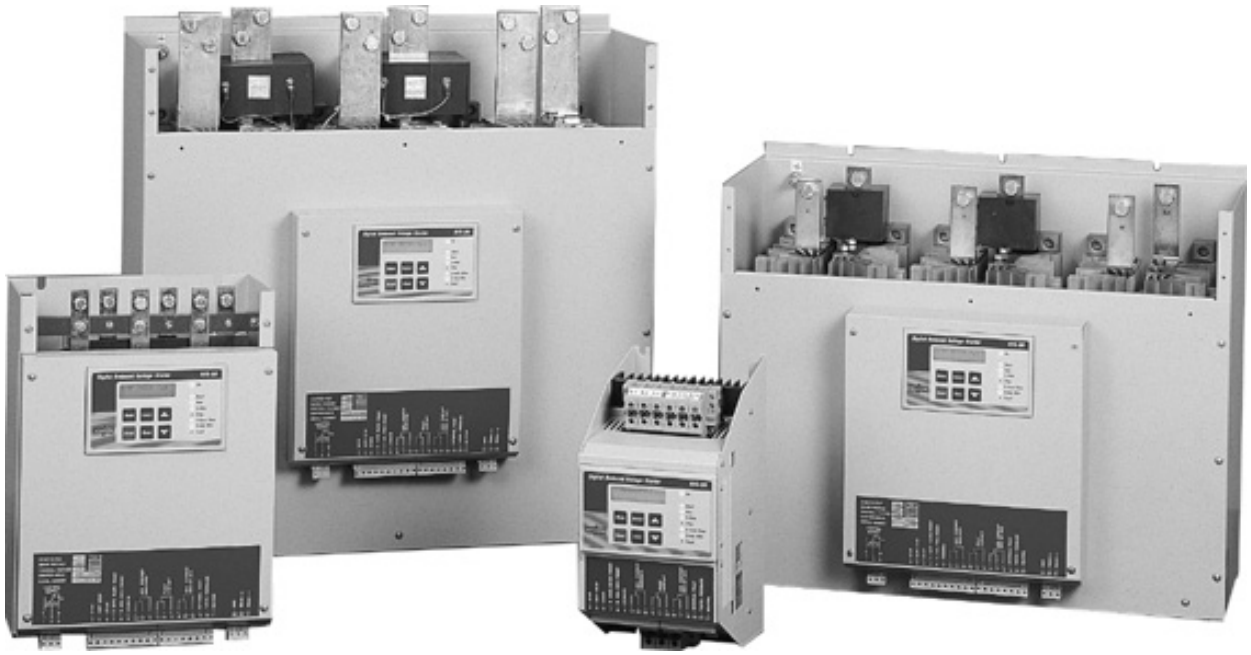
RVS-DN

Digital Soft Starter
8-3500A, 220-1000V



Instruction Manual

Ver. 12/10/2003

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Safety

- 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 operation 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.
- After installation, check and verify that no parts (bolts, washers, etc) have fallen into the power Section (IP00 for sizes B-G).

Attention

- This product was designed for compliance with IEC 947-4-2 for class A equipment.
- RVS-DN 8 - 820 are UL approved. RVS-DN 950 - 3500 are designed to meet UL requirements.
- RVS-DN 8 - 1400 are LR approved. RVS-DN 1800 - 3500 are designed to meet LR requirements.
- 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 AC53b. Form1. For further information, see Technical Specifications for further details.

Warnings

- Internal components and P.C.B's are at main potential when the RVS-DN is connected to main. This voltage is extremely dangerous and will cause death or severe injury if contacted.
- When RVS-DN is connected to main, even if control voltage is disconnected and motors is stopped, full voltage may appear on starter's output and motor's terminals.
- Unit must be grounded to ensure correct operation, safety and to prevent damage.
- Check that Power Factor capacitors are not connected to the output side of the soft starter.

Starter Selection

The RVS-DN is a highly sophisticated and reliable starter designed for use with standard three-phase, three-wire, squirrel cage induction motors. It provides the best method of reducing current and torque during motor starting.

The RVS-DN starts the motor by supplying a slowly increasing voltage to the motor, providing soft start and smooth acceleration, while drawing the minimum current necessary to start the motor.

The second generation, microprocessor based digital circuitry provides unique features like pump control, slow speed, electronic reversing and accurate motor protection, with optional Insulation Protection, Thermistor input, etc.

The optional RS 485 Communication with MODBUS protocol enables full control (Start, Stop, Dual Adjust, command, etc.) and supervision. Up to 32 starters can be connected on a shield twisted pair to a host computer.

RVS-DN Ratings and Frame sizes

Max Motor FLA (Amp)	Starter Type (FLC)	Frame Size
8	RVS-DN 8	A
17	RVS-DN 17	
31	RVS-DN 31	
44	RVS-DN 44	
58	RVS-DN 58	
72	RVS-DN 72	
85	RVS-DN 85	B
105	RVS-DN 105	
145	RVS-DN 145	
170	RVS-DN 170	
210	RVS-DN 210	C
310	RVS-DN 310	
390	RVS-DN 390	
460	RVS-DN 460	D
580	RVS-DN 580	
820	RVS-DN 820	
950	RVS-DN 950	
1100*	RVS-DN 1100	E
1400*	RVS-DN 1400	
1800*	RVS-DN 1800	
2150*	RVS-DN 2150	F
2400*	RVS-DN 2400	G
2700*	RVS-DN 2700	
3000*	RVS-DN 3000	
3500*	RVS-DN 3500	

* Fully rated when used with a by-pass contactor

Dimensions (mm)

For exact dimensions, see Dimension Sheets.

Size	Width	Height	Depth	Weight (Kg)
A	153	310	170*	4.5, 6.0, 7.5
B std.	274	370	222	15
B new	274	385	238	15
C	590**	500	290	45
D	623	660***	290	65
E	723	1100	370	170
F	750	1300	392	240
G	900	1300	410	314

* 217mm – for 44, 58 & 72A

** 536mm – By special order, without side covers

*** Add 160mm for bypass bus-bars extension

The starter should be selected in accordance with the following criteria (see Ordering Information data).

Motor Current & Starting Conditions

Select the starter according to motor's Full Load Ampere (FLA) – as indicated on its nameplate (even if the motor is not fully loaded).

The RVS-DN is designed to operate under the following conditions:

Max. ambient temp: 50ºC
Max. starting current: 400% motor's FLA
Max. starting time: 30 sec. (at 400% FLA)
Max. starts per hour: 4 starts per hour at max conditions. Up to 60 starts per hour at light load applications.

Note: For very frequent starts (inching applications), the inching current should be considered as the Full Load Ampere (FLA).

Main Voltage (line to line)

Thyristor's PIV rating, internal circuitry and insulation defines four voltage levels: 220-440V, 575-600V
460-500V, 660-690V
Each starter is suitable for one of the above levels & for 50/60 Hz.

Control Voltage

The Control Voltage operates the electronic circuitry and fans. Two voltage levels are available:

220-240V + 10%-15%, 50/60 Hz (standard)
110-120V + 10%-15%, 50/60 Hz
110 Vdc for Frame size B-G (by special order).

Control Inputs

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

Options (see Ordering Information Data)

- Communication Card (option # 3)
- Insulation Tester Card (option # 4)
- Analogue card-Thermistor in/Analogue out (option # 5)
- Special treatment – Consult factory (option # 8)
- Preparation for by-pass contactor (option # 9)
- Special width for size C-536 mm (option #A)
- Line/load bus-bars at the bottom, size C&D (option #B)
- Door install MMI instead of the original (option #D)
- Door install MMI w/op.#L&1.5m cable (option #DK)
- Back-lit LCD (option # L)
- Lloyds Register ENV-1, ENV-2 approval (option #M)
- Tachometer feedback (option # T)
- UL & cUL approvals (option # U)

Installation

Prior to Installation
Check that Motor's Full Load Ampere (FLA) is lower than or equal to the starters Full Load Current (FLC) and that Main and Control voltages are as indicated on the front panel.

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

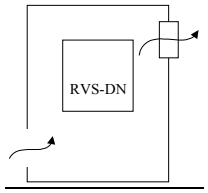
Note: For harsh environments, it is recommended to order the starter with Option # 8 – Special Treatment (printed circuit board coating).

Temp. Range and Heat Dissipation
The starter is rated to operate over a temperature range of -10ºC (14ºF) to + 50ºC (122ºF). Relative non-condensed humidity inside the enclosure should not exceed 95%.

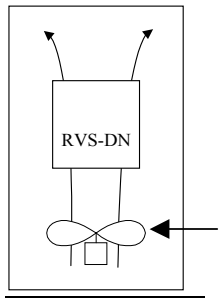
Starter's heat dissipation is approx. 3 x In (three times the current in watts).

Example: For a 100A motor, heat dissipation is approx. 300 watts.
Internal enclosure heating can be reduced through the use of:
a. Additional ventilation
b. Employing a by-pass contactor.

Additional Ventilation



General purpose enclosure
Fan on air outlet



Non-ventilated enclosure
Fan, creating air circulation

Fan

Calculating the enclosure size, for non-ventilated metallic enclosure:

$$\text{Area } (m^2) \quad \frac{0.12 \times \text{Total heat dissipation (Watts)*}}{60 - \text{External ambient temp. (ºC)}}$$

Where Area (m^2) - Surface area that can dissipate heat (front, sides, top).

* Total heat dissipation of the starter and other control devices in the enclosure.

Note: If the starter is installed in a non-metallic enclosure, a by-pass contactor must be used.

Short Circuit Protection
Protect the starter against a short circuit by Thyristor Protection Fuses (see appendix page 44 for I_2t and fuses).

Transient Protection
Line transient voltages can cause a malfunction of the starter and damage to the thyristors. Starters frame sizes B-E incorporate Metal Oxide Varistors (MOV to protect from normal line voltage spikes.

For size A, or when higher transients are expected, additional external protection should be used (consult factory).

ATTENTION
When Start signal is initiated and a motor is not connected to load terminals, the Wrong Connection protection will be activated.

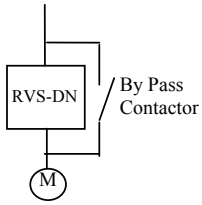
WARNING
1. When main voltage is connected to the RVS-DN, even if control voltage is disconnected, full voltage may appear on the starter load terminals. Therefore, for isolation purposes, it is necessary to connect an isolating device before the starter.
2. Power factor correction capacitors must not be installed on the starters load side. When required, install capacitors on starter's line side.

WARNING
RVS-DN current transformers, although may be installed outside of the soft-starter with extended wires, can not be grounded or connected to any other load except for the RVS-DN itself. Any such connection may cause damage to the load which was connected to it or to the RVS-DN itself!

By-pass Contactor

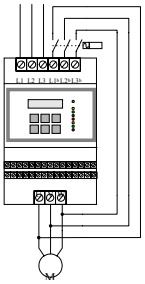
Under normal operating conditions, the heat dissipated by an electronic soft starter causes heating of the enclosure and energy losses. The heating and losses can be eliminated by the use of a by-pass contactor, which by passes the RVS-DN after completion of start-up, so motor current will flow through the by-pass contactor.

In this case the starter protection will be maintained except for the current protection, as the current will not flow through the internal current transformers after the by-pass closes.

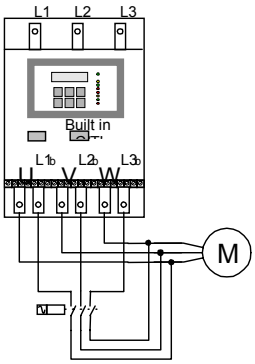


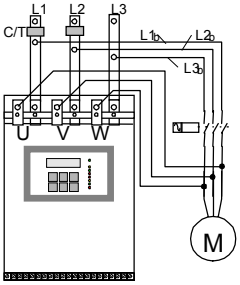
Preparation for By-pass Contactor (option)
In order to maintain current protection after the by-pass contactor closes, Preparations for By-pass Contactor can be ordered.

Frame Size A (8 – 72A)
Must be factory supplied, three additional terminals are added, marked L_{1b}, L_{2b}, L_{3b}.These terminals are connected after the internal C/Ts, intended for connection to the by-pass.

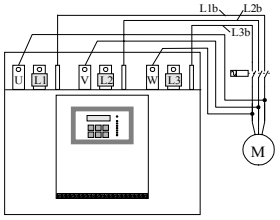


Frame Sizes B (Standard and New 85-170A)
Old – Additional set of bus-bars can be field mounted on the line side, after the C/Ts, marked L_{1b}, L_{2b}, L_{3b}.
New – Additional set of bus bars is built-in, where the line side is on top and motor side is at the bottom with the by-pass
L_{1b}, L_{2b}, L_{3b} terminals are located. By-pass contactor cables should be connected to these terminals.

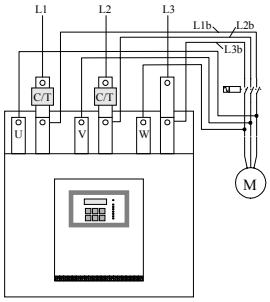




Frame Size C
(210 - 390A)
Additional set of bus bars can be field mounted on line side, after the C/T's marked L_{1b}, L_{2b}, L_{3b}. Bypass cables should be connected to these terminals.



Frame Size D
(460 - 820A)
Additional set of bus bars can be field mounted on line side, downstream to the C/T's marked L_{1b}, L_{2b}, L_{3b}. Bypass cables should be connected to these bus-bars.



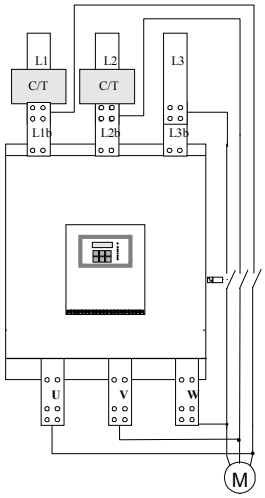
Note: Starter frame sizes C and D can be field modified to have Line and Load Bus-bars at the bottom (consult factory for further information).

Frame Size E
(1100 – 1800A)

Frame Size F
(2150A)

Frame Size G
(2400 – 3500A)

Additional set of bus-bars can be field mounted on line side, down stream to the C/Ts, marked L_{1b}, L_{2b}, L_{3b}. By-pass cables should be connected to the bus-bars down stream to the C/T's



Note: Connect as follows
- **Line to L1, L2, L3**
- **By-pass**
  Input to L_{1b}, L_{2b}, L_{3b}
  Output to U, V, W
- **Motor (Load)** to U,V,& W

Do not interchange line and load connections.

Control Terminals

Control Supply **Terminals 1-3**
110-120VAC or 220-240VAC, 50/60Hz as indicated on the front panel, required to power the electronic circuitry and fans when incorporated. This voltage can be from a grounded or ungrounded main system.

110VDC can be supplied by special order for starter sizes B-G (not field interchangeable).

Note: It is recommended that terminals 1-3 be always connected to the Control Supply.

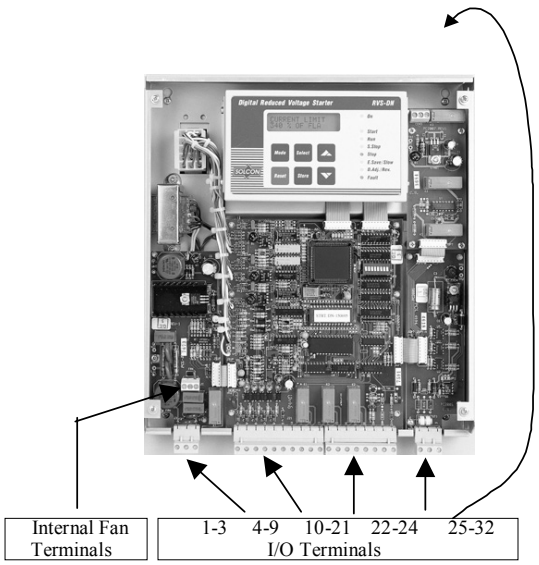
Fan's Supply Voltage **Terminal 2**
An internal jumper, connected between fan and terminal 2 enables three modes of operation (see Fan Control – page 16). For fan power consumption, see technical specification.

Continuous mode (factory default) – Fan operates as long as Control Supply is connected to terminals 1-3. Leave internal jumper connected to left lug of JI terminal (A).

External control mode – Fan operates when Control Supply is connected to terminal 2. Connect internal jumper to the center lug of JI terminal (B). For use without by-pass, connect fans before "start" and disconnect at least 5 minutes after "Stop/Soft-stop".

Automatic mode – Fan begins operation when start signal is initiated and stops approximately five minutes after start signal. When stop signal is initiated, the fan begins operation and stops after five minutes. Connect internal jumper right lug of JI terminal (C).

WARNING
Automatic mode may be used only if by-pass contactor is directly controlled by the RVS-DN "End-of-Acceleration" contact.



Control Inputs
Incorporating opto-couplers to isolate the micro-processor circuitry.
The starter is supplied standard for 220-240V, 50/60Hz Control Supply and Control Inputs voltage.

By special order, Control Inputs may be supplied for voltage levels of 24-240 VAC/DC. (for more information, see Ordering Information data – Appendix page 48).

Stop **Terminal 4**
Input from a N.C contact. To stop the motor, disconnect control voltage from Terminal 4 for at least 250mSec.

Soft stop **Terminal 5**
Input from a N.C contact. To soft stop the motor, disconnect control voltage from Terminal 5 for at least 250mSecs.

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

Start **Terminal 6**
Input from a N.O contact. To start the motor, connect control voltage to Terminal 6 for at least 250mSecs.

Notes:
1. Motor will start only if Stop (4) and Soft Stop (5) terminals are connected to control voltage.
2. Reset after a fault is not possible for as long as Start command is present.

Energy Save / Slow Speed / Reset **Terminal 7**
Input from a N.O contact. Selection between above functions is made from the keypad or through the communication (see I/O Programm.)

- When Energy Save function is selected –connect terminal 7 to control 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 voltage to terminal 7 **before** starting, to run the motor at 1/6 nominal speed. Closing terminal 7 while motor is running will not have any effect.
- When Reset function is selected, connect terminal 7 to control voltage (use a N.O momentary contact) to reset the starter.

Control Terminals

Dual Adjust Reverse / Reset Terminal 8
Input from a N.O contact. Selection between above functions is made from the keypad or through the communication (see I/O Programming).

a. When Dual Adjustment function is selected – connect terminal 8 to control voltage to operate starter with the Dual adjustment characteristic.
Switching between primary and Dual Adjustment settings can be done before and during starting. If a push-button arrangement is used, keep control voltage connected at least RUN LED is lit.

Note: When starting from Diesel Generator or weak power supply set dip. Switch # 3 "On" – connect terminal 8 to control voltage to operate starter with Generator Parameter settings.

b. When Slow Speed reverse function is selected (Slow Speed function must be selected for terminal 7 and Control Input voltage connected to it). Connect control voltage to terminal 8 to reverse direction. Reverse command can be given before motor is started, or during operation at Slow Speed.
Connecting Control Voltage to terminal 8 before motor is started, starts the motor in Reverse Direction.
Connecting control voltage while motor is running at Slow Speed, stops the motor for 0.6 – 2 sec (according to motor size) before reversing its direction.

c. When "Reset" function is selected, connect terminal 8 to control voltage (use a N.O momentary contact) to reset the starter.

Common 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
Terminals: 10- N.O. 11-N.C. 12 – common.
Voltage free 8A, 250VAC, 2000VA max.
Selection between functions is made from the keypad or through the communication, (see I/O Programming).

Programmable functions:

1. **Immediate** (after start signal).
When immediate is selected, the contact changes its position upon Start signal. The contact returns to its original position on Stop signal, in case of a 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 contact incorporates On & Off delays 0-60 sec. each.
The Immediate Contact can be used:
- To release the brake of a brake motor.
- For interlocking with other systems.
- For signaling.
- Used with delay for opening an upstream contactor at the end of soft stop thus, allowing current decrease to zero before opening the contactor.
- To switch to / from Dual Adjustment settings with a time delay from Start signal (see Special Starting).

2. **O/C Shear-pin detection**
When O/C Shear-pin is selected, the contact changes position upon Shear-pin detection (Starter's trip can be delayed 0-5 sec).

The O/C Shear-Pin contact can be used:
- For interlocking with other systems.
- For signaling.
- Used with delay for operating a reversing combination of upstream contactors when Shear-Pin is detected, thus, allowing clearing a Jam condition.

Control Terminals

Fault Contact **Terminals 13-14-15**
Terminals: 13-N.O. 14-N.C. 15 – Common.

Voltage free 8A, 250VAC, 2000VA max. changes its position on fault. The contact is programmable to function as Trip or Trip – fail safe relay.

a.When Trip function is selected, the relay is energized upon fault. The contact returns to its original position after fault has been removed and starter was reset, or upon disconnection of Control Supply.

b.When Trip-fail safe function is selected, the relay is energized immediately when Control Supply is connected and de-energizes upon fault or Control Supply disconnection.

End of Acceleration Contact **Terminals 16-17-18**
Terminals: 16-N.O. 17-N.C. 18 – Common.

Voltage free 8A, 250VAC, 2000VA max. changes its position at the end of acceleration, after an adjustable time delay (Contact Delay), 0 – 120 sec.

The contact returns to its original position, when Energy Saver is operated, on Soft Stop or Stop signals, on fault condition, or upon voltage outage.

The End of Acceleration contact can be used for:
- Closing a by-pass contactor.
- Activating a valve after compressor has reached full speed.
- Loading a conveyor after motor reached full speed.

External Fault **Terminal 19**
Input from a N.O contact, connected between terminals 19 and 21. The starter will trip 2 sec. after contact closes.

WARNING
- Only potential free contacts may be connected to terminal 19.
- Do not connect any voltage to terminal 19. Any connection of voltage to this terminal may disrupt soft-starter operation, and cause starter or motor damage.

Notes:
- Wires connecting the External Fault contact to terminal 19 should not exceed 1 meter in length.
- External Fault can be used only when terminal 21 is connected to Neutral or Ground.
- Do not use External Fault while using Insulation Alarm option.

Tacho Feedback – 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 before using Tacho feedback feature for further information.

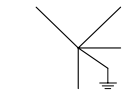
Neutral **Terminal 21**
When Neutral wire is available, connect Terminal 21 to Neutral (see pages 6, 8 & 10). Terminal 21 serves only as voltage reference.

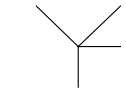
Note: Starter's power section incorporates and internal artificial neutral, which should only be used, when the system is not grounded and neutral connection is not available.

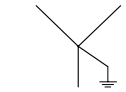
WARNING
- Only potential free contacts may be connected to terminal 21.
- Do not connect any voltage to terminal 21.Any connection of voltage to this terminal may disrupt soft-starter operation, and cause starter or motor damage.

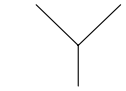
Notes:
- Wires connecting between terminal 21 and terminal 19 should not exceed 1 meter in length.
- Do not use External Fault when terminal 21 is not connected to Neutral or Ground.

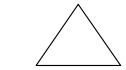
Terminal 21- Connections with various mains.

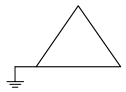

3P+N+GR Connect terminal 21 to neutral


3P+N Connect terminal 21 to neutral


3P+GR Connect terminal 21 to ground


3P Leave terminal 21 unconnected


3P Leave terminal 21 unconnected


3P+GR Leave terminal 21 unconnected

Control Terminals – Option Boards

Option # 3

RS-485 Communication **Terminals 23-24**
Terminals: 23 (-), 24 (+)

Standard RS485, Half Duplex with MODBUS Protocol, baud rate 1200, 2400, 4800, 9600 BPS.
Twisted shielded pair should be used, connect shield to ground a PLC/Computer side. Terminals 4 & 5 must be wired to control supply for operation in communication mode (see Wiring Diagram – page 14 and Communication Instruction Manual).

Option # 4

Insulation Alarm **Terminals 25-26-27**
Terminals: 25- Common 26- N.O. 27 – N.C.

Voltage free 8A, 250VAC, 2000VA max. changes its position when motor insulation level decreases below Insulation Alarm level. 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 set-point for more than 60 sec.

Notes:
1. Do not use External Fault while using Insulation Alarm option.

2. Insulation test can be performed only when main voltage is not connected to the RVS-DN, namely an upstream isolation device must be opened.
   For correct operation of Insulation test, it is important that the RVS-DN is properly grounded and that the control module is properly fastened to the power section.

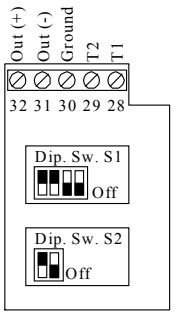
3. Option # 4 and option # 5 may not be applied together.

Option # 5

Analogue I/O (option # 5) **Terminals 28-32**

The Analogue card output incorporates two functions:
- Thermistor input
- Analogue output

Analogue P.C.B. layout:



Thermistor input **Terminals 28-29**
Programmable as PTC or NTC type thermistor. Trip value is adjustable between 1-10K, preset delay of 2 Sec.

Ground Terminal **Terminal 30**
Connect thermistor and / or Analogue output shield to this ground terminal.

Analogue Output **Terminals 31, 32**
Terminal: 31 (-), 32(+)
Dip switches allow selection between: 0-10VDC
0-20mA
4-20mA

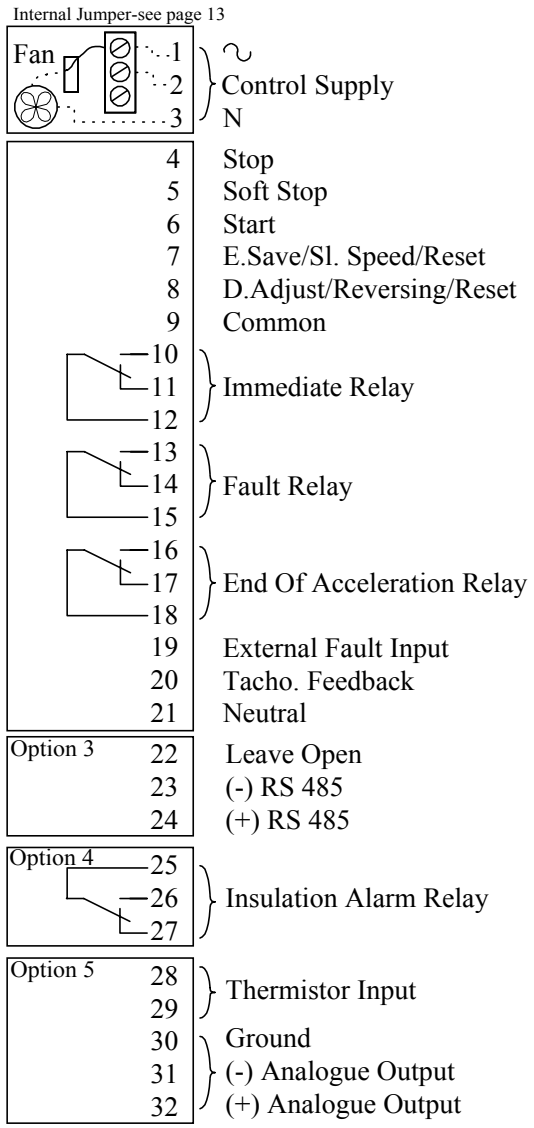
Analogue value is related to motor current and can be programmed to normal or inverted output. (Default = Normal) Maximum value (20mA or 10Vdc) is related to twice the RVS-DN rated current (2xFLC).

Dip No.	4-20 mA*	0-20 mA	0-10VDC
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	No use	No use	No use

* Default

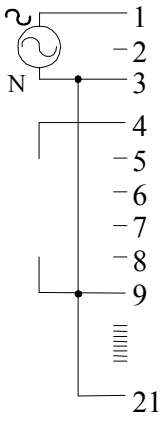
Notes:
1. It is important that the RVS-DN is properly grounded, and control module is tightly fastened to the power section.
2. Option # 5 and option # 4 may not be applied together.
3. Use twisted shielded cable for thermistor connection.

Control Wiring

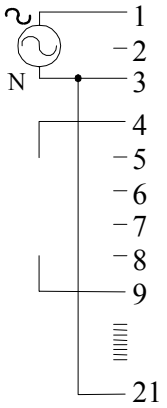


WARNING
Incorrect connection of terminal 19 and 21 may disrupt soft-starter operation and cause starter or motor damage.

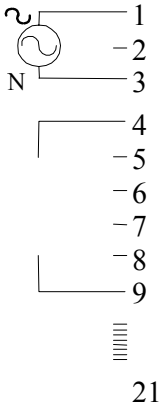
Fusing – Control Supply must be protected by a 6A fuse. It is recommended to use a separate fuse for the auxiliary circuits.



Control Supply and Control Inputs from the same source, Neutral connected to Terminal 21.



Separate sources for Control Supply and Control Inputs, Neutral connected to Terminal 21.



Separate sources for Control Supply and Control Inputs.

For grounded Y systems with neutral, connect 21 to neutral.

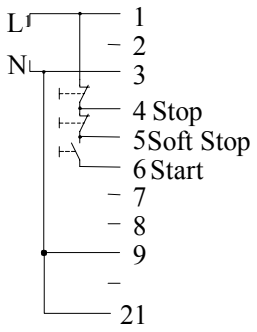
For grounded Y systems without neutral, connect 21 to ground.

For other systems, leave 21 open.

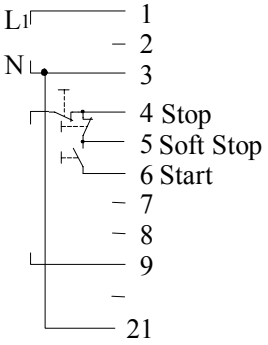
When terminal 21 is not connected to neutral, do not use External Fault – terminal 19.

Wiring Diagrams

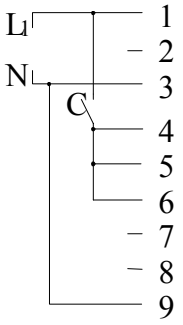
1. Start, soft stop and stop buttons, single supply source for Control Supply and Control Inputs.
If Soft Stop is not used, connect a jumper between terminals 4-5 connect emergency stop and /or soft stop between terminals 1-4.



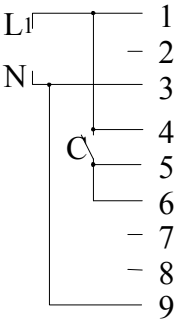
2. Start-Stop push buttons, Separate sources for Control Supply and Control Inputs.
If Soft Stop is not used, connect a jumper between terminals 4-5.



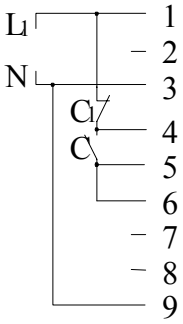
3. Motor will soft start when C closes and stops immediately when C opens.



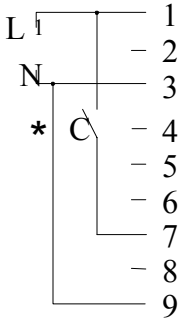
4. Motors will soft start when C closes and soft stop when C opens



5. Motors will soft start and soft stop with C. C1 act as emergency stop.

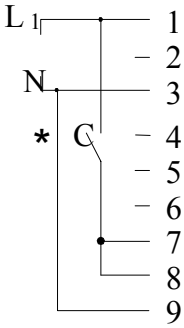


6. Close C to operate Energy Save, Slow speed or Reset – as selected.



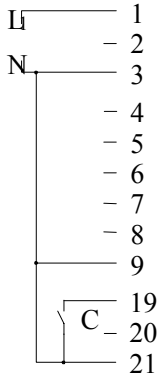
C must be of momentary type when used as Reset

7. Close C to operate Dual Adjust. Slow Speed Reversing or Reset – as selected.



For Slow speed reversing terminal 7 must be connected to Control Supply

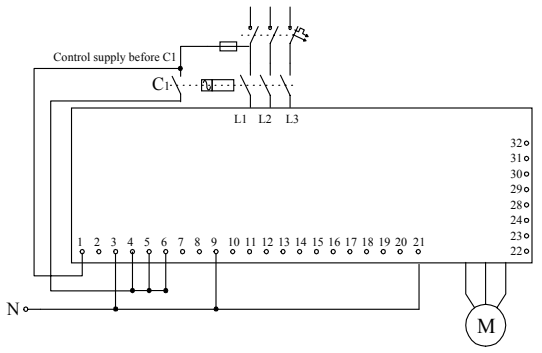
8. External Fault contact.
The starter will trip 2 sec after C closes.



Must Not be used when 21 is not connected to neutral/ground or when Insulation Test is used

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

Series contactor



This system is mainly used when the RVS-DN is retrofitted into an existing system, to reduce modifications in existing installations.

Main power and Start signal are switched on upon closure of the series contactor. The starter will operate as long as the series contactor is closed.

Control supply obtained from main voltage must match starter's Control Supply voltage.

Notes:

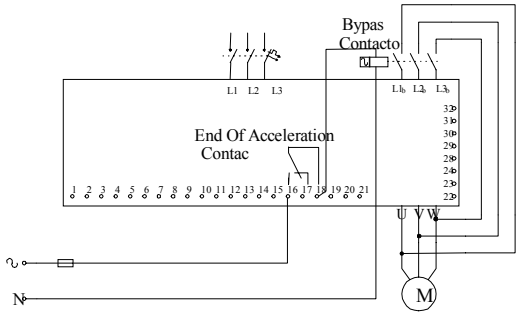
1. It is recommended that terminals 1-3 be always connected to Control Supply.

2. In some applications, it is required to open the upstream contactor after soft stopping. The upstream contactor can be operated by the Immediate Contact that changes its position only at the end of soft stop.

   It is therefore recommended to delay the opening of the upstream contactor for a few seconds after the completion of Soft stop process, when current reached zero, see Immediate/Shear-pin Contact delay – page 7.

- Ensure that auxiliary contact C_1 closes after the main contactor "the soft-starter provides a 500 mSec. delay for the start signal. If it closes before, Under Voltage, 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 delays "Run Contact Delay" – see page 29 at the end of start-up period, closing the by-pass contactor.

The contact will return to its original position when:

- Soft Stop or Stop signals are initiated
- Energy Saver signal is initiated
- Slow-Speed signal is initiated
- Fault condition occurs.

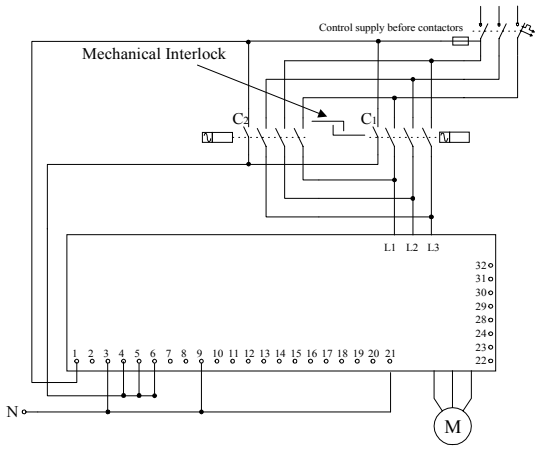
When the by-pass contactor closes, current to the motor will flow through the by-pass.

Note: When a by-pass contactor is used, it is recommended to order the starter with preparation for by-pass contactor, so that the RVS-DN current protections are operative also after the by-pass contactor closes.

When a Soft Stop signal is given, the End of Acceleration contact returns to its original position opening the by-pass contactor. Thereafter, the voltage will gradually ramp down to zero, soft stopping the motor.

Wiring Diagrams

Reversing with 2 series contactors



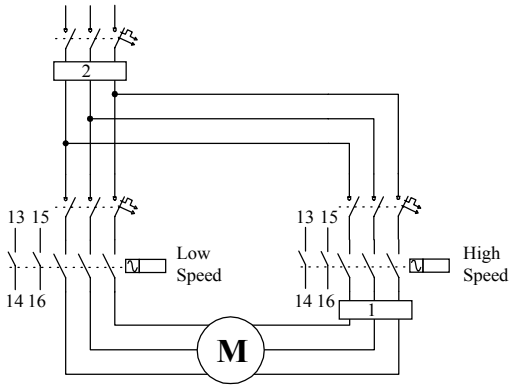
The start-stop control is by a N.O auxiliary contact in each of the two series contactors C_1 & C_2. Closure of either contactor will supply main power and a start signal to the RVS-DN.

Control voltage, obtained from main, must match the starter's Control Supply voltage.

Note:

1. It is recommended to employ a mechanical interlock between the Forward and Reverse Contactors.
2. It is required to delay the transfer between opening of one contactor and closing of second contactor.
3. Phase Sequence fault must be disabled to operate Reversing Contactors at the Line Input of the soft-starter.

Two Speed Motor



Used for Two Speed Motors:

* When soft start is required during transfer from low to high speed, the RVS-DN should be installed downstream to the high speed contactor (marked 1) and operated by its auxiliary contact (13-14).

* When soft start is required for both low and high speeds, the RVS-DN should be mounted before both contactors (marked 2) and operated by each of the downstream contactors (13-14 of each contactor).

Note: The RVS-DN should be sized for appropriate motor rating of either the low or the high speed.

If two different motor ratings and/or starting characteristics are required, for example, higher Initial Voltage and Current Limit for high speed, use the Dual Adjustment feature (see Dual Adjustment – page 21) which allows two different settings of:

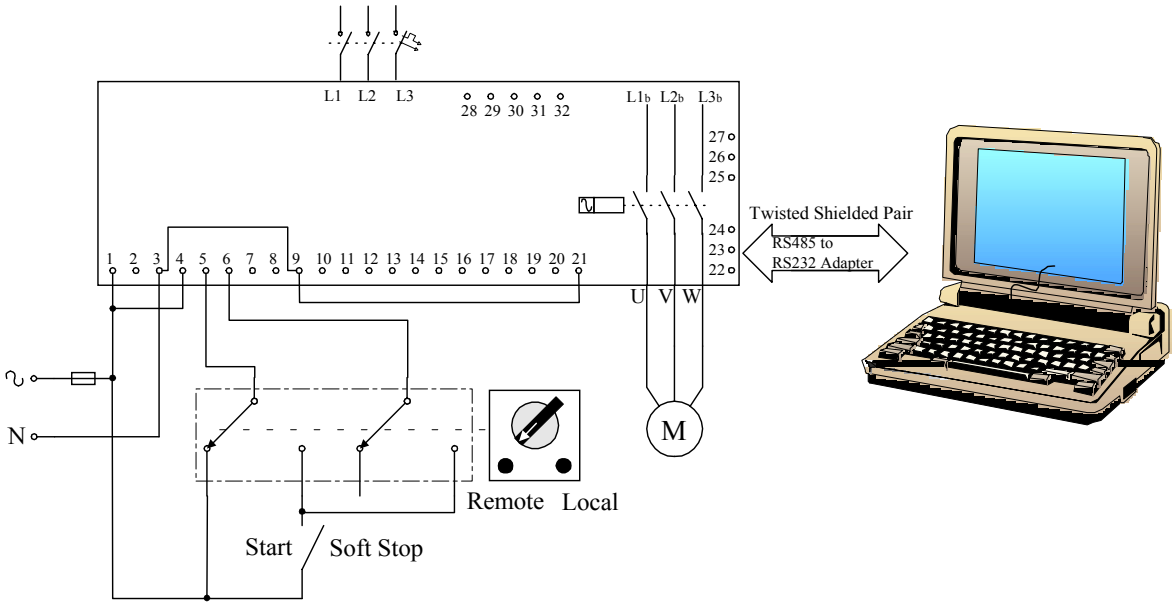
* Initial Voltage
* Current Limit
* Acceleration Time
* Deceleration Time
* Motor FLA.

An additional N.O. contact (15-16) on the high-speed contactor should act as the Dual Adjustment Switch. It should close simultaneously with 13-14 of the same contactor to start the RVS-DN and to switch to the Dual Adjustment settings.

Wiring Diagrams - Communication

Operation 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, stop, soft-stop, dual adjusts, etc terminals 4 and 5 must be wired as shown.

Soft-start and soft-stop

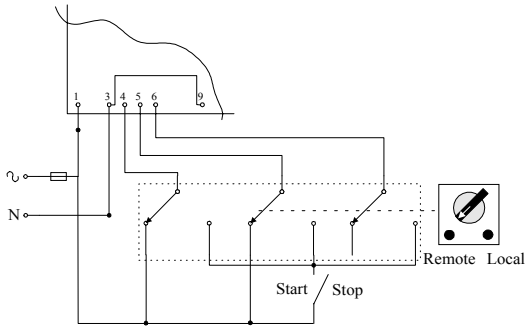
- Program the "Serial Link Number" in the communication page to a number between 1-247.
- Disconnect control supply, so the new information will be loaded on the next time you turn it on.
- Connect a communication line (twisted shielded pair) with its (+) to RVS-DN terminal 24 and (-) to terminal 23,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

WARNING
The host computer must be grounded when communicating with RVS-DN (unless using a Lap-Top Computer).

Wiring Diagrams - Communication

Operation via communication link with Local/Remote (selector switch)

- **Remote: via Communication link**
- **Local: Soft-start, immediate-stop by maintaining contact.**



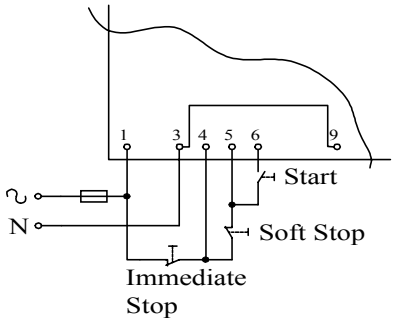
Soft-start and immediate stop

Same as the explanation for **Soft-start** and **soft stop**, except for # 4:

4. During operation via communication link, terminals 4 and 5 are connected through the Local / Remote selector switch to Control Supply and Start-Stop commands are controlled through the communication port.

   During operation in Local mode, terminals 4, 5 and 6 are connected to Control Supply through the Start-Stop toggle switch.

Operation via communication link with Momentary contact (Push-Buttons) Soft-start, immediate stop, soft-stop.



Soft-start, Soft-stop and immediate stop

Same as the explanation for **Soft-start** and **soft-stop**, except for # 2 and # 4:

2. Connect terminal 4 as described below.
4. During operation via communication link, terminals 4 and 5 are connected through the push buttons to Control Supply and Start-Stop commands are controlled through the communication port.

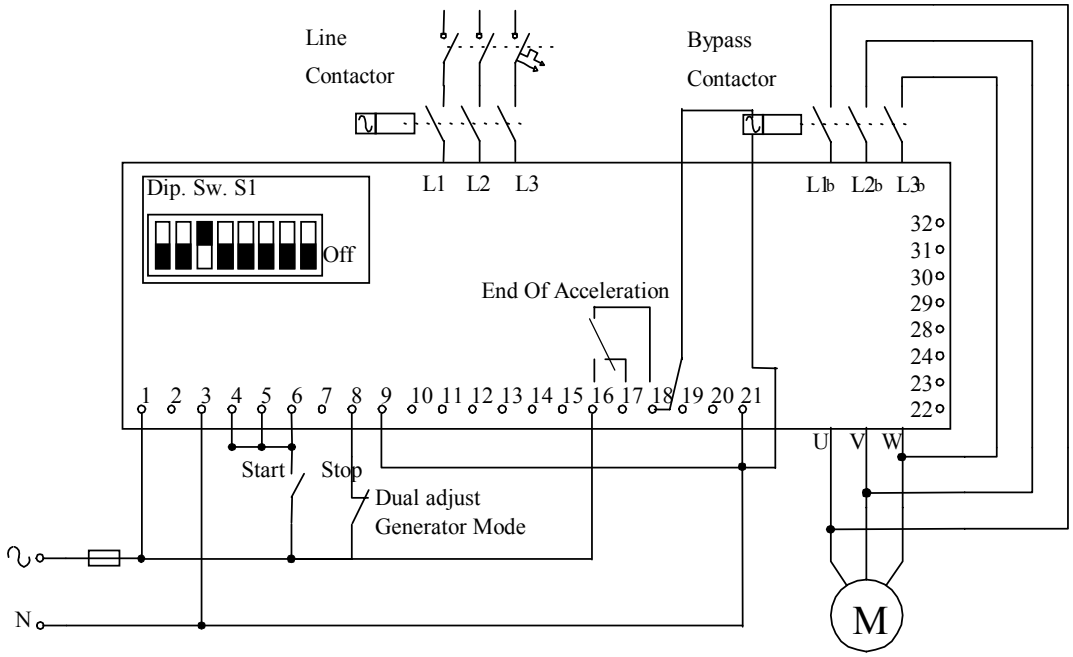
   During normal operation mode, terminals 4 and 5 are connected to Control Supply through the Immediate-stop and soft-stop push buttons, soft-start command may be initiated by pressing the start push-button.

Notes: 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 with immediate stop.
3. Soft-start/stop with immediate stop via push-button control.

Wiring Diagrams – Diesel Generator

Starting from Diesel-Generator



1. When starting from a Diesel-Gen., its voltage regulator (especially older type regulators) may be affected during the starting process, causing rapid voltage fluctuations (~350V to ~500V in 400V systems). In these rare cases, the voltage regulator must be upgraded – consult your Diesel-Gen. Supplier.
2. In most other 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 "On" (as shown above).
   b. Insert a contact (or jumper) between Control Supply and terminal 8 (Dual Adjust. Terminal) and close contact to operate the Generator Mode. Dual Adjust LED will light when operating in Generator Mode.
   c. Set Dual Adjust parameters to the values necessary for the application (e.g. faster acceleration, lower current limit, etc.).
3. When operating from Main and alternatively from Diesel Gen. Set normal starting characteristics for Main and suitable parameters for the Diesel Gen. in the Dual Adjustment setting. When starting from Main, the primary settings (suitable for main starting) will be operative. Upon starting from Generator, close contact between Control Supply and Terminal 8 to operate on Generator Mode.

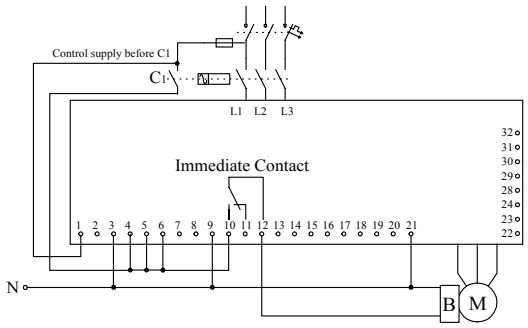
Note: Ensure that Diesel Gen. size is suitable (Diesel Gen. KVA should be at least is 1.35 motor KVA, consult factory for all other cases).

WARNING

1. Motor can not run idle and must be loaded when operating in Generator Mode, otherwise vibration may occur during starting and stopping.
2. When using extended range, use maximum precaution to avoid motor or starter burnout.
3. Disconnect all other loads before starting for the first time to prevent damages due to voltage fluctuations.
4. Disconnect Power Factor Capacitors when operating with Diesel Gen.
5. Connect terminal 21 to terminals 3 and/or 9 only if these terminals are connected to neutral or at ground potential.
6. Only potential free contacts may be connected to terminal 21. Do not connect any voltage to terminal 21. Any connection of voltage to this terminal may disrupt soft-starter operation, and cause starter or motor damage.

Wiring Diagrams – Brake Motor & Insulation Test

Brake Motor



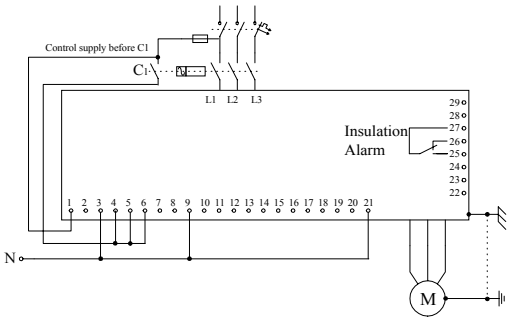
Upon starting, the "Immediate" contact is activated releasing the brake and allowing the voltage to ramp up (this contact will operate without a delay as long as "Immediate Relay ON delay" is set to 0 – see page 27). Upon stopping, the contact returns to its original position and the brake will close.

Note: Use an interposing relay when:

a. Brake voltage is different from starter's Control Input voltage.
b. Brake current is greater than relay's maximum Current (8A).

Caution: It is not recommended to use soft-starters in Vertical hoists applications.

Insulation Test Wiring

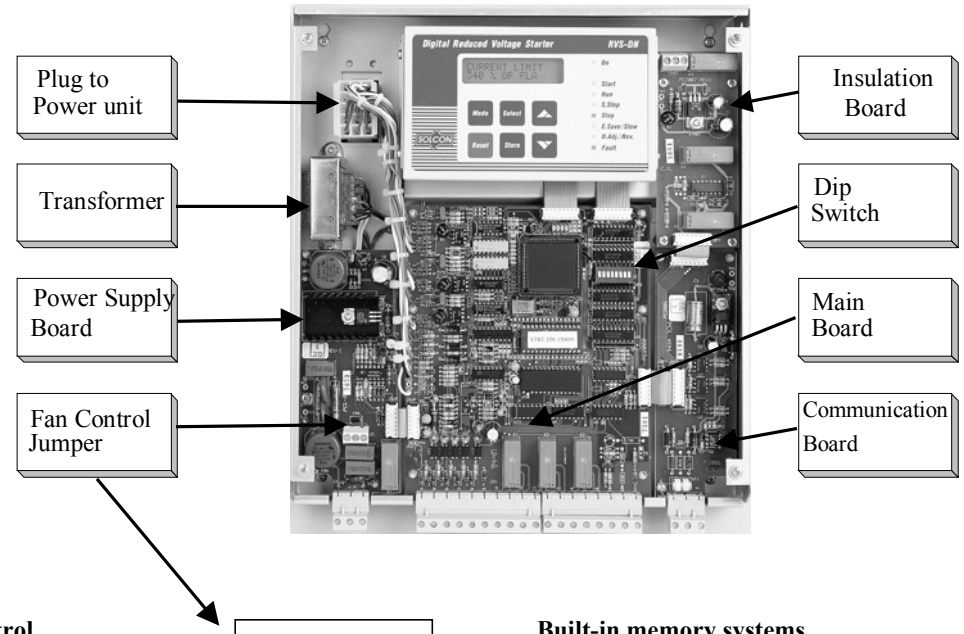


Few conditions must exist for the Insulation circuitry to operate, hence:

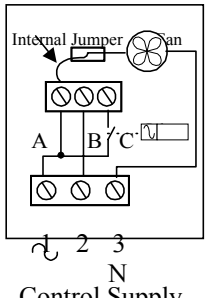
1. "On" and "Stop" LED's must be ON.
2. The series contactor has to be "Open".
3. Motor and starter must be properly grounded.
4. "External Fault" (terminal 19) can not be used.

Note: The Insulation circuitry begins operation after 120 seconds.

Internal Settings



Fan Control
Starter's fan(s) can be controlled by in internal jumper. It is recommended to use continuous operation as default.



- Continuous operation (default connection) – The internal jumper is connected to terminal A. Fan(s) will operate continuously as long as Control Supply is connected.

- External Control - Connect the jumper to terminal B Connect terminal 2 to Control Supply through an external contact. Fan(s) will operate when the external contact closes and stop when it opens.

- Automatic operation – Connect the jumper to terminal C. Fan(s) will operate automatically for a few minutes after start. The fan(s) will stop automatically a few minutes after stop signal.

WARNING

1. The starter is supplied with the internal jumper connected to terminal A, for continuous operation. If changed, it is the Customer's responsibility to operate the Fan(s).
2. Use only when by-pass contactor is utilized.

Built-in memory systems
The RVS-DN incorporates 3 memory systems:

EPROM A read-only, non-volatile memory, containing factory set parameters (default) that cannot be changed.

EEPROM A read/write, non-volatile memory, where field adjusted parameters, statistical and fault data are saved and stored**.**

RAM A read/write memory containing parameters loaded from the EEPROM which can be changed from the keypad. These parameters are stored only as long as Control Supply is connected.

Memory system operation

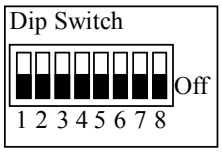
1. When Control Supply is switched on, the RAM is automatically loaded from the EEPROM and parameters are displayed on the LCD.
2. Parameters can now be modified from the keypad (if starter is in one of the operating modes and software lock is open – Dip Sw. 8 open).
3. Start Parameters can be modified during starting process and will immediately affect the operation. For example, if Current Limit is set too low and motor does not accelerate to full speed, increasing Current Limit setting will immediately affect starting process. This enables selection of the optimal starting characteristics. After completion of the adjustments, parameters should be stored in the EEPROM. Storing new parameters is possible at the end of each Mode Page by pressing Store key after "Store Enable" is displayed on the LCD.

Internal Settings

Inside Delta Motor Connection Mode
Allows connection of the RVS-DN inside the Delta. Current is reduced by 1.73 (√3), namely for an 800A motor the standard selection will be an 820A soft-starter. "In the Delta", the calculation will be 800 / 1.73 = 460A, hence, for a 800A motor, a 460A "Inside Delta" starter is selected. Programming via first window in "Main Parameters". Selectable options are: either "Line" or "Inside Delta". See Appendix for "Inside Delta" details and motor connection diagram.

Dip Switch settings

The Dip Switch, containing eight separate switches, is located under the front cover of Control Module (in sizes B-F) and under the Display unit (in size A).



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

Note: All switches are factory set in OFF position.

No	Switch Function	Switch Off	Switch On
1	Display Format	Minimized	Maximized
2	Tacho feedback	Disabled	Enabled
3	Main / Generator	Main	Generator
4	Must be Off		
5-6	LCD-language selection	See table	
7	Special settings - keep in Off position	Disabled	Enabled
8	Software lock	Open	Locked

Switch # 1 – Display Modes
For operation convenience, there are two display modes,
Maximized – Display of all possible parameters.
Minimized – Display of pre-selected parameters.

Setting Dip Sw. # 1 to Off will minimize the LCD displays.

Maximized mode
Switch 1 – On
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

Minimized mode
Switch 1 – Off
Display only
Main parameters
Start parameters
Stop parameters
Statistical data

Switch # 2 – Tacho feedback (0-10VDC)
Set Dip Sw. # 2 to On, when using Tacho feedback.

Note: To operate tacho feedback – consult factory for specific 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 Sw. # 3 to On, special starting characteristics, suitable for Diesel Generator supply – with unstable voltage & frequency, becomes operative.
Closure of Dual Adjustment contact (terminal 8) operates the special starting characteristics.

When operating from mains and alternatively from diesel generator, set normal starting characteristics for mains and suitable 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.

Switches # 5, 6 – Language Selection

Language	Switch 5	Switch 6
English	Off	Off
French	Off	On
German	On	Off
Spanish	On	On

Switch # 7 – Special settings – consult factory

WARNING
When using extended Soft-Starter range, apply maximum precautions to avoid motor or starter damage.

Switch # 8 – Software Lock
The software lock prevents undesired parameter modification.

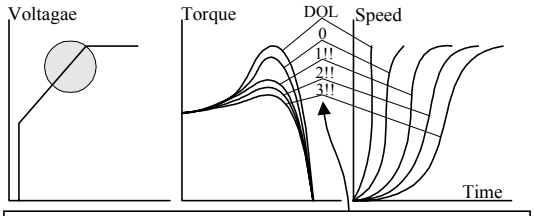
When locked, upon pressing Store,  or  keys, the LCD displays "Unauthorized Access".

Pump Control – Start Curves
Induction motors produce peak torque of up to 3 times the rated torque towards the end of starting process. In some pump applications, this peak may cause high pressure in the pipes.

The RVS-DN incorporates 4 different starting curves:

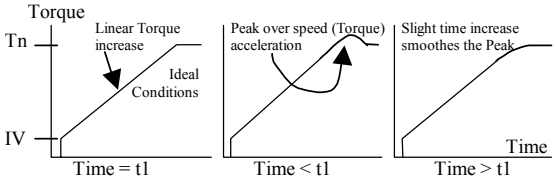
Start Curve 0 – Standard curve (Default). The most stable and suitable curve for the motor, preventing prolonged starting and motor overheating.

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



Choice of three pump control acceleration curves 0, 1!!, 2!!, 3!!

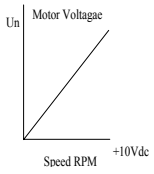
Start Curve 4 (Torque) – Torque Controlled acceleration, provides a smooth time controlled torque ramp for the motor and the pump.



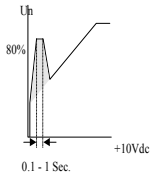
Note: Always starts with Start Curve 0. If towards end of acceleration, peak torque is too high (pressure is too high), proceed to Curve 1, 2, 3 or 4 if necessary.

Tacho Feedback, 0-10VDC (Optional)

Provides linear acceleration and deceleration curves according to rpm feedback. 12 tacho gain levels can be selected for closed loop control starting and stopping.
Note: Consult factory for additional information.



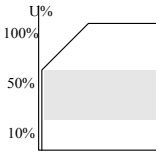
Pulse Start
Intended to start high friction loads, requiring high starting torque for a short time.
A pulse of approx. 80% Un without Current Limit is initiated to break the load frees. Pulse duration is adjustable, 0.1 – 1 sec.



After this pulse, the voltage is ramped down to Initial Voltage setting, before ramping up again to full voltage according to Start Parameters settings.

Initial Voltage
Determines motor's initial starting torque (the torque is directly proportional to the square of the voltage).
Range: 10-50% Un (consult factory for extended range). This adjustment also determines the inrush current and mechanical shock. A setting that is too high may cause high initial mechanical shock and high inrush current (even if Current Limit is set low, as the **Initial Voltage setting overrides Current Limit setting).**

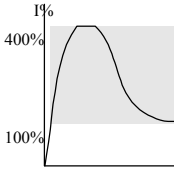
A setting that is too low may result in prolonged time until motor begins to turn. In general, this setting should ensure that the motor begins turning immediately after start signal.



Current Ramp (Initial Current)
Determines initial Ramp-Up starting Current. When desired, increase Initial Voltage to Max. (50% or 80% respectively). The LCD displays "Initial Current" and the starter will linearly Ramp Up the current following the desired acceleration time. Range: 100-400%

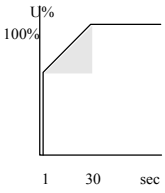
Current limit
Determines motor's highest current during starting. Range 100-400% of FLA setting (consult factory for extended range). A too high setting will cause greater current drawn from main and faster acceleration.

A setting that is too low may prevent motor from completing acceleration process and reaching full speed. In general, this setting should be set to a high enough value in order to prevent stalling.



Note: Current limit is not operating during Run and Soft stop.

Acceleration Time
Determines motor's voltage ramp-up time, from initial to full voltage. Range 1-30 sec. (consult factory for extended range). It is recommended to set Acceleration Time to the minimum acceptable value (approx. 5 sec).



Notes:
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 voltage reaches nominal, Acceleration Time setting is overridden, causing voltage to quickly ramp-up to nominal.
3. Using starting curves 1, 2, 3 prevents quick ramp up.

Maximum Start Time
The maximum allowable starts time, from start signal to end of acceleration. If voltage does not reach full voltage during this time (for example, because of low Current Limit setting), the starter will trip the motor. LCD displays "Long Start Time" message.
Range: 1-30 sec (consult factory for extended range).

Contact Delay
Time delay for End of Acceleration Contact, after completion of starting process. Range: 0-120 sec.

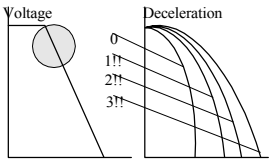
Pump Control – Stop curve
Intended to prevent Water Hammer during stopping. In pump applications, load torque decreases in square relation to the speed, thus, reducing the voltage will reduce torque and motor will smoothly decelerate to a stop.

The following **Stop curves** can be selected:

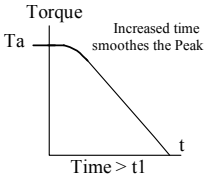
Stop curves 0 – Standard Default curve – voltage is linearly reduced from nominal to zero.

Stop curves 1, 2, 3 – In some pump applications, when pumping to a higher level, a considerable part of the torque is constant and does not decrease with speed. It may happen that during Soft Stop, when voltage is decreasing, motor torque quickly falls below load torque and motor will abruptly stall instead of smoothly decreasing speed to zero.

urves 1, 2, 3 designed to prevent
tall condition

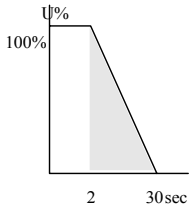


Stop Curve 4 (Torque) – Provides Linear Controlled torque deceleration ramp, from Ta (Actual Torque), thus, eliminating stall conditions.



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

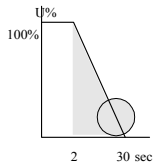
Deceleration Time – Soft Stop



Used for controlled deceleration of high friction loads. Determines motor's voltage ramp down time. Range: 1-30 sec. (consult factory for extended range).

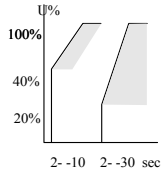
Note: When the starter operates with a by-pass contactor, Soft Stop initiation opens the End Of Acceleration contact, tripping open the by-pass contactor. Load will then be transferred to the RVS-DN and voltage begins ramping down.

Final Torque
Determines torque towards end of Soft Stop. If current is still flowing after speed is softly reduced to zero, increase Final Torque setting.



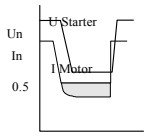
Dual Adjustment
A secondary set of parameters, used for varying loads, two speed motors, etc. Connecting Control Supply to Terminal 8 makes transfer to Dual Adjustment settings.

IV - Initial Voltage 10-50% of 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.



Note: Consult factory for extended range.

Energy Save
Activated when motor is lightly loaded for extended periods of time. Supply voltage the motor decreases (lowering the rotating magnetic field intensity), thus, reducing the reactive current and copper/iron losses.



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 RMS current value.

ATTENTION
To meet CE standards while in 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. (consult factory for extended range).

WARNING
Operating current while motor is running at 1/6 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.

Motor Insulation (option)
Operational when motor is not running (the motor must be galvanically isolated). Two distinct level can be set for Alarm and Trip functions.

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

When insulation decreases below Alarm Level set point for more than 120 sec., the LCD displays ALARM:
INSULATION LEVEL and shows the value in MΩ.
The Fault LED flashes and the Insulation Alarm Relay is activated.
Alarm signal will disappear automatically 60 seconds after insulation level returns to normal. Trip does not reset automatically.

When insulation decreases below Trip Level set point, the LCD displays TRIP: INSULATION LEVEL and shows the value in Mohm. The fault LED illuminates and Fault Relay is activated.

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

Too Many Starts
Combines three parameters:

- **Number of Starts**
  Determines maximum allowable number of starts.
  Range: Off, 1-10 starts.

- **Start Period**
  Time period during which Number of Starts is being counted. Range: 1-60 min.

- **Start inhibit**
  Determines time period during which starting is disabled after "Too many starts" trip.
  Range: 1-60 min

Note: Motor can not be started before "Start Inhibit Time" has elapsed. Trying to start the motor during this time delay will result in LCD displaying "Wait Before Rst: ___ MIN.

Long Start Time – (Stall Protection)
Trips the starter if motor does not reach full speed during "Maximum Start Time".
Range: 1-30 sec. (consult factory for extended range).

Over Current Shear-pin
Becomes operational when starter is energized and has two Trip functions:

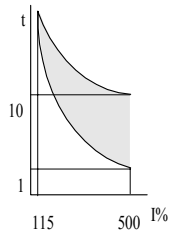
- Trips the starter when current exceeds 850% of starter's FLC setting in 1 cycle or less.

- During run (after RUN LED is lit) – Trips the starter when current exceeds set level and time delay.

Range: 200 - 850% of motor FLA setting
Delay: 0 – 5 sec. (0=up to 200 mSec)

Note: The O/C Shear-Pin is not intended to replace the fast acting fuses, required to protect the thyristors (see fuse table in the appendix).

Overload (O/L)
Inverse time electronic overload becomes operational when RUN LED is lit.
The O/L circuitry incorporates a Thermal Memory Register calculating heating minus dissipation of the motor. The starter trips when the register fills up. The thermal register resets itself 15 minutes after motor stops.



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

ATTENTION
Overload protection is not operative during soft-start or soft stop.

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

Under Voltage
Becomes operational only 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 Trip, Range: 120-600V (phase to phase)
Under Voltage delay, range 1-10 sec.

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

Over Voltage
Becomes operational only 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).
Range: 150 – 750V (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 sec.

Starter will also trip when frequency is less than 40 or greater than 65Hz.

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

Phase Sequence
Becomes operational when starter is energized, provided this protection has been activated (Fault Enable – Phase Sequence Protection, see Fault Parameters). Trips the starter when phase sequence is wrong.

Long Slow-Speed Time
Trips the starter if motor operates at slow speed for a time longer than "Maximum Slow Speed Time"
Range: 1-30 sec. (consult factory for extended range).

Note: Operate motor at slow speed for the minimum possible time to prevent overheating. When motor operates at slow speed, it draws higher than nominal current (depending on Slow-Speed Torque adjustment) thus, motor and starter may overheat.

Wrong Connections
Become operational after start signal. Trips if motor is not properly connected to starter's Load terminals, or when:
Internal disconnection in the motor winding is detected.

Shorted SCR
Trips the starter in case one or more SCRs have been shorted.

Heatsink Over Temperature
Thermal sensors are mounted on the heatsink and trip the starter when temperature rises above 85ºC.

WARNING
The over temperature protection is designed to operate under normal conditions e.g. in the event of extended low overload, insufficient ventilation – fan stoppage or air flow blockage.
Incorrect starter selection or operation frequents starting at max. conditions, or repeated starting under fault conditions can cause SCRs to overheat and fail before the heatsink reaches 85°C to trip the thermal sensors.

External Fault
Becomes operational when starter is energized, trips the starter when an External Contact closes for more than 2 sec.

WARNING
Do not use External Fault when terminal 21 is not connected to ground.

Fault and Reset
When any of the above protection (except Insulation Alarm) operates, the starter locks in a fault condition, disabling thyristors firing. Fault LED lights up, fault description is displayed on the LCD and Fault Relay operates.

- For local resetting, after fault has been removed, press Reset key.
- Remote resetting can be done through terminals 7 or 8 (see I/O Programming).

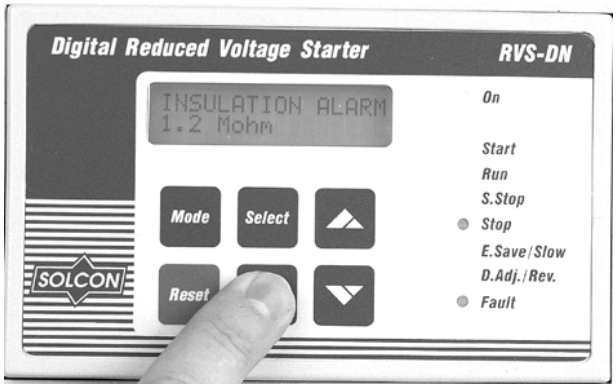
When Fault occurs, followed by a voltage outage, fault condition is latched and reappears upon voltage restoration.

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

Auto Reset
Under-voltage and Phase-loss, faults can be set to Auto-Reset (see Fault Parameters). The starter will reset itself 60 sec. after voltage was fully restored provided no start signal exists.

Note:
Auto- Resetting is not possible as long as Start signal exists.

Front Panel



LED's Arrangement

On
Lights up when Control Supply voltage is connected to the starter.

Start
Lights up during start process, indicating that motor supply voltage is ramping up.

Run
Lights up after completion of starting process, indicating that motor is receiving full voltage.
Flashes during slow speed operation.

S. Stop
Lights up during Soft Stop process, indicating that 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 Slow Speed.

D. Adj. / Rev
Lights up when Dual Adjustment is in operation.
Flashes when motor is running in the Reverse direction at slow speed.

Fault
Lights up upon operation of any of the built-in protection.
Flashes when Insulation Alarm (optional) relay is activated

Keypad Provides selection of the following modes:
(When Dip Switch 1 is in "On", gray zone shows list of maximized parameters).

- Display Only
- Main Parameters
- Start Parameters
- Stop Parameters
- Statistical Data
- Dual-Adjustment Parameters
- Energy Saver and Slow Speed Parameters
- Fault Parameters
- I/O Programming Parameters
- Communication Parameters

Select To select function within each mode.

To increase adjusted parameters.
Press momentarily or continuously.

To decrease adjusted parameters.

Store To save modified parameters.

Reset To reset the starter after fault has been removed, canceling the displayed fault and allows restarting.

Note: Pressing Mode or Select continuously increases parameters changing speed.

LCD Arrangement
Two lines of 16 alphanumeric characters, displaying: System Parameters, Starter Settings, Motor Current, Insulation and Fault Identification.
Four selectable languages – English, French, German and Spanish (see Dip Switch setting – page 19).

CURRENT LIMIT
390%

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

Parameter Review and modifiation

1. Press mode key several times until you reach the required **Mode** page.
2. Press **Select** to review parameters of this Mode.
3. When reaching the required parameter, modifying its values with  or  keys.
4. To store the new parameters, press **Selec**t until "Store Enable" appears and then press **Store** key

Note: Pressing **Mode** or **Select** keys continuously increase parameter change speed.

Mode pages
Upon initiation of the starter, the LCD displays motor's operating current.

% OF MOTOR FLA
98 %

When Dip Sw.#1 is set to On (see Display Options – page 19), by pressing the Mode key all **Mode** pages can be reviewed.
When Dip Sw. # 1 is set to Off, the following Mode pages marked ** will not appear.

	MAIN PARAMETERS
	START PARAMETERS
	STOP PARAMETERS
**	DUAL ADJUSTMENT PARAMETERS
**	EN. SAVE & SL. SPD PARAMETERS
	FAULT PARAMETERS
**	I/O PROGRAMMING PARAMETERS
**	COMM. PARAMETERS
	STATISTICAL DATA

Display Mode

In this mode, parameters cannot be adjusted

% OF MOTOR FLA

Displays operating current as a percentage of motor FLA.

Note: Starter's Default Display, after pressing Mode or Select, a time delay is initiated. Following the delay, the LCD defaults back to display "% OF MOTOR FLA".

Press Select – When Insulation card is incorporated

MOTOR INSULATION 52.8 Mohm

Displays motors winding insulation level

Press Select – When Analogue card is incorporated

THERMISTOR RES. 3.1 Kohm

Displays motor thermistor's resistance

When option cards are not incorporated, the LCD displays

OPTION CARD Not installed

Press Select

ANALOGUE OUTPUT Normal

Normal- Analogue output increases when current increases.

Inverted- Analogue output decreases when current increases.

Range: Normal, Inverted.

This concludes the DISPLAY Mode.
Pressing **Select** key at this point returns to the first display.

Obtaining "Default Parameters"

- Press **Mode** and  keys simultaneously, the LCD will display "Store Enable Default Parameters".
- Press **Store** + **Mode** keys simultaneously.

CAUTION
Obtaining Default Parameters erases all previously modified settings and requires the operator to program FLC and FLA values again.

Press Mode
To advance to:

MAIN PARAMETERS

Press Select
Press ▲ ▼ keys to set Starter's connection type.
(see Appendix for: Inside Delta description).

CONNECTION TYPE LINE / INSIDE DELTA

Press Select
Press ▲ ▼ keys to set Starter's FLC.
(see RVS-DN ratings – Page 3).

STARTER FLC 105 AMP

Press Select
Press ▲ ▼ keys to set motor's FLA
Range: 50-100% of "STARTER FLC"

MOTOR FLA 105 AMP

Press Select
Press ▲ ▼ keys to set Under Current Trip.
Range: 0 = OFF, 20-90% of FLA

UNDERCURR. TRIP 0% OF FLA

Press Select
Press ▲ ▼ keys to set under Current Trip Delay.
Range: 1-40 sec.

UNDERCURR. DELAY 10 SEC.

Press Select
Press ▲ ▼ keys to set Over Current Shear-pin.
Range: 200 – 850% of FLA

O/C – SHEAR PIN 850% OF FLA

Press Select
Press ▲ ▼ keys to set O/C Shear-pin Delay.
Range: 0.5-5 sec.

O/C DELAY 1.5 SEC.

Press Select
Press ▲ ▼ keys to set Overload Trip Current.
Range: 75-150% of FLA

OVERLOAD TRIP 115% OF FLA

Press Select
Press ▲ ▼ keys to set Overload Delay
at 500% of motor FLA
Range: 1-10 sec.

OVERLOAD DELAY 4 SEC – AT 5 FLA

Press Select
Press ▲ ▼ keys to set Under Voltage Trip.
Range: 120-600V

UNDERVOLT. TRIP 300 VOLT

Press Select
Press ▲ ▼ keys to set Under Voltage Trip Delay
Range: 1-10 sec.

UNDERVOLT. DELAY 5 SEC.

Press Select
Press ▲ ▼ keys to set Over Voltage Trip.
Range: 150-750V (can not be set below Under Voltage).

OVERVOLT. TRIP 480 VOLT.

Press Select
Press ▲ ▼ keys to set Over Voltage Trip Delay.
Range: 1 – 10 sec.

OVERVOLT. DELAY 2 SEC.

Press Select
To store selected parameters, press **Store** key.

STORE ENABLE **MAIN PARAMETERS**

Note: Storing selected parameters is possible only when Stop or Run LED are lit. Storing cannot be done when Start, Soft Stop, Slow Speed, Energy Save, or Fault LED are lit.

When parameters have been correctly stored, the LCD will read:

DATA SAVED OK

This concludes MAIN PARAMETER settings.
Pressing **Select** key after "Data Saved OK" returns to the first display in this mode.

Note: In case of a failure in parameter storing, the LCD displays:

STORAGE ERROR

Press **Select** button again until "Store Enable Main Parameters" returns. Then press **Store** key until "Data Saved OK" appears.

Press Mode
To Advance to:

START PARAMETERS

Press Select

SOFT START CURVE 0 (STANDARD)

Then press ▲ ▼ keys to set Soft Start Curve:
0 (Standard) = Standard Curve
1!! = Pump Control Curve # 1
2!! = Pump Control Curve # 2
3!! = Pump Control Curve # 3
4 (Torque) = Torque Control Pump Curve # 4

When setting Dip sw. # 2 On for Tacho Mode

Press ▲, following Curve #4 message changes to:

START TACHO. GAIN 0 (MIN. GAIN)

Then press ▲ ▼ keys to set Tacho gain:
0 = Minimum gain tacho, control
1!! = Second level tacho gain
2!! = Third level tacho gain
3!! = Fourth level tacho gain
4!! = Fifth level tacho gain
5!! = Sixth level tacho gain

Note: Tacho Feedback is operational in its basic form. Additional curves except for the basic linear curve are optional. Consult factory for correct tacho selection and mechanical installation.

Press Select,

Press ▲ ▼ keys to set Pulse Start Time.
Range: 0-1 sec. (Pulse level at 80% Un)

PULSE TIME 0 SEC.

Press Select,

Press ▲ ▼ keys to set Initial Voltage.
Range: 10-50% of Un.

INITIAL VOLTAGE 30%

When Up Arrow key is pressed at 50% Initial Voltage, the display will change to the current curve and show:

INITIAL CURRENT 100%

At this point, the choice of current will determine the Initial Current at the beginning of the starting curve.
Range: 100-400% of Motor FLA

Press Select,

Press ▲ ▼ keys to set Current Limit
Range: 100-400% of motor FLA.

CURRENT LIMIT 400% OF FLA

Press Select

Press ▲ ▼ keys to set Acceleration Time
Range: 1-30 sec.

ACC. TIME 10 SEC.

Press Select

Press ▲ ▼ keys to set Maximum Start Time
Range: 1-30 sec.

MAX. START TIME 30 SEC.

Press Select

Press ▲ ▼ keys to set Number of Starts permitted (During STARTS PERIOD below). Range: 1-10, Off.

NUMBER OF STARTS 10

Press Select

Press ▲ ▼ keys to set Number of Starts Time Period
Range: 1-60 min.

STARTS PERIOD 30 MIN.

Press Select

Press ▲ ▼ keys to set Start Inhibit Period
Range: 1-60 min.

STARTS INHIBIT 15 MIN.

Press Select

Press ▲ ▼ keys to set Time Delay for End of Acceleration Contact.
Range: 0-120 sec.

RUN CONTACT DEL. 5 SEC.

Press Select
To store selected parameters, press **Store** key

STORE ENABLE START PARAMETERS

When parameters have been correctly stored, the LCD reads:

DATA SAVED O.K.

This concludes START PARAMETERS setting.

Press Mode
To advance to

STOP PARAMATERS

Press Select

Then press ▲ ▼ keys to set Soft Stop Curve
0 = Standard Curve
1!! = Pump Control Curve # 1
2!! = Pump Control Curve # 2
3!! = Pump Control Curve # 3
4 = Pump Control Curve 4 (Torque Control)

SOFT STOP CURVE 0 (STANDARD)

When setting Dip sw # 2 On for Tacho Mode,

Press ▲ curve message changes to:

STOP TACHO GAIN 0 (MIN. GAIN)

Then press ▲ ▼ keys to set Tacho gain:
0 = Minimum gain tacho, control
1!! = Second level tacho gain
2!! = Third level tacho gain
3!! = Fourth level tacho gain
4!! = Firth level tacho gain
5!! = Sixth level tacho gain

Note: Tacho Feedback is operational in its basic form. Additional curves except for the basic linear curve are optional. Consult factory for correct tacho selection and mechanical installation.

Press Select

Then press ▲ ▼ keys to set Deceleration Time.
Range: 1-30 sec.

DEC. TIME 10 SEC.

Press Select

Then press ▲ ▼ keys to set Final Torque during Soft Stop.
Range: 0 – 10 (0 = min., 10 = max.)

FINAL TORQUE 0 (MIN)

Press Select
To store selected parameters, press **Store** key

STORE ENABLE **STOP PARAMETERS**

When parameters have been correctly stored the LCD displays:

DATA SAVED OK

This concludes STOP PARAMETERS setting.

Press Mode
To advance to (only when Dip Sw. # 1 is set to ON):

DUAL ADJUSTMENT **PARAMETERS**

When selecting "Generator Mode" (Dip sw # 3 is On) the following display appears instead of the above.

D. ADJ: GENERATOR **PARAMETERS**

Press Select

Then press ▲ ▼ keys to set DA: Initial Voltage.
Range: 10-50% of Un.

DA: INIT. VOLT. 30%

Press Select

Then press ▲ ▼ keys to set DA: Current Limit.
Range: 100-400% of motor's FLA.

DA: CUR. LIMIT 400% OF FLA

Press Select

Then press ▲ ▼ keys to set DA: Acceleration Time.
Range: 1-30 sec.

DA: ACC. TIME 10 SEC.

Press Select

Then press ▲ ▼ keys to set DA: Deceleration Time.
Range: 1-30 sec.

DA: DEC. TIME 10 SEC.

Press Select

Then press ▲ ▼ keys to set DA: Motor FLA
Range: 50-100% of "STARTER FLC"

DA: MOTOR FLA 105 AMP.

Press Select
To store selected parameters, press **Store** key

STORE ENABLE **D.ADJ. PARAMETERS**

When parameters have been correctly stored, the LCD displays:

DATA SAVED OK

This concluded DUAL ADJUSTMENT PARAMETERS setting.

Press Mode
Set Dip. Sw. # 1 ON, to advance to:
Energy Save and Slow Speed Modes

EN. SAVE & SL. SPD PARAMETERS

Press Select

Then press ▲ ▼ keys to set Energy Saving Level.
Range: 0-10 (0 = min., 10 = max.)

SAVING ADJUST. 0 (MIN.)

Press Select

Then press ▲ ▼ keys to set Slow Speed Torque.
Range: 1-10 (1 = min., 10 = max.)

SLOW SPEED TORQ. 8

Press Select

Then press ▲ ▼ keys to set Maximum Slow Speed Time.
Range: 1-30 sec.

MAX SLOW SP TIME 30 SEC.

Press Select
To store selected parameters, press **Store** key

STORE ENABLE **EN. SAVE & SL. SPD**

When parameters have been correctly stored, the LCD displays:

DATA SAVED OK

This concludes ENERGY SAVING / SLOW SPEED PARAMETERS setting.

Press Mode

Set Dip. Sw. # 1 ON, to advance to:

FAULT PARAMETERS

Press Select

Then press ▲ ▼ keys to set Phase Sequence trip.
Range: Yes / No

PHASE SEQ. Y/N **NO**

Press Select

Then press ▲ ▼ keys to set Insulation Alarm.
Range: Off, 0.2 – 5 MΩ

INSULATION ALARM **OFF**

Press Select

Then press ▲ ▼ keys to set Insulation Trip.
Range: Off, 0.2 – 5 MΩ

INSULATION TRIP **OFF**

Press Select

Then press ▲ ▼ keys to set Auto.Reset (for Under-voltage and Phase-loss faults).
Range: Yes / No.

AUTO RESET **NO**

Press Select

Then press ▲ ▼ keys to set Thermistor Type.
Range: PTC, NTC.

THERMISTOR TYPE **PTC**

Press Select

Then press ▲ ▼ keys to set Thermistor Trip Level.
Range: Off, 0.1 – 10 KΩ, step: 0.1Kohn.

THERMISTOR TRIP **OFF**

Press Select

Then press ▲ ▼ keys to set UNDER CUR. RESET (for temporary Under-currents, in remote installations.)
Range: 10-120Min./OFF.

UNDER CUR. RESET **OFF**

Press Select
To store selected parameters, press **Store** key

STORE ENABLE **FAULT PARAMETERS**

When parameters have been correctly stored,
the LCD displays:

DATA SAVED OK

This concludes FAULT PARAMETERS setting.

Press Mode
Set Dip Sw. # 1 ON, to Advance to:

I/O PROGRAMMING PARAMETERS

Press Select
Then press ▲ ▼keys to set Terminal # 7 function
Range: Energy Saver, Slow Speed, Reset

PROG. INPUT # 7 ENERGY SAVER

Press Select
Then press ▲ ▼keys to set Terminal # 8 function
Range: Dual Adjustments, Slow Speed Reverse, Reset

PROG. INPUT # 8 DUAL ADJUSTMENT

Press Select
Then press ▲ ▼keys to set Fault Relay function
Range: Fault, Fault - Fail Safe (Fail-Safe Logic - page 23)

FAULT RELAY TYPE FAULT

Press Select
Then press ▲ ▼keys to set Immediate Relay function
Range: Immediate, Shear-Pin

IMM / S.PIN RELAY IMMEDIATE

Press Select
Then press ▲ ▼keys to set Imm / S. Pin Relay On Delay
Range: Immediate 0-60 sec. / Shear-Pin 0-5 sec.

RELAY ON DELAY 0 SEC.

Press Select
Then press ▲ ▼keys to set Imm / S. Pin Relay Off Delay
Range: Immediate 0-60 sec. / Shear-Pin 0-5 sec.

RELAY OFF DELAY 0 SEC.

Press Select
Then press ▲ ▼keys to set Normal or Inverted output
Range: Normal, Inverted

ANALOG OUTPUT NORMAL

Press Select
To store selected parameters, press **Store** key

STORE ENABLE **I / O PROG. PARAM.**

When parameters are correctly stored, the LCD displays

DATA SAVED OK

This concludes I/O PARAMETER setting.

Press Mode
Set Dip Sw. # 1 ON, to Advance to:

COMM. PARAMETERS

Communication is optional and operates only when starter incorporates this feature.

Note: When using communication and local commands, the last command determines the function.

Press Select
Then press ▲ ▼keys to specify Communication Protocol.

COMM. PROTOCOL MODBUS

Range: Modbus, Profibus, Modbus-TCP

Press Select
Then press ▲ ▼keys to set Communication Baud Rate.
Range: 1200-9600 bps

BAUD RATE 9600

Press Select
Then press ▲ ▼keys to set Communication Parity Check. Range: Even / Odd

PARITY CHECK EVEN

Press Select
Then press ▲ ▼keys to set Communication Serial Link Number.
Range: 1-248 (for up to 32 starters on one twisted pair)

SERIAL LINK NO. 248 (OFF)

Note: If communication is not used, serial link number must be set to 248 (Off)

Press Select
To store selected parameters press **Store** key

STORE ENABLE **COMM. PARAMETERS**

When parameters have been correctly stored, the LCD displays:

DATA SAVED OK

This concludes COMMUNICATION PARAMETERS setting.

Press Mode
To Advance to

STATISTICAL DATA
- **-**

Press Select
To store selected parameters, press **Store** key

LAST STRT PERIOD
NO DATA

Displays last starting time in seconds.
(Time duration until motor's current reached nominal)

Press Select

LAST START MAX I
NO DATA

Displays the maximum current at last start.

Press Select

TOTAL RUN TIME
0 HOURS

Displays motor's hour counter since commencement or since "Statistical Data" was last reset.

Press Select

TOTAL # OF START
0

Displays the total numbers of starts since commissioning or since "Statistical Data" was last reset.

Press Select

LAST TRIP
NO DATA

Describes last fault.

Press Select

TRIP CURRENT
0% OF FLA

Displays the current at the last fault.

Press Select

TOTAL # OF TRIPS
0

Displays the total numbers of trips since commencement or since "statistical Data" was last reset.

Press Select

PREVIOUS TRIPS – 1…9
PHASE LOSS

Displays historical event of the last 1-9 faults, by scrolling with the "▲" or "▼" arrows through the trips stored since commencement or since "Statistical Data" was last reset.

Press Mode to return to Display Only Mode

% OF MOTOR FLA

Service Mode

Press **Mode** and ▼ keys simultaneously, the LCD displays:

STORE ENABLE
DEFAULT PARAMET.

Press Store and **Mode** simultaneously to store factory Default Parameters. All previously stored parameters will be erased. This also returns to "Display Only" Mode.

Or, to Reset Statistical Data:
Press Select

RESET STATISTICS

Press Reset and **Store** simultaneously to reset all your statistical data. This also returns automatically to Statistical Data Mode.

Press Select to see the software program version
Displays program version

PROGRAM VERSION
STRT.DN-020797

Or, for Factory Calibration:
Press Select
Read phase to phase mains voltage.

VOLTAGE ADJUST.
XXX % VOLT

Press Select
Reads current for factory calibration use only.

CURRENT ADJUST.
XX% OF RVS FLC

Press Select
Display goes back to Store Enable Default Parameters

STORE ENABLE
DEFAULT PARAMET.

To exit "Service Mode" press **Mode** + ▼ simultaneously.

NOTES:

- Entering "Service Mode" is possible only when Stop LED is On.
- A Start signal while in "Service Mode" exits from this mode.

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).

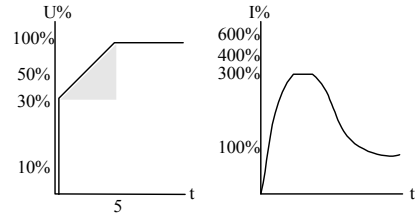
Start-up procedure with start-stop buttons

1. Connect Control Supply. **On** and **Stop** LEDs will lit.
2. Review all parameters with **Mode** and **Select** keys Set parameters as required.
3. If necessary, return to Default Parameters (see "Service Mode" page 33).
4. Connect mains 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 Para 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 Para 7.
7. Motor begins to turn. If speed accelerates smoothly to nominal, proceed to Para 8. If current during acceleration is too high, decrease "Current Limit" setting and proceed to Para 8. If motor speed does not accelerate to nominal, increase Current Limit setting.
8. Press Stop and wait until motor stops.
9. Slightly increase Initial Voltage and Current Limit settings to allow for load changes.
10. Press Start and see that motor is 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 set Max. Start Time to approx. 5 sec. Longer than the maximum time required to complete the starting process.

Examples of starting curves

Light Loads-Pumps, Fans, etc.

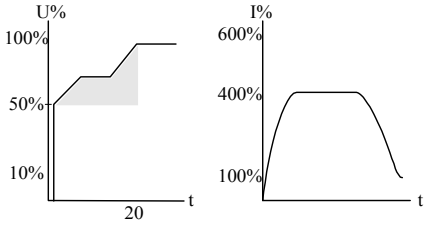
Initial Voltage (IV) – set to 30% (Factory Default)
Current Limit (CL) – set 300%
Acceleration Time (AT) – set 5 sec.



Voltage quickly increases to the Initial Voltage value and then gradually ramps-up to nominal. Current simultaneously and smoothly increases to reach Current Limit setting or less, before smoothly decreasing to the operating current. Motor speed will accelerate to full speed quickly and smoothly.

High Inertia Loads – Fans, Centrifuges, etc

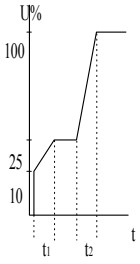
Initial Voltage – set 50%
Current limit – set 400%
Acceleration time– set 20 sec



Voltage and current increase until current reaches "Current Limit value". The voltage is held at this value until motor is close to nominal speed, then current will begin to decrease. The RVS-DN continues to ramp-up the voltage until reaching nominal. Motor speed smoothly accelerates to full speed.

Special starting – Using Dual Adjustment

Using two starting characteristics, the starter will accelerate to DA-IV reaching 100% current limit. After Tx (Imm. Relay delay) voltage to terminal 8 is switched off, using the standard characteristic to complete acceleration. Useful to prevent initial high acceleration. (Applications: Submersible pumps, Drum fans with resonating frequency, etc).



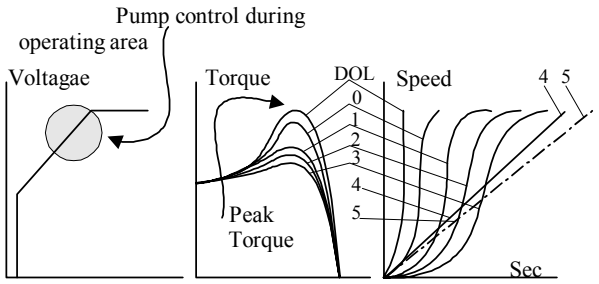
	Dual Adj. Par.	Standard Par.
Initial Voltage	10%	25%
Acceleration Time	tl = 2-30 sec	t2 = 2-30 sec
Current Limit	200%	300-400%
Imm.Rel. ON delay	Tx = 1-60 sec.	-----

Pump Control

Choosing a suitable **Pump Curve** (centrifugal Pumps)

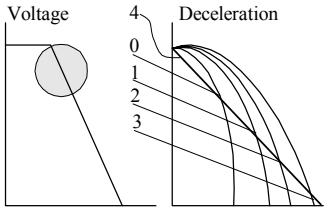
Starting Curve

1. Adjust main parameters as necessary (FLA, FLC, etc..)
2. Set Starting Curve, Acceleration Time, Current Limit, and Initial Voltage to their default values (curve 0, 10 sec., 400% and 30% respectively).
3. Start the pump while watching the pressure gauge as the pump starts and look for overshooting ("Pressure Surge") of the gauge needle above the target pressure. In case of over pressure, choose a peak torque reduction curve (Pump Control curve 1!).
4. Set Start Curve 1!, increase Acceleration Time to 15 sec. and reduce Current Limit to 350%. Start the pump and watch the pressure gauge while the pump starts.
5. In most cases, overshooting is reduced, if the overshoot persists, increase Acceleration time to 25 sec. (confirm with motor manufacturer) and try again.
6. If the overpressure persists, increase Starting Curve setting to 2!, 3!, 4 (Torque) or 5 (Current Ramp) if necessary. Each increase in Starting Curve setting will reduce the Peak Torque, thus, reducing the overpressure and preventing the "Pressure Surge" during start.
7. To increase starting time above these maximums, employ "Special Starting" (page 32) with these techniques or incorporate Torque and Current characteristics.



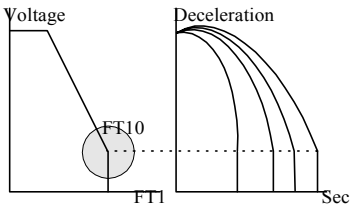
Stopping Curve

1. Adjust main parameters as necessary (FLA, FLC, etc..)
2. Set Stop Curve and Deceleration Time, to their default values (curve 0, 10 sec., respectively).
3. Stop the pump, watching the pressure gauge and the check valve as the pump stops. Look for undershooting/overshooting ("Water Hammer") of the gauge (which may abruptly stops the pump and the motor).
4. Select Stop Curve 1, increase Deceleration time to 15 seconds. Stop the pump and watch the pressure gauge and the rate of closing of the check valve as the pump stops. Abrupt stopping of the pump and motor will cause a loud audible noise emitted from the check valve.
5. In most cases, "Water Hammer" is reduced. If the "Water Hammer" persists, increase the time to 25 seconds (confirm with motor manufacturer) and try again.
6. If the "Water Hammer" persists, increase Stop Curve setting to 2!, or 3!. Each increase in stop curve will reduce the abrupt stop of the pump, thus, preventing the "Water Hammer" phenomenon.
7. If the extent of the water hammer was not reduced, increase to stop curve # 4 to employ Torque Controlled deceleration.

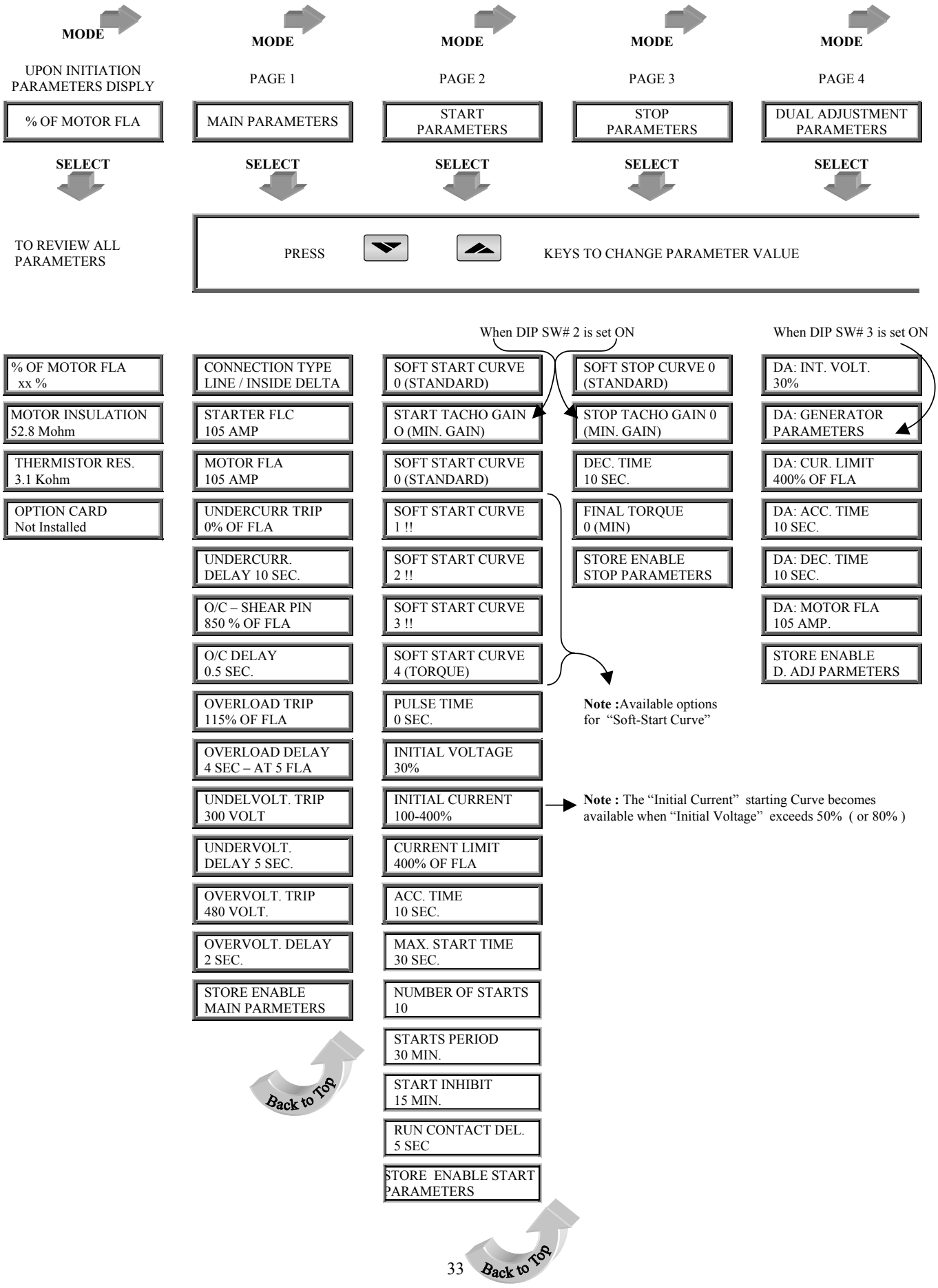


Final torque during soft-stopping a pump motor

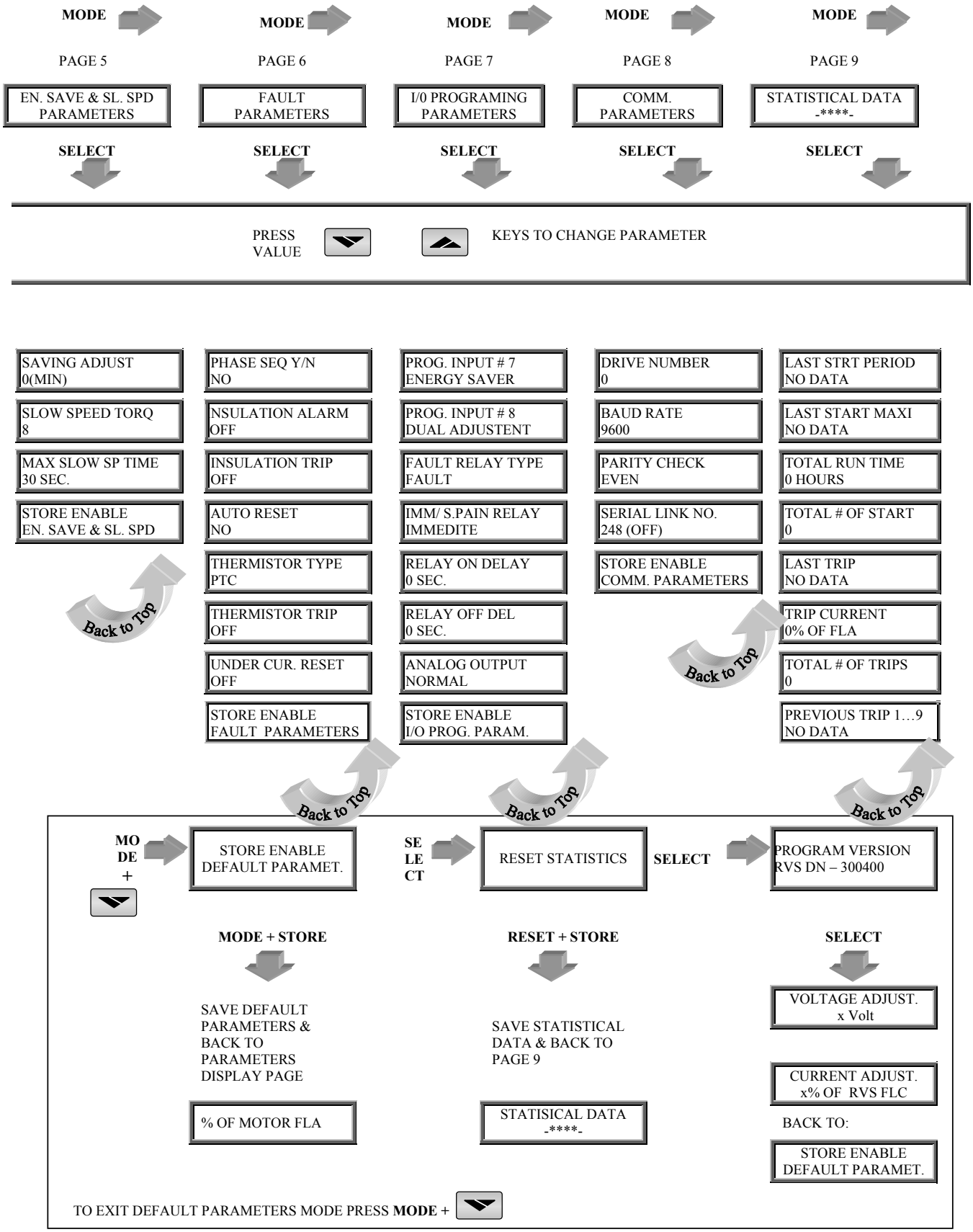
1. While decelerating, the check valve may close before Deceleration Time has elapsed, thus, allowing current to flow through stator winding causing unnecessary heat. Select Final Torque sensitivity to 1, and stop the pump, confirm that current stopped flowing through the motor shortly after the check valve closed.
2. If current still flows more than 3-5 seconds after check valve closure, increase Final Torque up to 10 if necessary, to stop current flow earlier.



Menu Description



Menu Description



Trouble Shooting

Upon fault – motor stops, Fault LED lights and Fault Relay operates. The LCD shows TRIP: and fault description.
Upon Alarm – motor continues running, Alarm Relay operates and Fault LED flashes. The LCD shows ALARM: and fault description
(for example: **ALARM: MOTOR INSULATION).**

INSULATION ALARM	(Optional) Alarms when motor insulation level decreases below set level. Alarm ceases automatically 60 sec. after resistance able set level. Check motor and cable insulation.
INSULATION TRIP	(Optional) Trips the starter when motor's insulation level decreases below trip value. Check motor and cable insulation level.
THERMISTOR TRIP	(Optional) Trips the starter when motor's thermistor resistance decreases below trip value. Check thermistor and cable's resistance, check motor temperature near thermistor location.
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.
LONG START TIME	Trips the starter if output voltage does not reach nominal at the preset max. Start time. Check FLA, FLC, and Max Start Time settings. Increase Initial Voltage, Current Limit & Max. start time or decrease Acceleration Time as necessary.
O/C – SHEAR PIN	Trips the starter when: 1. Instantaneously when current exceeds 8.5 x Starter FLC. 2. During starting when current exceed 8.5 x Motor FLA. 3. During running when current exceeds 200-850%. O/C Shear-Pin has a programmable delay of 0-5 seconds where the starter detects the fault and does not trip before time delay has elapsed (delay is override when current reaches 8.5 x Starter FLC). Check that motor is not installed or Jammed. Check FLA, FLC settings. Check motor and cable connections. Perform a "Megger" test to verify motor 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.
UNDER CURRENT	Trips the starter when line current drops below the preset level for the preset time. Check "Under Current Trip" and "Time Delay" settings, check line currents through L_1, L_2, L_3.

CAUTION

- Check that "Megger" maximum voltage is no more than 500V!.
- Disconnect terminal 21 before performing a "Megger" test.

Trouble Shooting

UNDER VOLTAGE	Trips the starter when line voltage drops below the preset level for the preset time. Check "Under Voltage Trip " and "Time Delay" settings, check line voltages on L_1, L_2, L_3. When voltage drops to zero, the starter trips immediately with no delay.
OVER VOLTAGE	Trips the starter when line voltage increases above a preset level for a preset time. Check "Over Voltage Trip" and "Time Delay" settings, check line voltage on L1, L_2, L_3.
PHASE LOSS	Trips the starter if 1 or 2 phases are missing. Check line voltages related to terminal 21 is connected correctly (see page 8). Check that frequency variations are between 40-65Hz.
PHASE SEQUENCE	Trips the starter if line phase sequence is wrong. Check line phase sequence, and if wrong, swap two wires on line side. If motor now rotates in the wrong direction, swap two wires on load side.
MAX SLOW SP TIME	Trips the starter when operating at slow speed for extended period of time. Check that operation time at Slow Speed is shorter than "Max Slow Speed Time" setting. **Note:** Motor and starter may be overheated when operating at slow speed for an extended period.
WRONG CONNECTION	Trips the starter when one or more motor phases is not properly connected to starter's load terminals or in case of internal disconnection in motor winding. If required, may be eliminated by using Dip Sw # 3 and wiring the soft-starter in generator mode (programming D.A. parameters accordingly*).
SHORTED SCR	Trips the starter and prevents starting if any SCR is short-circuited or when motor windings are shorted. Check with an ohmmeter between L_1-U, L_2-V, L_3-W; resistance > 20 KΩ. Check for no voltage on terminals U, V, W (from parallel system or an independent by-pass). SCRs may fail due to: * High short current not protected by proper fuses * High voltage spikes not protected by proper external Varistors. * Frequent starting at maximum conditions or fault conditions.
OVER TEMPERATURE	Heat-sink over-temperature. Trips the starter when heat-sink temp. rises above 85˚C. Improve cooling or use a by-pass contactor. Check that motor starting is not too frequent.
EXTERNAL FAULT	Trips the starter when a N.O contact between terminals 19-21 closes for over two seconds. Check contact position and cause of closure.
WRONG PARAMETERS	Parameters not transferred from RAM to EEPROM or vice versa. After replacing the EPROM with a new software version or after power up, press **Reset**, than **Mode** and ▼ simultaneously and save the default parameters by pressing Store and Mode simultaneously. (If Fault LED is on, press **Reset** after strong parameters).
*** NOTE:**	When operating in generator mode, Shorted SCR and Wrong Connection faults are not active.

Technical Specification

General Information:

Supply Voltage	Line to Line 220-690V (to be specified) + 10%-15%
Frequency	45 – 65 Hz (Fixed or variable frequency source)
Control Supply	110-230V (to be specified) +10% - 15%
Control inputs & Outputs	Either same as Control Supply or by special order 24-230V AC/DC (to be specified)
Load	Three phases, three wires, squirrel cage induction motor.
Connection type	Standard 3 wire U, V, W connection, or 6 wire "Inside Delta" (Programmable)

Start-Stop Parameters:

Starter FLC	Starter's Full Load Current, according to Selector Guide
Motor FLA	Motor Full Load Ampere 50-100% of Starter FLC
Starting Curve 0 (Standard)	2 Standard Starting and stopping curves.
Pump Control Curves (1!, 2!, 3!)	6 field selectable curves preventing Over-pressure during start and Water Hammer during stop.
Torque Control Curve (4)	2 Selectable curves preventing Over-pressure during start and Water Hammer during stop. In addition, these curves may be used for Torque control starting of constant torque applications.
Pulse Start Duration	A pulse of 80% Un, for an adj. time 0.1-1 Sec, for starting high friction loads
Initial Voltage	10-50% Un (*10-80%), 5% - by special order
Initial Current	100-400% In (1 Current Control starting Curve, appears when Initial Voltage is displayed , "Up" arrow is pressed, and IV% has reached its Max.)
Current Limit	100-400% of Motor FLA (*100-500%)
Acceleration Time	1-30 Sec (*1-90 sec)
Deceleration Time	1-30 Sec (*1-90 sec, not in Dual Adjust)
Dual Adjustments	Secondary start stop characteristic for: Motor FLA, Initial Voltage, Current Limit, Acceleration Time and Deceleration Time.
Energy Saving	Energy save for lightly loaded motors
Slow Speed Torque	Torque while motor is at 1/6 nominal speed
Tacho and Linear Acceleration	12 field selectable curves – defining gain control, improving Tacho Feedback.

* Consult Factory

Motor Protection:

Too many starts	Maximum number of starts, range: Off or 1-10, during a time period 1-60 min.
Starts inhibit	Time period 1-60 min, when starting is prevented, after Too Many Starts fault
Long start time (Stall protection)	Maximum allowable starting time 1-30 sec. (*1-250 Sec).
Over current (Shear-pin)	Two operation functions: during starting trips the starter at 850% and during running at 200-850% In, both within 1 Cycle.
Electronic overload (I^2t)	Adjustable 75-150% of motor FLA, adjustable Trip time 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 main voltage drops below 120-600V, time delay 1-10 Sec
Over voltage	Trips when main voltage increase above 150-750V, time delay 1-10 sec.
Phase loss, Under/over Frequency**	Trips when one or two phases are missing or frequency is < 40Hz or > 65Hz.
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 notconnected / incorrectly connected to the starter.
Shorted SCR	Trips in case one or more SCRs have been shorted
Heat Sink over temperature	Trips when heat-sink temperature rises above 85˚C.
External fault	Trips when an External Contact closes for 2 sec.
Motor Insulation (optional	Alarm level setting 0.2 – 5MΩ, trips when insulation decreases below 0.2-5MΩ
Motor Thermistor (optional)	Trip level setting 1-10KΩ, trips when resistance decreases below the set level.

* Special settings – Consult Factory
** With optional Auto Reset.

Technical Specification

Control:

Displays	LCD in 4 – Field selectable languages and 8 LEDs.
Keypad	6 keys for easy setting
Aux Contact – Immediate	1 C/O, 8A, 250VAC, 2000VA
Aux Contact – End Of Acceleration	1 C/O, 8A, 250VAC, 2000VA
Fault Contact	1 C/O, 8A, 250VAC, 2000VA
Insulation Alarm Contact (option)	1 C/O, 8A, 250VAC, 2000VA
Communication	RS 485 with MODBUS protocol for full control and supervision.
	Consult factory for other communication protocol.

Temperatures ..... Operating -10˚ to 50˚C
Storage -20˚ to 70˚C

Standards:

Dielectric Test		2500VAC	
Degree of Protection		IP 20 for frame size A	
		IP 00 for frame sizes B, C, D, E, F, G	
Pollution Degree		3	
EMC	Emissions	EN 55011	CISPR 11 Class A
	Immunity	EN 55082-2	ESD 8KV air, IEC 801-2
			Electric RF field 10 V/m, 20-1000Mhz, IEC 801-3
			Fast transients 2KV, IEC 801-4
	Safety	EN 600947-1	Related to safety requirements.
		UL508C	

Normal Service Conditions:

Altitude	Up to 1000m. For equipment to be used at higher altitudes consult Factory.
Humidity	95% at 50˚C or 98% at 45˚C.

Fan and Starter Consumption Ratings:

Size A (8-31A)	No fan	Total starter Consumption 150VA
Size A (44-72A)	Fan 35 VA	Total starter Consumption 185VA
Size B	Fan 60 VA	Total starter Consumption 210VA
Size C	Fans 105 VA (35VA x 3)	Total starter Consumption 255VA
Size D, E, F, G	Fans 150 VA (50VA x 3)	Total starter Consumption 300VA

Appendix Table of Contents

UL, cUL Installation Instructions

1. Input power and output motor field wiring shall be copper conductors, rated 75ºC.
2. Use UL listed closed-loop connectors sized for the selected wire gauge. Install connectors using the correct crimp tool recommended by the connector manufacturer. Applies only to units bus bars.
3. Table showing corresponding wire size, terminal screw, closed-loop connector size. Torque ratings for attachment of connector to bus bar (see table).
4. Branch circuit protection, shall be provided per the NEC.

For units with UL cUL, see ordering information.

Cables, Terminal screws and Torque recommendations

No.	Max. Mot. FLA	Min. dimensions for copper cables (mm^2)	Term Screw	Mech. Torq. Kg.cm
1	8	3 x 1.5 + 1.5		
2	17	3 x 2.5 + 2.5		
3	31	3 x 6 + 6		
4	44	3 x 6 + 6		
5	58	3 x 10 + 10		
6	72	3 x 16 + 16		
7	105	3 x 50 + 50	M8	180
8	145	3 x 70 + 35	M8	180
9	170	3 x 95 + 50	M8	180
10	210	3 x 150 + 70	M10	220
11	310	2 x (3 x 120+ 70)	M10	220
12	390	2 x (3 x 185+ 95)	M10	220
13	460	2 x (3 x 240+120)	M10	220
14	580	3 x (3 x 185+ 95)	M10	220
15	820	3 x (3 x 240+120)	M10	220
16	1100			
17	1400			
18	1800			
19	2500	TBD	TBD	TBD

LR Recommendation

LR recommendations for marine, offshore or industrial use.

System design needs to take into account the power supply source and the motor drive together with the electronic soft starter. Particular features to be considered are torque production, harmonic production and their consequential effects and EMC. These points are relevant for marine, off-shore or industrial use.

Fuse Selection (Recommended Values For Main Supply Of 400V)

RVS-DN Fuse Value	Max. thyristor I^2t Allowed (A^2Sec)	BUSSMAN	Schneider	GEC ALSTOM Ultra Fast Fuse	JEAN MULLER Semicon Fuse	FERRAZ - SHAUMAT	FERRAZ publication Reference / Publication
RVS – DN 8	400	T.B.D.	T.B.D.	GSGB30	500V - 40A	6,9 Grb 17.32	A220961 / A60070
RVS – DN 17	5,000	T.B.D.	T.B.D.	GSGB55	500V - 50A	6,9 Grb 17.63	G220967 / A60070
RVS – DN 31	10,000	T.B.D.	T.B.D.	GSGB110	500V - 80A	6,6 URB 000 BS 88 110	E330100 / F600397
RVS – DN 44	12,000	T.B.D.	T.B.D.	GSGB125	500V - 125A	6,6 URB 000 BS 88 150	F330101 / F600397
RVS – DN 58	15,000	T.B.D.	T.B.D.	GSGB150	500V - 200A	6,6 URB 000 BS 88 160	F330055 /F600397
RVS – DN 72	18,000	T.B.D.	T.B.D.	GSGB170	500V - 250A	6,6 URC 000 BS 88 180	C330144 / H600399
RVS – DN 105	60,000	T.B.D.	T.B.D.	GSGB225	500V - 315A	6,6 URD 000 BS 88 250	F330146 / H600399
RVS – DN 145	100,000	T.B.D.	T.B.D.	GSGB350	500V - 350A	6,6 URD 2 x 000 BS 88 355	V330160 / H600399
RVS – DN 170	140,000	T.B.D.	T.B.D.	GSGB400	500V - 400A	6,6 URD 2x000 BS 88 400	W330161 / H600399
RVS – DN 210	200,000	T.B.D.	T.B.D.	GSGB450	500V - 450A	6,6 URC 2x000 BS 88 450	X330162/ H600399
RVS – DN 310	600,000	T.B.D.	T.B.D.	GSGB580	500V - 710A	6,6 URD 31 D 11 0630	Q300026/ D600188
RVS – DN 390	700,000	T.B.D.	T.B.D.	GSGB710	500V - 800A	6,6 URD 31 D 11 0700	R300027/ D600188
RVS – DN 460	800,000	T.B.D.	T.B.D.	GSGB800	500V - 1000A	6,6 URD 32 D 11 0800	W300192 / D600188
RVS – DN 580	1,200,000	T.B.D.	T.B.D.	GSGB900	500V - 1250A	6,6 URD 32 D 11 1250	B300266 / D600188
RVS – DN 820	2,000,000	T.B.D.	T.B.D.	GSMJ1200	N.A.	6,6 URD 33 D 111 400	C300267 / D600188
RVS – DN 1100	N.A	T.B.D.	T.B.D.	N.A	N.A	A065URD33LI 1600 OR AO60R1600 orA60X1500A	J301706 / Z600483 OR V479
RVS – DN 1400	N.A	T.B.D.	T.B.D.	N.A	N.A	A060URD33LI 2000 OR A060R2000 or A60X2000A	J301078 / Z600483 OR
RVS – DN 1800	N.A	T.B.D.	T.B.D.	N.A	N.A	T.B.D.	T.B.D.
RVS – DN 2150	N.A	T.B.D.	T.B.D.	N.A	N.A	T.B.D.	T.B.D.
RVS – DN 2400	N.A	T.B.D.	T.B.D.	N.A	N.A	T.B.D.	T.B.D.
RVS – DN 2700	N.A	T.B.D.	T.B.D.	N.A	N.A	T.B.D.	T.B.D.
RVS – DN 3000	N.A	T.B.D.	T.B.D.	N.A	N.A	T.B.D.	T.B.D.
RVS – DN 3500	N.A	T.B.D.	T.B.D.	N.A	N.A	T.B.D.	T.B.D.

Notes: 1. The above table is for maximum starting current of 500% of FLC, maximum starting time of 30 sec and rated voltage of 400 V (see note 3 for exception).
2. Rating may change with different external conditions such as ambient temperature, forced cooling etc. Refer to fuse manufacturer catalogs to confirm correct values.
3. Ferraz ratings are simulated for 4In, 4 times per hour with a 10sec. starting time for each start.

Motor and Starter Protection Occurance Table

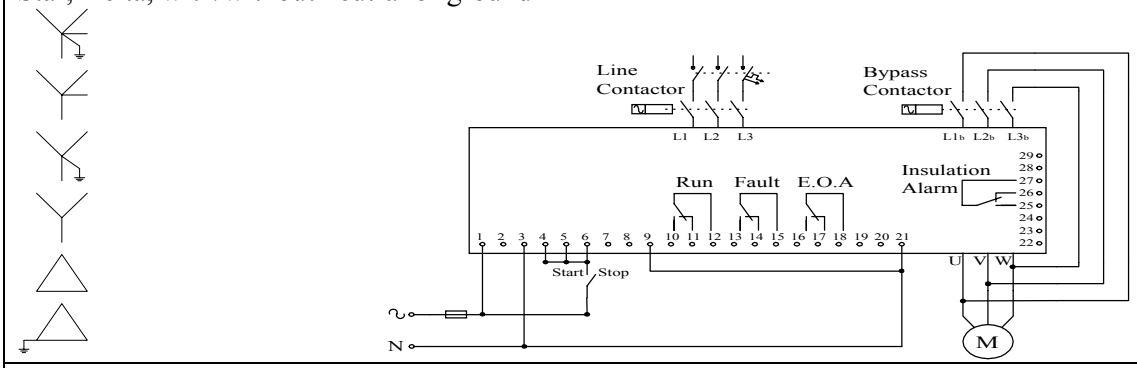
Timing And Occurrence	Active During			
	Start	**Run**	**Stop**	**Soft Stop**
Too many starts with Start Inhibit period	√			
Electronic Overload with Curve selection		√		
Shear Pin (Jam) * Default setting				
Starter Protection – trip function at 850% FLC	√	√		√
Motor Protection – trip function				
During Start – factory set at 850% FLA in less than 1 cycle.	√			√
During Run – adjust. 200 – 850% FLA within 1 cycle		√		
Programmable setting (Dip switch # 2 On)				
Starter Protection – trip function at 850% FLC	√	√		√
Motor Protection – Alarm & Trip functions On fault "Immediate Relay" acts as Alarm w/adj. delay – If fault is cleared within the time delay, trip will not occur				
During Start – preset at 850% FLA, adjust. delay (Imm. Relay)	√			√
During Run – adjust. 200-850% FLA adjust. delay (Imm. Relay)		√		
Under current adjustable time delay		√		
Phase Loss	√	√		√
Phase sequence	√	√		√
Under voltage with adjustable time delay. Time delay is overriden in case of "No-Volt".	√	√		√
Over voltage with adjustable time delay	√	√		√
Long start time (Stall protection)	√			
Shorted SCR	√			√
Wrong connection (Load Loss)	√			
External fault – input from a N.O. contact	√	√	√	√
SCR protection by Metal Oxide Varistors (MOV)	√	√	√	√
Starter over-temperature	√	√	√	√
Starter internal test, when "On" LED is lit.	√	√	√	√
Motor Insulation test (option) – two levels for Alarm & Trip when installed, operates upon no main voltage			√	
Motor Thermistor (option) – programmable PTC/NTC, With adjustable Trip level.	√	√	√	√

* Available from software version 5/11/97

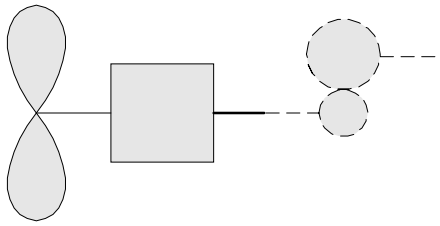
Warranty Report and Problem Inquiry – Complete the form and fax for inquiry

Representative Name:	Country:	Fax Number:
Model Number And Built Options:	Example: 390 – 400 – 230 – 230 – 3 + 4 + 9 + L + A + B – S RVS-DN _ _ _ _ - _ _ _ - _ _ _ - _ _ _ - _ + _ + _ + _ + _ - _	
Serial Number:		
Purchasing Date:		
Sale / Installation Date:		
Failure Date:		
Program Version: STRT.DN- _ _ _ _ _ _	Press MODE + ∇, press SELECT twice, the LCD displays the program version (e.g. STRT.DN-011197)	

Connection Diagram & Supply Network Type. Circle the correct main supply and add or erase parts in the drawing:
Star, Delta, with/without neutral or ground



Application Description:



Details of Fault / Fault Message:	
Define time of fault occurrance: (during start, after start, during soft stop, end of soft stop, when closing B.P. contactor, when performing…)	

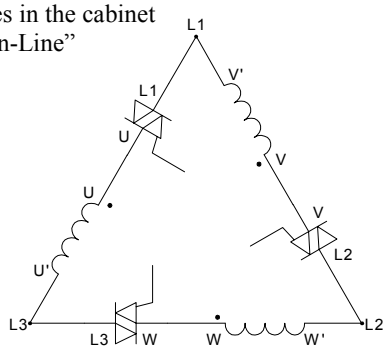
Statistical Information		Starter Operative Information	
Last Start Period:		Starter FLC:	
Last Start Max. I		Motor FLC:	
Total Run Time:		Initial Voltage:	
Total Number Of Starts:		Acceleration Time:	
Last Trip:		Current Limit:	
Trip Current:			
Total Number Of Trips:			
Trip History :			

“Inside Delta” mode - Description

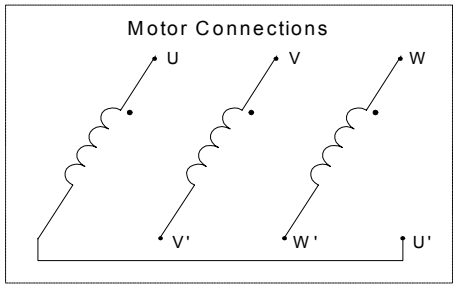
General information

- Mains current is reduced by 1.73 (√3), namely for an 800A motor, an 820A starter will be selected, to operate “In-Line”. For “Inside Delta” starter, we calculate (800 / 1.73 =) and select a 460A starter.
- Less heat dissipates in the cabinet vs. the standard “In-Line” connection.

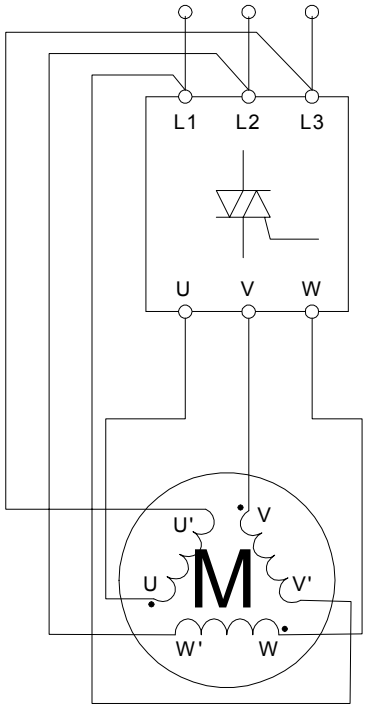
The attached drawings are for reference purposes only.



Standard Motor Connection Box



Standard Inside Delta Connection



Important Notes:

- **Wrong motor connection will cause serious damage to the motor windings.**
- The sinusoidal shape of the current is imperfect (since each phase is separately fired and not influenced by other phase firing). As a result, higher harmonic content is incurred (THD), which can be as high as twice the THD value as in the standard “In-Line”.
- Higher motor heating is expected for the same motor size (due to the higher THD).
- Phase sequence must be correct; otherwise, “Phase Sequence fault” will trip the starter immediately (without any damage).
- Higher torques can not be obtained
- “Inside Delta” requires 6-wire to the motor.
- Factory preset - features and functions when “Inside Delta” mode is configured:
  - No Pulse Start.
  - No curve selection (Curve 0 !!).
  - No Energy Save
  - No Slow Speed
  - No Phase sequence “Off” mode

Note :
For a high starting torque process, we recommend to use the starter in the “standard” connection (in-line).

WARNING
Beware
Wrong connection of the starter or the Motor, will seriously damage the motor.

Motor Ratings for In-Line and Inside Delta, at 400V

Starter Type In Line	Soft-Starter Current (A)	Motor KW @400V “In- Line”	Motor KW @ 400V “Inside Delta”
RVS-DN 8	8	4	6
RVS-DN 17	17	7.5	12
RVS-DN 31	31	15	25
RVS-DN 44	44	22	38
RVS-DN 58	58	30	50
RVS-DN 72	72	37	64
RVS-DN 85	85	45	75
RVS-DN 105	105	55	95
RVS-DN 145	145	75	120
RVS-DN 170	170	90	155
RVS-DN 210	210	110	190
RVS-DN 310	310	160	275
RVS-DN 390	390	220	380
RVS-DN 460	460	250	430
RVS-DN 580	580	315	540
RVS-DN 820	820	450	770
RVS-DN 1100	1100	600	1000
RVS-DN 1400	1400	750	1300

The starter must always be selected according to motor’s nominal current and starting conditions.
For “Inside Delta” connection, the “In Line” KW ratings were multiplied by 1.73.

Overload Trip Time Calculation

Note: In overload procedure, current is limited to 5 x Motor FLA to prevent saturation in calculation, so trip time at 5 or 8 times motor FLA will be identical.

The approximate trip time is given in the following equation:

$$\text{O/L Trip Time} = \frac{1{,}375{,}000}{I_{\%}^{2} - \text{OLT}^{2}} \times \frac{\text{OLD}}{6} \text{ (In Seconds)}$$

$$\text{Where : } I_{\%} = \text{Actual Current} \times \frac{100}{\text{Motor FLA}}$$

OLT = Overload Trip setting (default 115%)

OLD = Overload Delay setting – trip delay at 5 x Motor FLA, (default 4 sec).

Example 1: Motor FLA = 80A, actual current = 120A,
$I_{\%}$ = 120 x 100 / 80 = 150%
If settings are as in default then

$$\text{O/L Trip Time} = \frac{1{,}375{,}000}{150^{2} - 115^{2}} \times \frac{4}{6} = 99 \text{ sec.}$$

Example 2: Same motor and setting, but current is 400A,
$I_{\%}$ = 400 x 100 / 80 = 500%
If settings are as in default then

$$\text{O/L Trip Time} = \frac{1{,}375{,}000}{500^{2} - 115^{2}} \times \frac{4}{6} = 4 \text{ sec.}$$

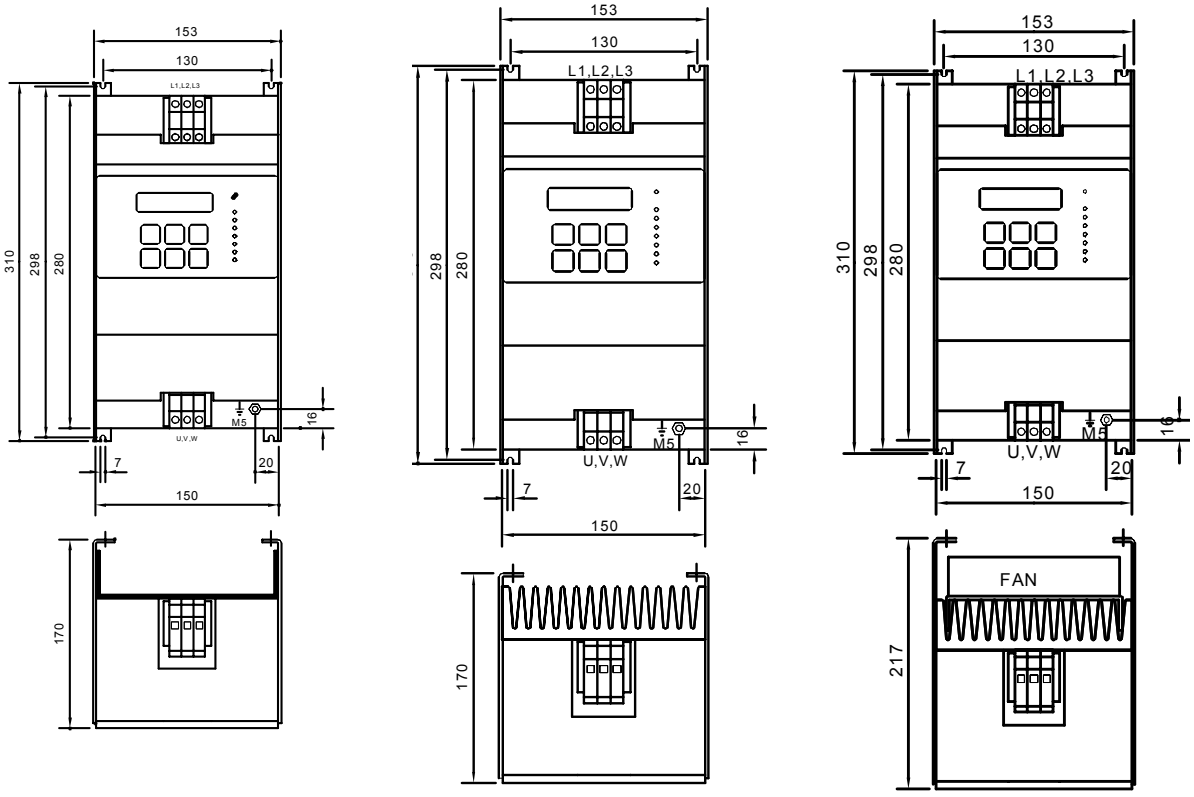
Example 3: Motor FLA = 80A, actual current = 200A, Overload Delay (OLD) = 10
$I_{\%}$ = 200 x 100 / 80 = 250%

$$\text{O/L Trip Time} = \frac{1{,}375{,}000}{250^{2} - 115^{2}} \times \frac{10}{6} = 47 \text{ sec.}$$

Dimensions (mm)

FRAME SIZE - A

8,17A **31A** **44, 58, 72A**



Note: Main voltage terminals size: 8A – 58A - 16mm^2
72A - 25mm^2

Dimensions (mm)

FRAME SIZE – B (Standard)

105, 145, 170A

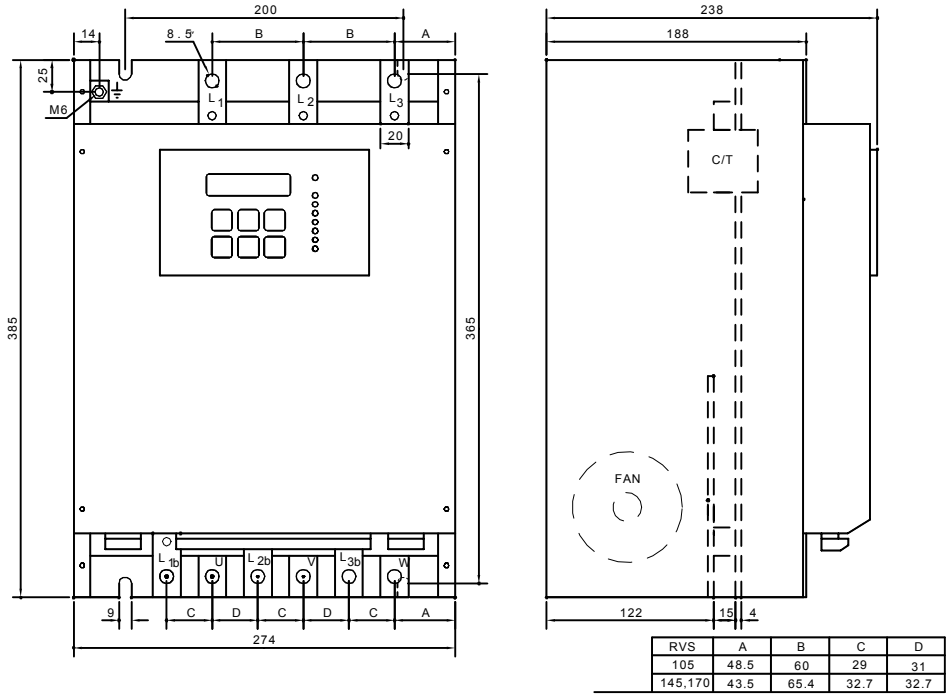
Drawing will be delivered upon request

With preparation for by-pass contactor

Drawing will be delivered upon request

FRAME SIZE – B (New – New type includes preparation for bypass as standard)

85, 105, 145, 170A (Deep Type)



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

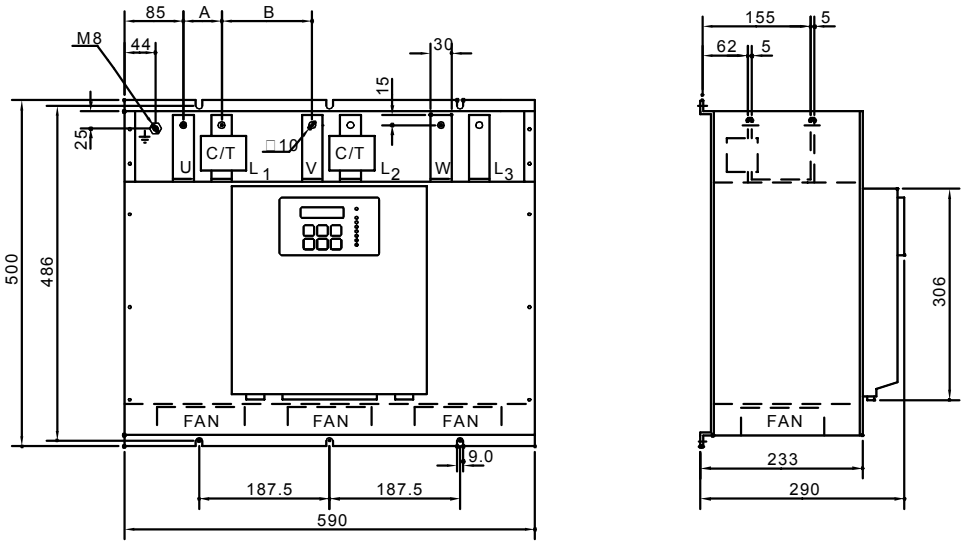
With preparation for by-pass contactor

Notes:
Frame size B (New type, shallow and deep) includes:
1. Preparation for by-pass as standard
2. Line bus bars at the top, Load and By-pass outputs at the bottom.

Dimensions (mm)

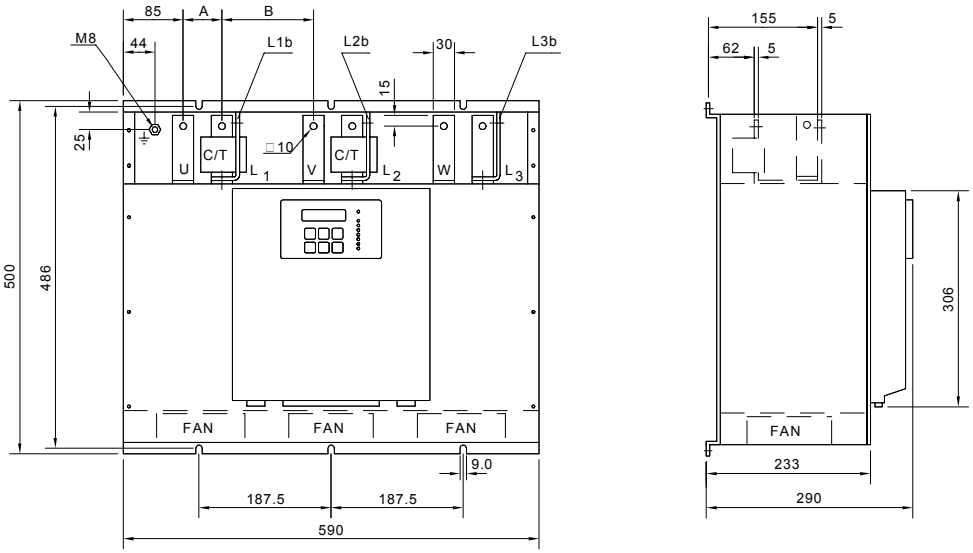
FRAME SIZE - C

210, 310, 390A



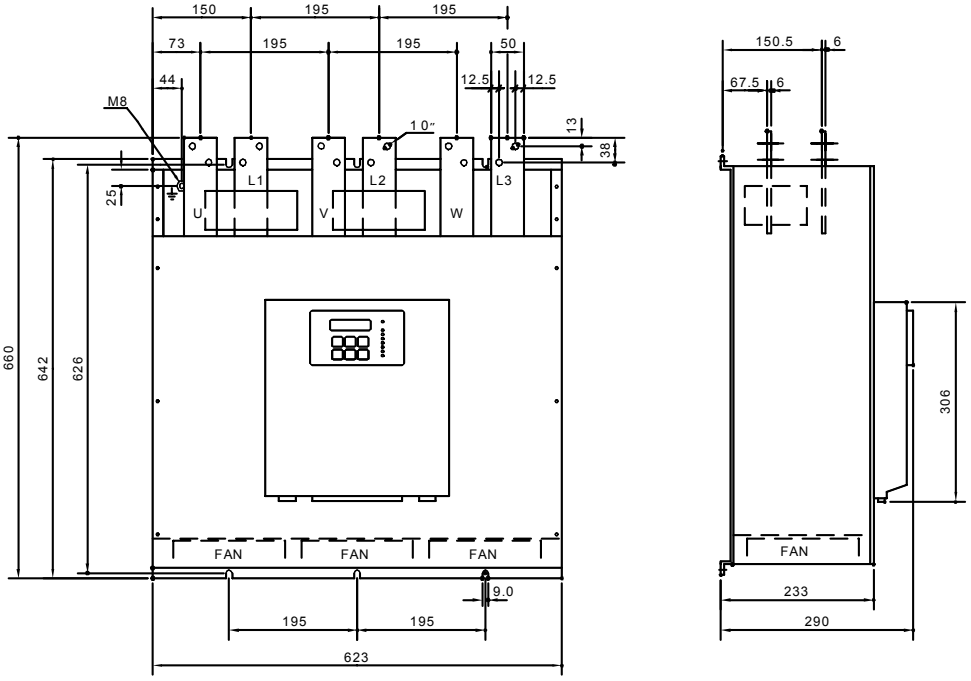
RVS-DN	210	310	390
A	45	45	55
B	140	135	130

- The starter can be supplied with line & load bus-bars at the bottom
- The starter can be supplied without side covers, with max width of 536 mm (instead 590)



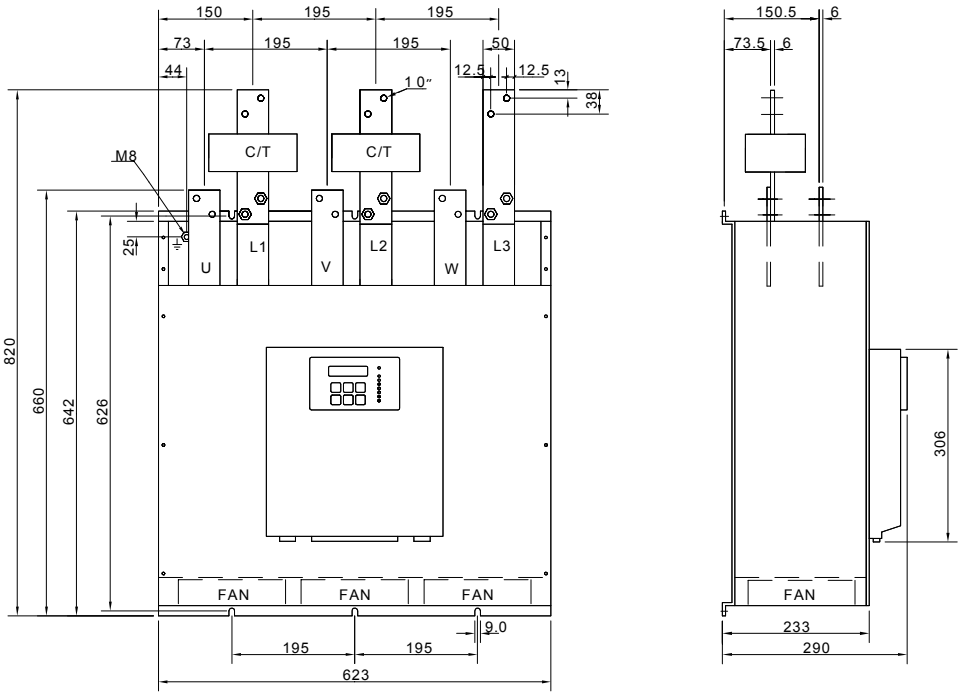
Dimensions (mm)

FRAME SIZE - D
460, 580, 820A



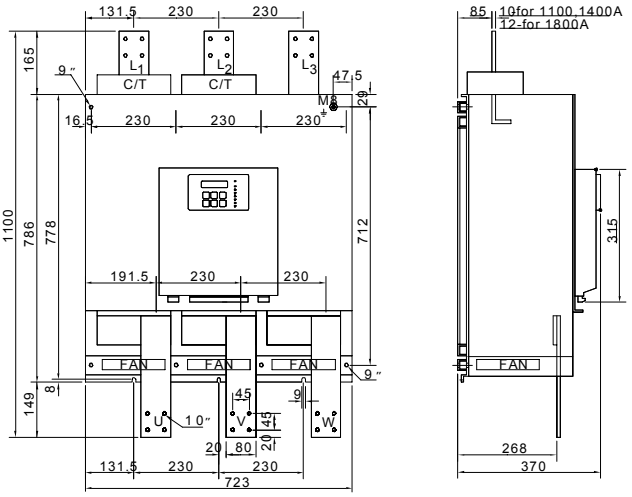
- The starter can be supplied with line & load bus-bars at the bottom

Preparation for by-pass contactor

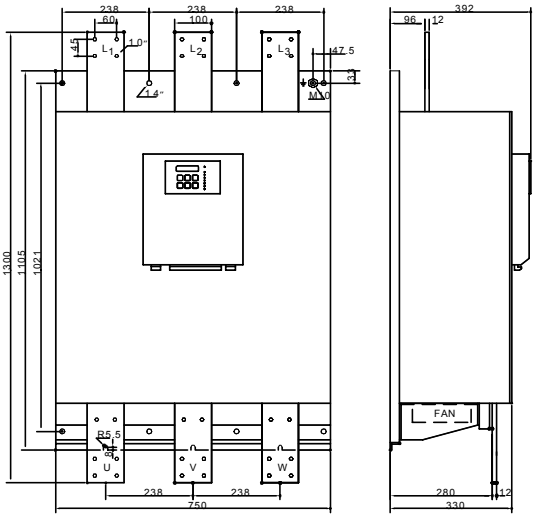


Dimensions (mm)

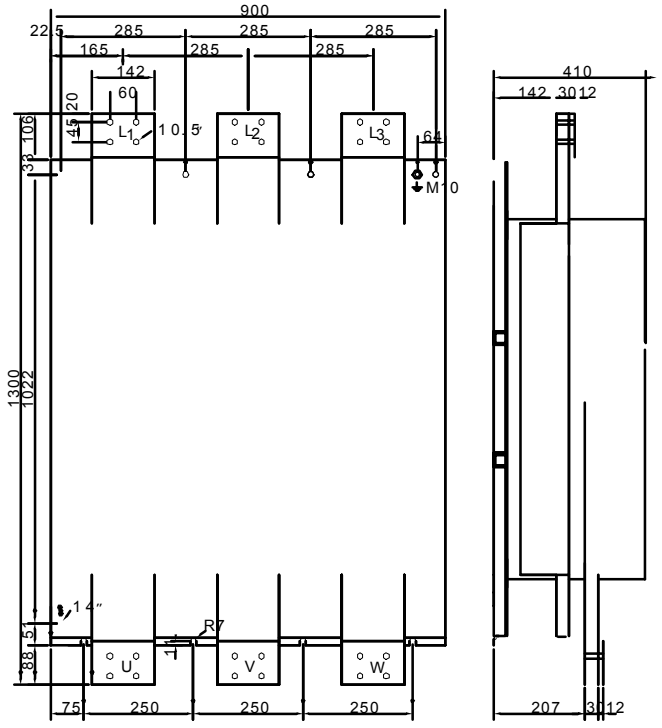
FRAME SIZE – E 1100, 1400, 1800A



FRAME SIZE – F 2150A



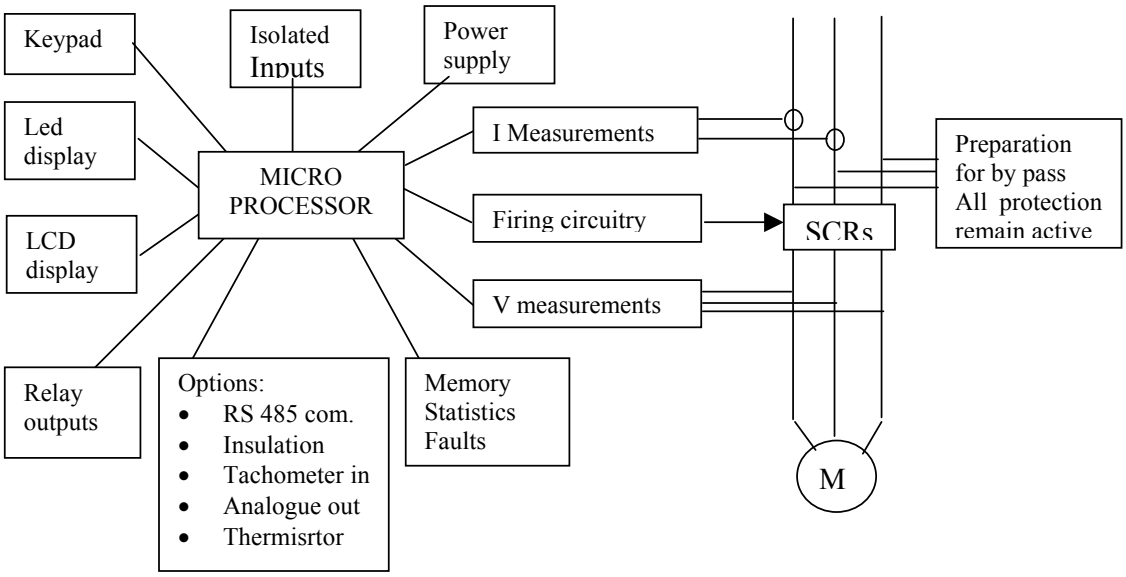
FRAME SIZE – G 2400A, 2700A, 3000A, 3500A



Starter Type	Current FLC (Amp)	Frame Size	Width	Height	Depth	Weight (Kg.)
RVS-DN	8, 17	A	150	310	170	4.5
	31	A	150	310	170	6
	44, 58, 72	A	150	310	217	7.4
	105, 145, 170	B	274	370	222	15.1
	210, 310, 390	C	590	500	290	44.8
	460, 580, 820	D	623	660	290	65
	1100, 1400, 1800	E	723	1100	361	170
	2150	F	750	1300	392	235
	2400, 2700, 3000, 3500	G	900	1300	360	350

RVS-DN Block Diagram

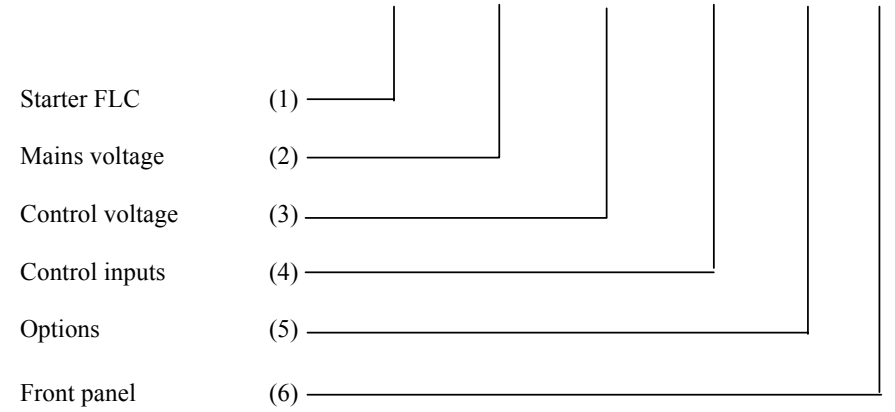
Block Diagram for the RVS-DN control, power and firing module, inputs and option boards.



Notes:

Ordering Information

Example: RVS-DN 210 - 400 - 230 - 230 - 9 - S
RVS-DN xxxx - xxx - xxx - xxx - x - x



(1) Starter FLC: 8, 17, 31, 44, 58, 72, 85, 105, 145, 170, 210, 310, 390, 460, 580, 820, 1100, 1400, 1800, 2150, 2700, 3000, 3500 Amp

(2) Mains voltage 50/60Hz	Specify	For
	230	220- 240 Vac + 10%-15%
	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	850-1100 Vac + 10%-15% (Special – Please Consult Factory)

(3) Control Supply Voltage (terminals 1-3) 50/60Hz	Specify	For
	115	110-120 Vac + 10%-15%
	230	220-240 Vac + 10%-15%
	DC	90-250 Vdc + 10%-15%

(4) Control Input Voltage (terminals 4-9) 50/60HZ or DC	Specify	For
	115	110-120 Vac + 10%-15%
	230	220-240 Vac + 10%-15%
	24	24- 48 Vdc

(5) Required Options For more than one option indicate, for example, 3+4 (Comm. + Insulation)	Specify	For
	0	No options
	3	Comm. RS-485 (MODBUS, PROFIBUS, MODBUS-TCP) (c)
	4	Insulation tester (b)
	5	Analogue card – Thermistor in + Analogue out .(b)
	8	Harsh environment treatment (must be factory supplied)
	9	Preparation for by-pass contactor
	A	536mm special width (for size C only)
	B	Line & Load Bus Bars at the bottom (sizes C & D)
	D	Remote Panel Mounting replacing the original (with 1.5m cable).
	DK	Remote Panel Mounting kit with MMI, option #L and 1.5m cable.
	L	Illuminated LCD
	M	Lloyd's ENV-1, ENV-2 approval, GL as well (consult factory)
	T	Tachometer for special drive systems (consult factory) (b)
	U	UL & cUL Approval (8-820A)

(6) Front Panel	Specify	For
	S	Standard

Notes: (a) RVS-DN ratings 1100-3500 have to be used with a by-pass.
(b) RVS-DN size A (8-72A), options should be factory supplied.
(b) Only one option, either #4, # 5 or # T may be installed in one starter.
(c) Consult factory for any communication protocol other than MODBUS.