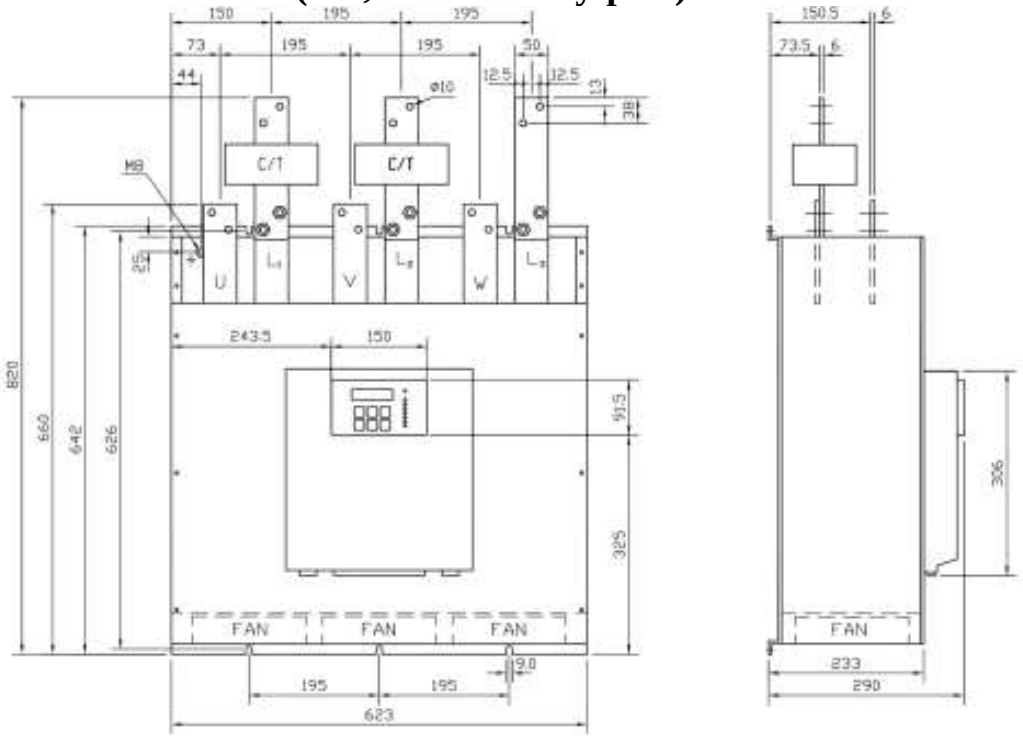
14-30 Dimension Drawing UL/Marine Model 460A with by-pass

UL/Marine Model (580, 820A without by-pass) Busbar Connections from top



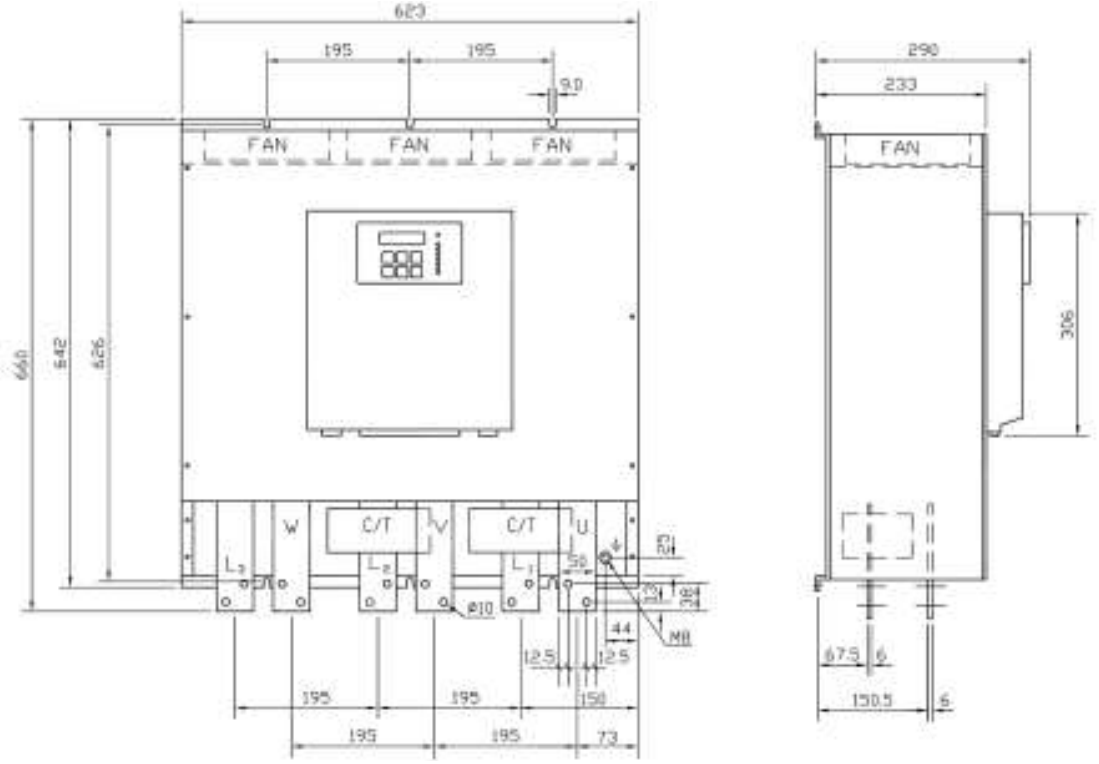
14-31 Dimension Drawing UL/Marine Model 580, 820A without by-pass

UL/Marine Model (580, 820A with by-pass) Busbar Connections from top



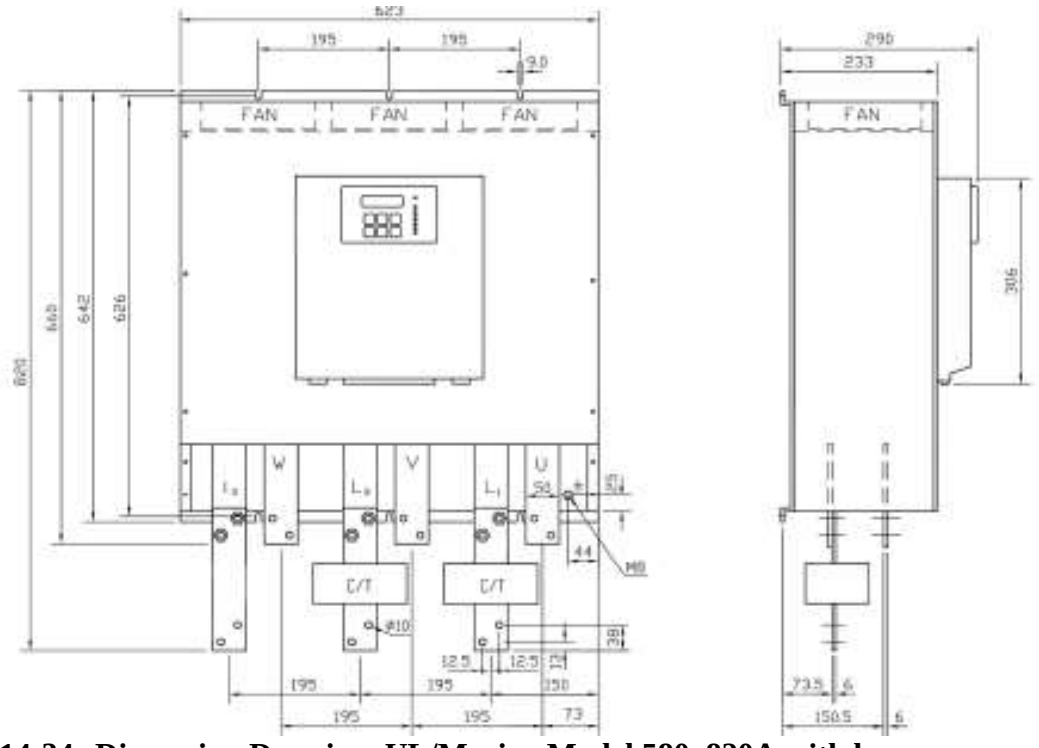
14-32 Dimension Drawing UL/Marine Model 580, 820A with by-pass

UL/Marine Model (580, 820A without by-pass) Busbar Connections from bottom



14-33 Dimension Drawing UL/Marine Model 580, 820A without by-pass

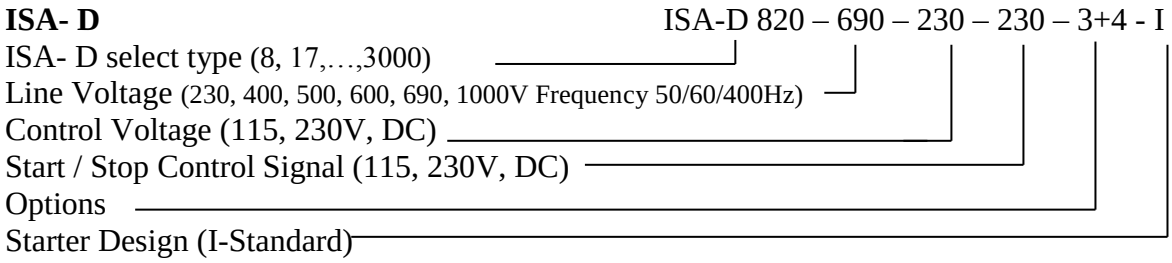
UL/Marine Model (580, 820A with by-pass) Busbar Connections from bottom



14-34 Dimension Drawing UL/Marine Model 580, 820A with by-pass

13 Ordering Information

The starter should be ordered according to the following example:



Example: ISA- D

ISA- D	310 -xxxx	-1000 -xxxx	-230 -xxx	-DC -xxx	-5+9 -x	-I -x
Starter Rated Current (1)						
Motor Line Voltage (2)						
Control Voltage (3)						
Control Voltage Input (4)						
Options (5)						
Starter Design (6)						

(1) Starter Current	8, 17, 31, 44,58,72,85,105,145, 170, 210, 310, 390, 460, 580, 820, 950, 1100, 1400, 1400, 1800, 2150, 2400 and 2700 Ampere.	
(2) Line Voltage	to specify	
	400	380-440 VAC + 10%-15%
	480	460-500 VAC + 10%-15%
	600	575-600 VAC + 10%-15%
	690	660-690 VAC + 10%-15%
	1000	1000 VAC
(3) Control Voltage (Terminals 1-3)	to specify	
	115	110-120 VAC + 10%-15%
	230	220-240 VAC + 10%-15%
	DC³	110 VDC + 10%-15%
(4) Control Voltage Input (Terminals 4-9)	to specify	
	230	90-240 VAC/DC + 10%-15%
	DC³	24-48 VAC/DC + 10%-15%
(5) Options	to specify	
	0	no options
	3M	RS-485 communication
	3P	PROFIBUS communication
	4	insulation alarm
	5	Analogue Card (motor current/thermistor)
	8	Design for harsh environments
	9	Preparation for by-pass contactor
	L	lighted LCD- Display
	M	Marine Model
(6) Starter Design	to specify	
	I	Standard

NOTES:

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