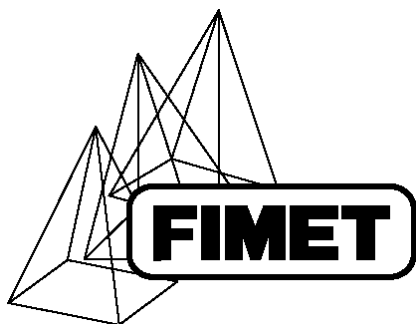




USER GUIDE

RVS-DX 8...580A

Digital Soft Starter

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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 starter.
- During shipping, the soft-starter might have been roughly handled, therefore, it is recommended to initialize the soft-starter by connecting supply voltage prior to operating the soft-starter with a motor.

Attention

- This product was designed for compliance with IEC 947-4-2 for class A equipment.
- RVS-DX 8 - 170 are UL approved. RVS-DX 210 - 820 are designed to meet UL 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, Form 1. For further information, see Technical Specification

Warnings



- Internal components and P.C.B's are at mains potential when the RVS-DX is connected to mains. This voltage is extremely dangerous and will cause death or severe injury if contacted.
- When RVS-DX is connected to mains, even if control voltage is disconnected and motor is stopped, full voltage may appear on starter's output and motor's terminals.
- The starter 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.
- Do not interchange line and load connections

The company reserves the right to make any improvements or modifications to its products without prior notice.

Starter Selection

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

The RVS-DX is equipped with internal by-pass relays controlled by its micro-controller. The relays close after the end of the starting process, thus reducing heating and saving power.

The future option RS 485 Communication with MODBUS protocol will enable full control (Start, Stop, commands etc.) and supervision. Up to 32 starters can be connected on a shield twisted pair to a host computer.

Ratings and Frame sizes

Max Motor FLA (Amp)	Starter Type FLC	Frame Size	Bypass
8	RVS-DX 8	D1	Yes
17	RVS-DX 17		Yes
31	RVS-DX 31		Yes
44	RVS-DX 44		Yes
58	RVS-DX 58	D2	Yes
72	RVS-DX 72		Yes
85	RVS-DX 85	D3	Yes
105	RVS-DX 105		Yes
145	RVS-DX 145	D4	Yes
170	RVS-DX 170		Yes
210	RVS-DX 210	D5	Yes
310	RVS-DX 310		Yes
390	RVS-DX 390	D6	Yes
460	RVS-DX 460	D7	Yes
580	RVS-DX 580	D8	Yes
820	RVS-DX 820	D9	Yes

8A-310A models are equipped with Internal by-pass relays.
390A-820A models are equipped with Internal by-pass contactors.

Dimensions (mm) and Weights

Size	Width	Height	Depth	Kg
D1	120	232	122	3.0
D2	129	275	182	5.2
D3	129	380	182	8.5
D4	172	380	192	12.5
D5	380	455	300	42
D6	350	545	308	
D7	436	632	318	
D8	436	632	318	
D9	560	650	318	

For accurate dimensions, see page 34

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 will not be fully loaded).

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

Ambient Temp.	I start	Acc. Time
40° C	300% In	30 Sec
	350% In	20 Sec
	400% In	5 Sec

Max. Starts per Hour: four (4) starts per hour at maximum ratings and up to 10 starts per hour at light load applications (consult factory).

Note: For very frequent starts (inching applications) the inching current should be considered as the Full Load Current (FLC) – consult factory.

Mains Voltage (line to line)

Thyristors PIV rating, internal circuitry and insulation defines two voltage levels:

- 220-600V

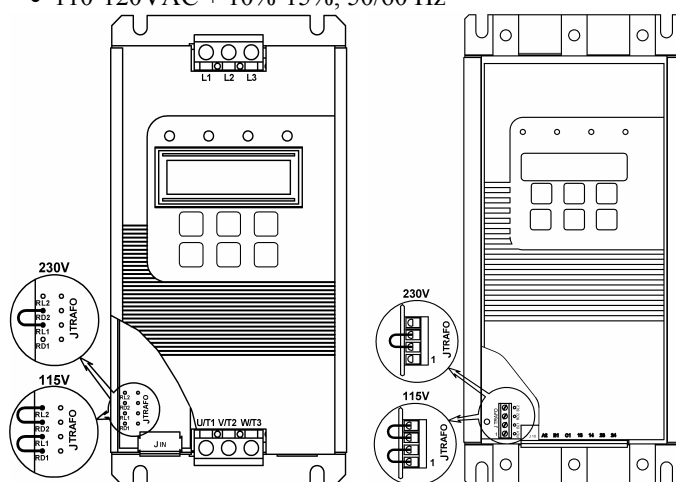
Each starter is suitable for one of the above levels & for 50/60 Hz.

Control Voltage

The Control Voltage (terminals A1 – A2) operates the electronic circuitry and bypass relays.

Two voltage levels are available, selectable by internal jumper, either from a terminal block (58-820A) or via soldering (8-44A):

- 220-240VAC + 10%-15%, 50/60 Hz (standard)
- 110-120VAC + 10%-15%, 50/60 Hz



Options (see Ordering Information Data)

- Option # 8 - Varnish coating of PCBs, for harsh environments (Sewage treatment plants, etc.)
- Option # L - Back-lit LCD
- Option # 3 – Modbus Comm. (Not Available)
- Option # 4 – Insulation (Not Available)
- Option # 5 – Ana. out & Therm. In. (not Available)
- Option # R – D.O.L & Fun control (for 390A and up)

Other options are available when using “Maximized Mode”.

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 Mains and Control voltages are as indicated on the starter’s side label.

Mounting

- The starter must be mounted vertically, allow sufficient space (at least 100mm) 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.
- Surrounding air temp. in the cabinet should not exceed 40°C
- Protect the starter from dust and corrosive atmospheres.

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

Temp. Range and Heat Dissipation

The starter is rated to operate over a temperature range of -10°C (14°F) to + 40°C (104°F). Relative non-condensed humidity inside the enclosure should not exceed 95%.

ATTENTION

Operating at surrounding air temp. (inside the cabinet) higher than 40°C may cause damage to the starter.

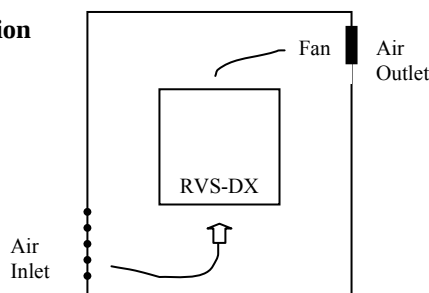
Starter’s heat dissipation while motor is running and the internal bypass relays are closed is typically less than $0.4 \times I_n$ (in watts). During soft start and soft stop, heating is approximately three times the actual starting current.

Example: For a 100A motor, heat dissipation is less than 40 watts while running and during starting (for example at 350A), power dissipation is approximately 1100 watts.

Important note: If motor is frequently started, cabinet should be designed for the higher heat dissipation.

Internal enclosure heating can be reduced through the use of additional ventilation.

Additional Ventilation



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

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

Where Area (m²) - Surface area that can dissipate heat (front, sides, top).

* Total heat dissipation of the starter and other control devices in the enclosure. If starter is frequently started, average power should be used.

Short Circuit Protection

Protect the starter against a short circuit by Thyristor Protection Fuses (consult factory for I²t and fuses).

Transient Protection

Line transient voltages can cause a malfunction of the starter and damage to the thyristors. All RVS-DX starters incorporate Metal Oxide Varistors (MOV) to protect from normal line voltage spikes.

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 Shorted SCR or Wrong Connection protection will be activated.

WARNING

1. When mains voltage is connected to the RVS-DX, 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 starters load side. When required, install capacitors on starter’s line side.
3. Do not interchange line and load connections

Control Supply

Terminals A1-A2

220-240V or 110-120V, 50/60Hz are required to power the electronic circuitry and bypass relays. Factory set value is indicated on the starter's side label.

This voltage can be from a grounded or ungrounded mains system.

Voltage level 110V /220V can be changed in the field.

Note: It is recommended that terminals A1-A2 be always connected to the Control Supply.

Start / Stop (or momentary start) Input Terminal B1

Input from a maintained contact. Close contact between A2 and B1 to soft start the motor.

To stop the motor (immediate stop) open the contact for at least 250mSec.

If Aux Input is set as Start / Stop then terminal B1 is used as momentary N.O. Start input and terminal C1 is used as maintained N.C Stop input.

When Soft Stop is required set Deceleration Time On the LCD as required (see chapter 3).

Aux. Input Remote Reset

Terminal C1

Input from a maintained contact, connected between terminals A2 and C1 to operate Dual Adjustment feature. Or, open Maximized parameters and program the input contact as one of six possibilities:

Dual Adjust

Generator Function

Slow Speed / Reverse

External fault

Remote reset after fault has been removed.

Start / Stop (terminal C1 is used as maintained N.C

Stop input and terminal B1 as momentary N.O. Start input).

Auxiliary Output Relay

Terminals 13-14

Voltage free, N.O , 8A, 250VAC, 1800VA max.

The contact incorporates 0-60 sec. On & Off delays.

The contact changes its position upon Start signal and 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 off position at the end of the Soft Stop process.

- To release the brake of a brake motor.
- For interlocking with other systems.
- For signaling.

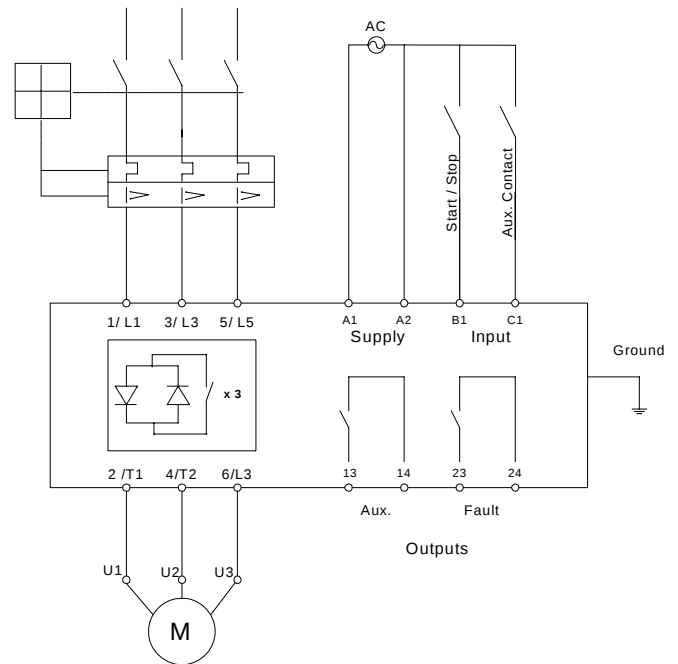
Fault Contact

Terminals 23-24

Voltage free, N.O , 8A, 250VAC, 1800VA max.

The contact closes upon fault and returns to its original position after fault has been removed and starter was reset, or upon disconnection of Control Supply.

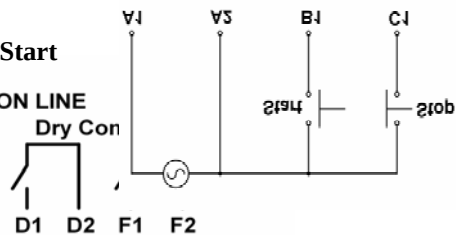
Input #4 (Terminal C1) Control Wiring



Direct On Line Start

DIRECT ON LINE

Dry Con
D.O.L



* Optional in RVS-DX 390 and above.

ATTENTION

When using D.O.L option, motor and Soft Starter protections will not be active.

Front Panel

Keypads	Provide selection of the following modes: • % of Motor FLA • Main Parameters • Start Parameters • Stop Parameters • Statistical Data
Mode	
Select	To select function within each mode.
	To increase adjusted parameters. Press momentarily or continuously. In Statistical data page, functions like "Select Forward"
	To decrease adjusted parameters. Press momentarily or continuously. In Statistical data page functions like "Select Reverse"
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.

LED Arrangement

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

Ramp - Lights during soft start and soft stop process, indicating that motor supply voltage is ramping up or down.

Run - Lights after completion of starting process, indicating that motor is receiving full voltage.

Fault - Lights upon operation of any of the built-in protection.



LCD Arrangement

Two lines of 16 alphanumeric characters, with four selectable languages – English, French, German and Spanish (see Language setting).

CURRENT LIMIT
390%

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

Reviewing and modifying parameters

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

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

LCD (Displays)

Mode pages

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

% OF MOTOR FLA

By pressing **Mode** key all Mode pages can be reviewed.

MAIN PARAMETERS

START PARAMETERS

STOP PARAMETERS

STATISTICAL DATA

Selecting Display Language

LCD language is programmable through the keypad. Available languages are:

- English
- German
- French
- Spanish

See language programming on page 8, parameter 1.1

General note: While during programming one or more parameters are not known, leave setting at default parameter.

Display Mode – Page 0

In this mode, parameters cannot be adjusted

**% OF MOTOR
FLA**

Displays operating current as a percentage of motor FLA (Full Load Ampere).

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

When option cards are not incorporated, the LCD displays

OPTION CARD
Not installed

This concludes the DISPLAY Mode.

Pressing **Select** key at this point returns to the first display.

Obtaining “Default Parameters”

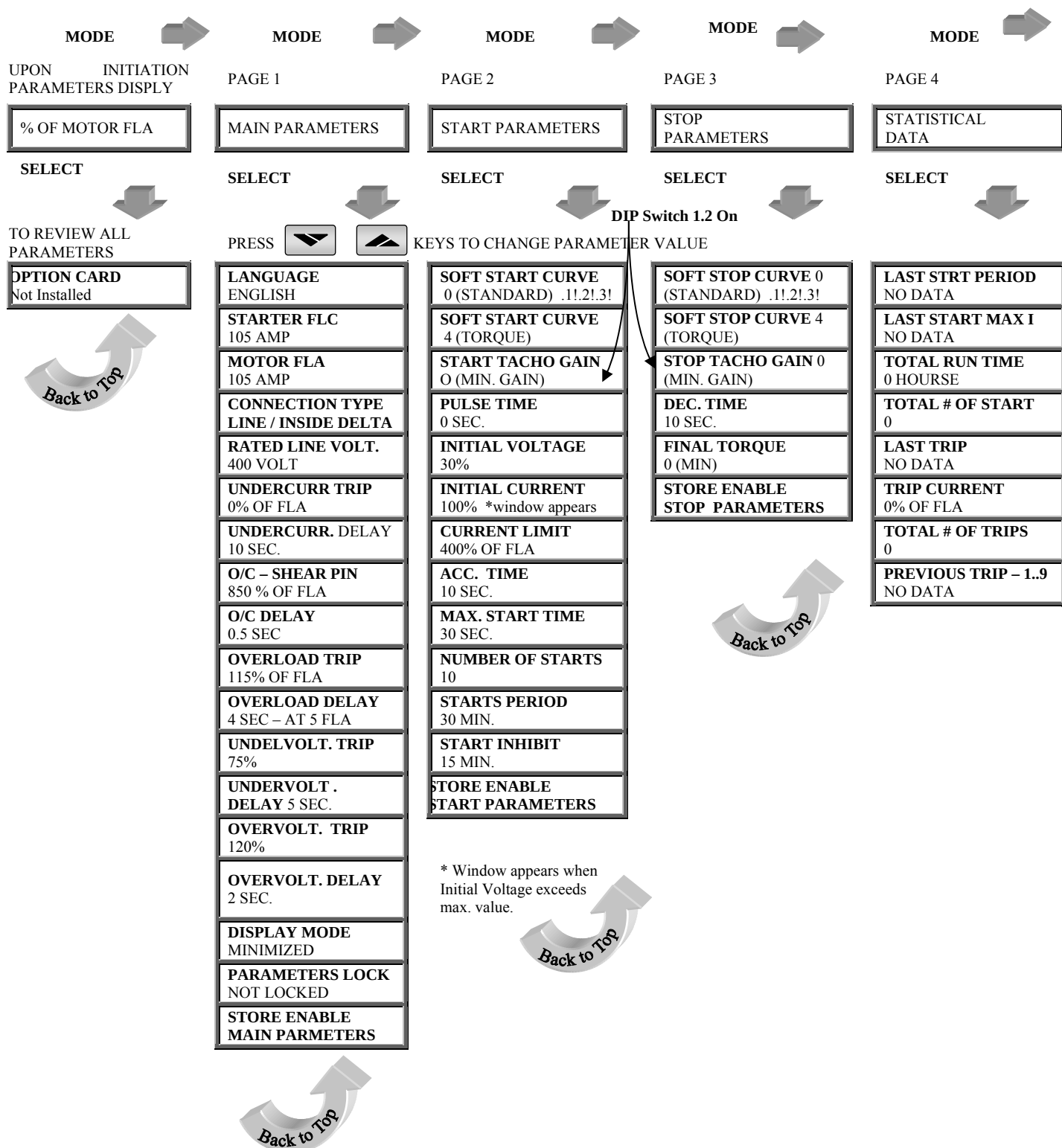
Press **Mode** and  keys simultaneously, the LCD will display “Store Enable Default Parameters”.

Press **Store** + **Mode** keys simultaneously.

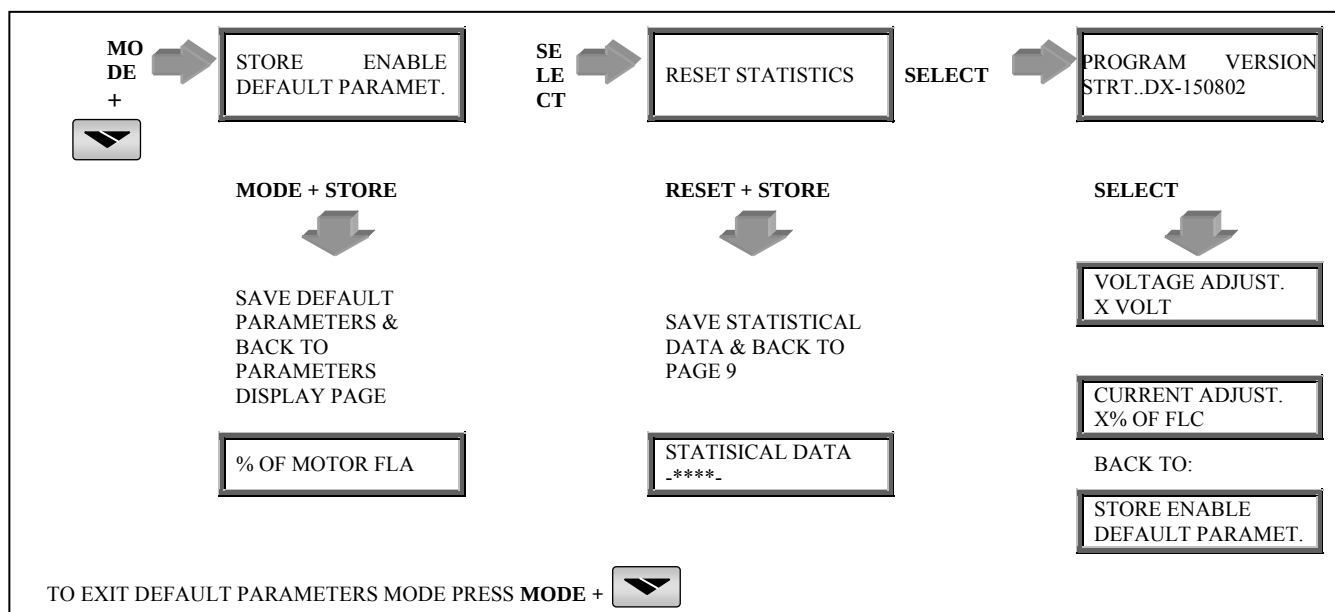
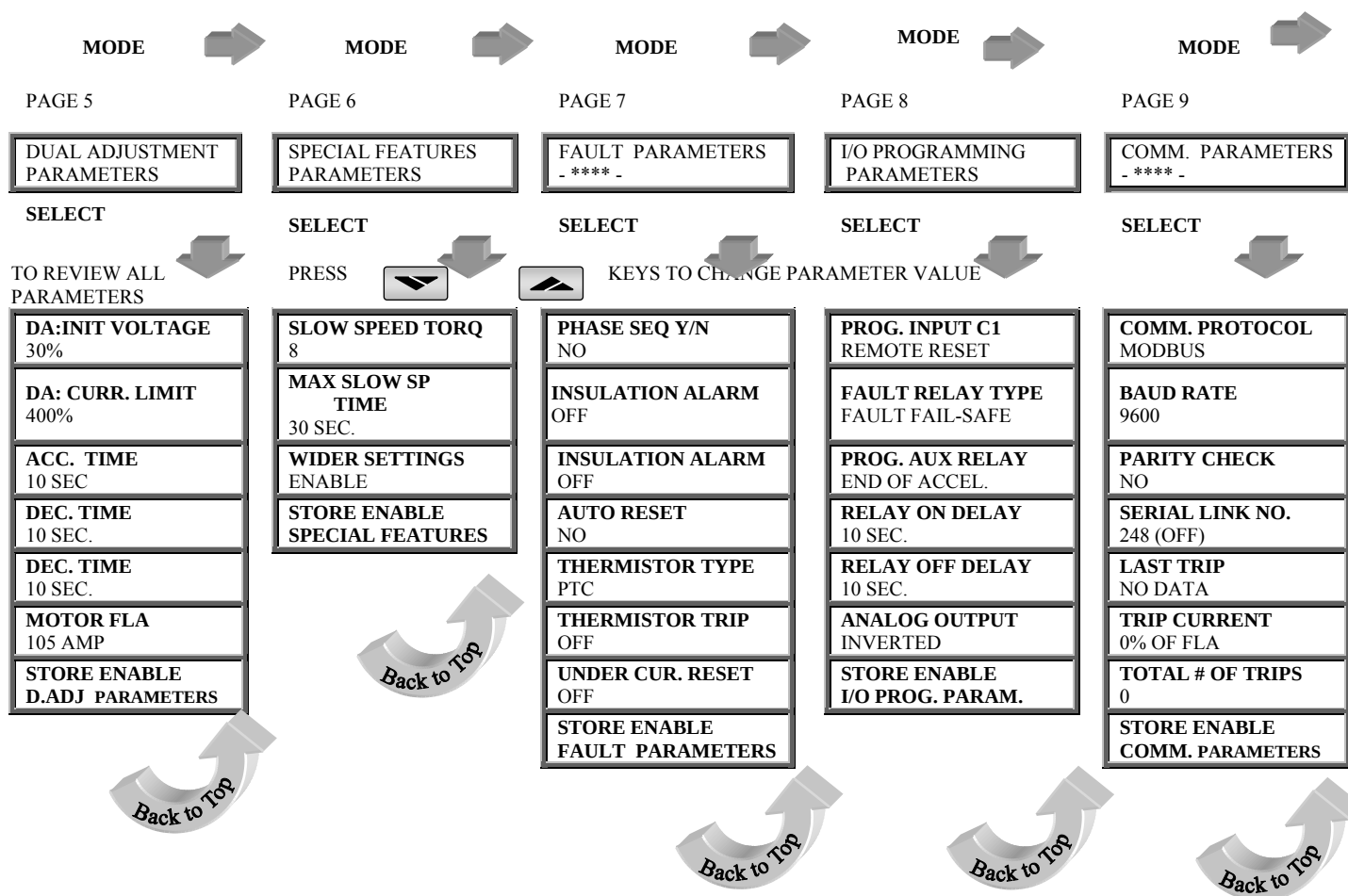
CAUTION

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

Menu Description (Minimized Mode)



Menu Description (Maximized Mode)



Parameter Setting–Main Parameters (1)

1. Press Mode

To advance to:

MAIN PARAMETERS

1.1 Press Select

Press Up / Down keys to set Starter's Language.
Range: English, French, German, Spanish.

LANGUAGE
ENGLISH

1.2 Press Select

Press Up / Down keys to set Starter's FLC (Full Load Current) – as shown on starters name plate.
Range: 8 - 820A.

STARTER FLC
105 AMP

1.3 Press Select

Press Up / Down keys to set motor's FLA (Full Load Ampere) – as shown on motors name plate.
Range: 50-100% of "STARTER FLC"

MOTOR FLA
105 AMP

1.4 Press Select

Press Up / Down keys to set Starter's connection type.
(see Appendix for: Inside Delta description).

CONNECTION TYPE
LINE / INSIDE DELTA

1.5 Press Select

Press Up / Down keys to set Rated Line Voltage
Range: 220V – 600V.

RATED LINE VOLT.
400 VOLT

1.6 Press Select

Press Up / Down keys to set Under Current Trip.
Range: 0=Off, 20-90% of FLA.

UNDERCURREN. TRIP
0% OF FLA

Trips the starter when motor current drops below set level for a time longer than Under Current Delay.

1.7 Press Select

Press Up / Down keys to set under Current Trip Delay.
Range: 1-40 sec.

UNDERCURREN. DELAY
10 SEC.

1.8 Press Select

Press Up / Down keys to set Over Current Shear-pin.
Range: 100 - 850% of motor FLA setting

O/C – SHEAR PIN
850% OF FLA

O/C-SHEAR PIN protection 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.

Important 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).

1.9 Press Select

Press Up / Down keys to set O/C Shear-pin Delay.
Range: 0.5-5 sec.

O/C DELAY
1.5 SEC.

1.10 Press Select

Press Up / Down keys to set Overload Trip Current.
Range: 75-150% of FLA.

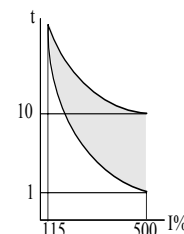
OVERLOAD TRIP
115% OF FLA

Overload (O/L) Trip

Inverse time electronic overload becomes operational when RUN LED is lit.

The O/L circuitry incorporates a Thermal Memory Register that calculates heating minus dissipation of the motor. The starter trips when the register fills up.

The thermal register resets itself 15 minutes after motor stops.



ATTENTION

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

1.11 Press Select

Press Up / Down keys to set Overload Delay at 500% of motor FLA
Range: 1-10 sec.

OVERLOAD DELAY
4 SEC – AT 5 FLA

Parameter Setting – Main Parameters

1.12 Press Select

Press Up / Down keys to set Under Voltage Trip.
Becomes operational only after **Start** signal.

UNDERVOLT. TRIP
75%

Trips the starter when mains voltage drops below the set level for a time longer than Under Voltage Delay.
Range: 50 – 90% of Rated Line Volt

1.13 Press Select

Press Up / Down keys to set Under Voltage Trip Delay
Range: 1-10 sec.

UNDERVOLT. DELAY
5 SEC.

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

1.14 Press Select

Press Up / Down keys to set Over Voltage Trip.
Range: 110-125% (can not be set below Under Voltage).

OVERVOLT. TRIP
120%

Trips the starter when mains voltage increases above the set level for a time longer than Over Voltage Delay

1.15 Press Select

Press Up / Down keys to set Under Voltage Trip Delay
Range: 1-10 sec.

OVERVOLT. DELAY
5 SEC.

1.16 Press Select

Press Up / Down keys to set Display Mode.
Range: Minimized, Maximized.

DISPLAY MODE
MINIMIZED

For operation convenience, there are two display modes:

MINIMIZED – Display of pre-selected parameters for standard applications.

MAXIMIZED – Display of all possible parameters.

Setting Display Mode to Minimized will minimize the LCD displays.

Minimized mode

Display Only
Main Parameters
Start Parameters
Stop Parameters
Statistical Data

Maximized mode

Display Only
Main Parameters
Start Parameters
Stop Parameters
Dual Adjustment
Special Features Parameters
Fault Parameters
I/O Programming
Communication Parameters
Statistical Data

1.17 Press Select

Press Up / Down keys to set Parameters Lock
Range: Not Locked, Locked.

PARAMETERS LOCK
NOT LOCKED

The software lock prevents undesired parameter modification.

When **locked**, upon pressing Store,  or  keys, the LCD displays

UNAUTHORIZED ACCESS

1.18 Press Select

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

STORE ENABLE
MAIN PARAMETERS

Note: Storing selected parameters is possible only when RAMP LED does not lit.
Storing cannot be done when Soft Starting or Soft Stopping.

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 presses **Store** key until “Data Saved OK” appears.

Parameter Setting – Main Parameters, non-adjustable protection & Fault Resetting

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 45 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). Trips the starter when phase sequence is wrong.

Shorted SCR or Wrong Connections

Becomes operational after start signal. Trips if motor is not properly connected to starter's Load terminals, when Internal disconnection in the motor winding is detected, or when 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 85°C.

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 frequent starting at max. conditions, or repeated starting under fault conditions can cause SCR's overheating and failure before the heatsink reaches 85°C to trip the thermal sensors.

External Fault

Becomes operational when starter is energized, trips the starter when Aux. Input Contact (programmed as an External Fault) closes for more than 2 sec.

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 Aux. Input (see I/O Programming).

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

Note: Resetting (Local, Remote, Serial Link or Auto Reset) 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.

Parameter Setting – Start Parameters (2)

2. Press Mode

To Advance to:

START PARAMETERS

2.1 Press Select

Then press Up / Down keys to set Soft Start Curve

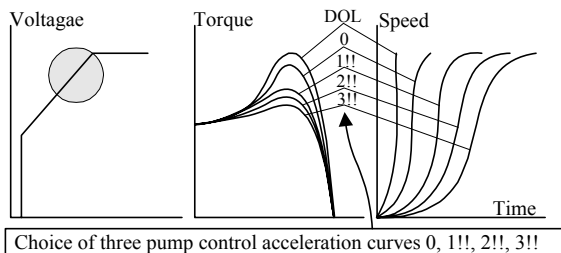
SOFT START CURVE 0 (STANDARD)

The RVS-DX incorporates 4 “Starting Curves”, enabling selection the suitable torque curve:

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

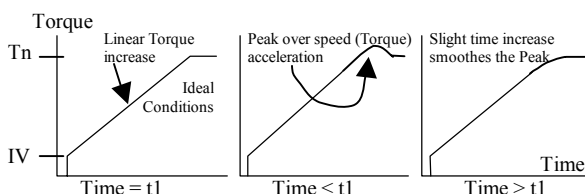
Start curves 1-3 “Pump Control” - Induction motors produce peak torque of up to 3 times the rated torque towards the end of starting process. In some pump applications, this peak may cause high pressure in the pipes.

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



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

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.

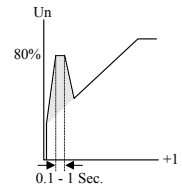
2.2 Press Select

Press Up / Down keys to set Pulse Start Time.
Range: 0-1 sec. (Pulse level at 80% U_n)

PULSE TIME 0 SEC.

Intended to start high friction loads, requiring high starting torque for a short time.

A pulse of 80% U_n , without Current Limit, is initiated to break the load free. Pulse duration is adjustable, 0.1 – 1sec. After this pulse, the voltage is ramped down to Initial Voltage setting, before ramping up again to full voltage according to Start Parameters settings.



2.3 Press Select

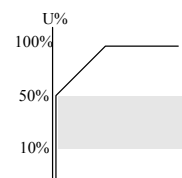
Press Up / Down keys to set Initial Voltage.
Range: 10-50% of U_n .

INITIAL VOLTAGE 30%

Determines motor's initial starting torque (the torque is directly proportional to the square of the voltage).
Range: 10-50% U_n .

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.



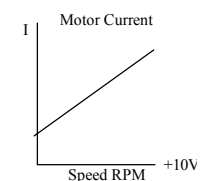
Note: When Initial Voltage is set above 50% (it's maximum value), display changes to INITIAL CURRENT.

Range: 100-400% of Motor FLA (Full Load Amp. – see 1.3, page 9).

INITIAL CURRENT 100%

Current Ramp (Initial Current)

Determines initial and Final 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%



Parameter Setting – Start Parameters (2)

2.4 Press Select

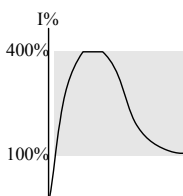
Press Up / Down keys to set Current Limit
Range: 100-400% of motor FLA.

CURRENT LIMIT
400% OF FLA

Determines motor's highest current during starting.
A too high setting will cause greater current drawn from mains 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.



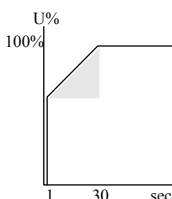
2.5 Press Select

Press Up / Down keys to set Acceleration Time
Range: 1-30 sec.

ACC. TIME
10 SEC.

Acceleration Time

Determines motor's voltage ramp-up time, from initial to full voltage.
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.

2.6 Press Select

Press Up / Down keys to set Maximum Start Time
Range: 1-30 sec.

MAX. START TIME
30 SEC.

The maximum allowable start time, from Start signal to end of acceleration process. If voltage does not reach full voltage / speed during this time (e.g. because of too low Current Limit setting), the starter will trip the motor.

LCD displays "LONG START Time" message.

2.7 Press Select

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

NUMBER OF STARTS
10

Limiting the number of operations during an adjustable period of time. Combines three parameters:

2.8 Press Select

Press Up / Down to set Starts Period during which Number of Starts is being counted.
Range: 1-60 min.

STARTS PERIOD
10 Min.

2.9 Press Select

Press Up / Down to set Starts Period during which Number of Starts is being counted.
Range: 1-60 min.

START INHIBIT
10 Min.

Note: Motor cannot 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."

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.

Parameter Setting – Stop Parameters (3)

3. Press Mode

To advance to

STOP PARAMETERS

Note: When Soft Stop is used, the internal bypass opens, thereafter voltage begins ramping down.

3.1 Press Select

Then press Up / Down keys to set Soft Stop Curve

Range: 0-4

SOFT STOP CURVE 0 (STANDARD)

The RVS-DX incorporates 4 “Starting Curves”, enabling selection the suitable torque curve:

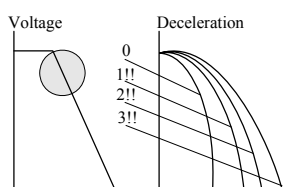
Stop Curve 0 – Standard curve (Default) – voltage is linearly reduced from nominal to zero. The most stable and suitable curve for the motor, preventing prolonged stopping and motor overheating.

Stop curves 1, 2, 3 Pump Control – 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 deceleration process, when voltage is decreasing, motor torque quickly falls below load torque abruptly (instead of smoothly decreasing speed to zero) closing the valve and causing Water Hammer.

Curves 1, 2 and 3 are intended to prevent Water Hammer phenomenon. In pump applications, load torque decreases in square relation to the speed, thus correct control of voltage reduction reduces torque adequately to smoothly decelerate to a stop.

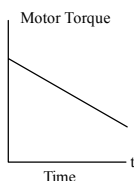
Note: It is recommended that for all standard applications (not pumps), Stop Curve 0 will be used. To reduce Water Hammer select Stop Curve 1, than 2 or 3 if necessary.



Curve 4 - Torque Curve

Provides linear deceleration of the torque. In certain loads, linear torque deceleration can result in close to linear speed deceleration.

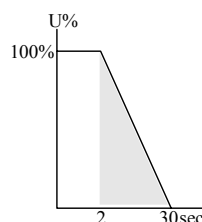
The RVS-DX Torque Control does not require any external torque or speed sensor (tacho-gen. etc.).



3.2 Press Select

Then press Up / Down keys to set Deceleration Time.
Range: 1-30 sec.

DEC. TIME 10 SEC.



Used for controlled deceleration of high friction loads. Determines motor's voltage ramp down time.
Range: 1-30 sec.

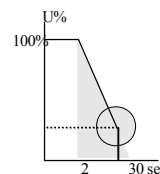
3.3 Press Select

Then press Up / Down keys to set Final Torque during Soft Stop.

Range: 0 – 10 (0 = min., 10 = max.)

FINAL TORQUE 0 (MIN)

Determines torque towards end of Soft Stop.
If current is still flowing after speed is softly reduced to zero, increase Final Torque setting.
Range: 1-10 (Min.-Max.)



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.

Statistical Data & Service Mode

4. Press Mode

To Advance to

STATISTICAL DATA
- **** -

4.1 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)

4.2 Press Select

LAST START MAX I
NO DATA

Displays the maximum current at last start.

4.3 Press Select

TOTAL RUN TIME
0 HOURS

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

4.4 Press Select

TOTAL # OF START
0

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

4.5 Press Select

LAST TRIP
NO DATA

Describes last fault.

4.6 Press Select

TRIP CURRENT
0% OF FLA

Displays the current at the last fault.

4.7 Press Select

TOTAL # OF TRIPS
0

Displays the total numbers of trips since start-up or since "statistical Data" was last reset.

4.8 Press Select

PREVIOUS TRIP - 1
NO DATA

Describes fault occurred before last fault.

4.9 Press Select

PREVIOUS TRIP - 9
NO DATA

5. Service Mode

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

STORE ENABLE
DEFAULT PARAMET.

Press **Mode** and **Store** 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 (without storing default parameters)

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.DX-150802

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.
XXX% OF RVS FLC

Press Select

Display goes back to Store Enable Default Parameters

STORE ENABLE
DEFAULT PARAMET.

To exit "Service Mode" press **Mode** + ltaneously.

Notes:

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

Press Mode

This page is seen only if Display Mode is set to Maximized.

**DUAL ADJUSTMENT
PARAMETERS**

When selecting “Generator Start/Stop” (Prog. Input C1 = Gen. Start/Stop) the following display appears instead of the above.

**D. ADJ: GENERATOR
PARAMETERS**

Press Select

Then press Up / Down keys to set DA: Initial Voltage.
Range: 10-50% of Un.

DA: INIT. VOLT.
30%

Press Select

Then press Up / Down keys to set DA: Current Limit.
Range: 100-400% of motor’s FLA.

DA: CUR. LIMIT
400% OF FLA

Press Select

Then press Up / Down keys to set DA: Acceleration
Time. Range: 1-30 sec.

DA: ACC. TIME
10 SEC.

Press Select

Then press Up / Down keys to set DA: Deceleration
Time. Range: 1-30 sec.

DA: DEC. TIME
10 SEC.

Press Select

Then press Up / Down 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.**

Parameter Setting, Special & Fault Param.

Press Mode

This page is seen only if Display Mode is set to Maximized.

**SPECIAL FEATURES
PARAMETERS**

Press Select

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

SLOW SPEED TORQ.
8

Press Select

Then press Up / Down keys to set Maximum Slow Speed Time.
Range: 1-30 sec.

MAX SLOW SP TIME
30 SEC.

Press Select

Then press Up / Down keys to Enable or Disable Wider Settings.
Range: Enable, Disable.

WIDER SETTINGS
DISABLE

Do Not set to Enable unless starter is significantly larger than motor.

Press Select

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

**STORE ENABLE
SPECIAL FEATURES**

When parameters have been correctly stored, the LCD displays:

DATA SAVED OK

This concludes SPECIAL FEATURES PARAMETERS setting.

Press Mode

This page is seen only if Display Mode is set to Maximized.

FAULT PARAMETERS

Press Select

Then press Up / Down keys to set Phase Sequence trip.
Range: Yes / No

PHASE SEQ. Y/N
NO

Press Select

Then press Up / Down keys to set Insulation Alarm.
Range: Off, 0.2 – 5 MΩ

INSULATION ALARM
OFF

Press Select

Then press Up / Down keys to set Insulation Trip.
Range: Off, 0.2 – 5 MΩ

INSULATION TRIP
OFF

Press Select

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

AUTO RESET
NO

Press Select

Then press Up / Down keys to set Thermistor Type.
Range: PTC, NTC.

THERMISTOR TYPE
PTC

Press Select

Then press Up / Down keys to set Thermistor Trip Level. Range: Off, 0.1 – 10 KΩ, step: 0.1Kohn.

THERMISTOR TRIP
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.

Parameter Setting – I / O Parameters

Press Mode

This page is seen only if Display Mode is set to Maximized.

I/O PROGRAMMING PARAMETERS

Press Select

Then press Up / Down keys to set input #4 function (Terminal C1). Range: Dual Adjust, Gen. Start/Stop, Slow Speed/ Reverse, External Fault, Remote Reset, Start/Stop.

PROG. INPUT #4 DUAL ADJUST

Press Select

Then press Up / Down keys to set Fault Relay function
Range: Fault, Fault - Fail Safe (Fail-Safe Logic)

FAULT RELAY TYPE FAULT

Press Select

Then press Up / Down keys to set Immediate Relay function
Range: Immediate, End Of Acceleration.

PROG. AUX. RELAY IMMEDIATE

Press Select

Then press Up / Down 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 Up / Down 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 Up / Down 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

This page is seen only if Display Mode is set to Maximized.

COMM. PARAMETERS

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

Note: When using communication and local commands (Start/Stop, Dual Adjust, Gen. Mode, Slow Speed, Reverse, Reset) the last command determines the control function function.

Press Select

Then press Up / Down keys to set Drive Number

PROTOCOL Modbus

The protocol is fixed by firmware and cannot be changed.

Following settings change with protocol. For Modbus RTU:

Press Select

Then press Up / Down keys to set Communication Baud Rate. Range: 4800-9600 bps

BAUD RATE 9600

Press Select

Then press Up / Down keys to set Communication Parity Check. Range: Even / Odd

PARITY CHECK EVEN

Press Select

Then press Up / Down 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.

Starting Procedure

Note: It is necessary to connect a **motor** to load terminals otherwise “S.SCR or Wrong Connection” Protection is activated. Other loads such as light bulbs, resistors, etc. may also cause “Wrong Connection” Fault.

Start-up procedure with start-stop buttons

1. Connect Control Supply. **On** LED will lit.
2. Review all parameters with **Mode** and **Select** keys Set parameters as required.
3. If necessary, return to Default Parameters (see “Service Mode”).
4. Connect mains voltage to starter’s line terminals.
5. Set LCD to show “MOTOR FLA” (% of motor FLA).
6. Apply Start command. 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. Apply Stop command and wait until motor stops.
9. Slightly increase Initial Voltage and Current Limit settings to allow for load changes.
10. Apply Start command and see that motor is Acceleration time to full speed is as required.
11. If acceleration time is too short, increase “Acceleration Time” setting and/or decrease C.L. (when decreasing CL, make sure motor increases speed gradually and does not stall).
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.

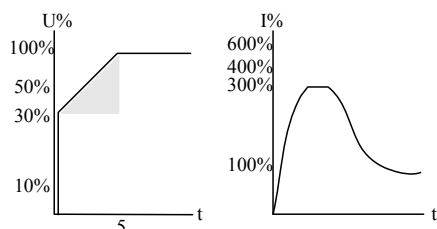
Examples of starting curves

Light Loads-Pumps, Fans, etc.

Initial Voltage – set to 30% (Factory Default)

Current Limit – set 300%

Acceleration Time – set 5 sec.



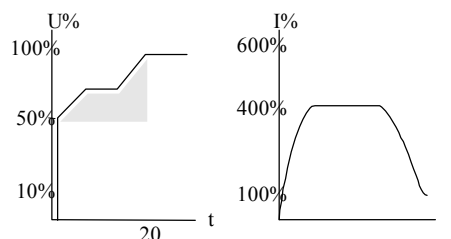
Voltage quickly increases to the Initial Voltage value and then gradually ramps-up to nominal. Current simultaneously and smoothly increases to reach Current Limit setting or less, before smoothly decreasing to the operating current. Motor speed will accelerate to full speed quickly and smoothly.

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”. The voltage is held at this value until motor is close to nominal speed, then current will begin to decrease. The RVS-DX 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 t_x (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).

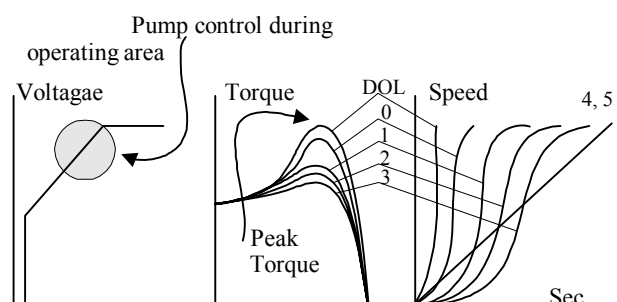


	Dual Adj. Par.	Standard Par.
Initial Voltage	10%	25%
Acceleration Time	$t_1 = 2-30$ sec	$t_2 = 2-30$ sec
Current Limit	200%	300-400%
Imm.Rel. ON delay	$T_x = 1-60$ sec.	-----

Choosing a suitable Pump Curve (centrifugal Pumps)

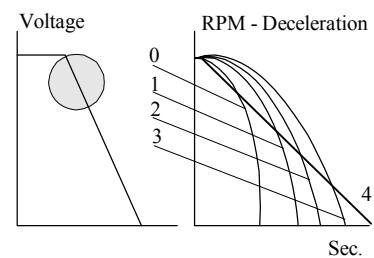
Starting Curve

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!, or 3!, 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" for these techniques (Consult factory).



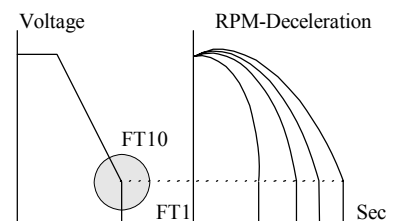
Stopping Curve

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 check valve as the pump stops. Look for overshooting ("Water Hammer") of the gauge (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.



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.



Trouble Shooting

Upon fault – motor stops, Fault LED lights and Fault Relay operates. The LCD shows TRIP: and fault description. fault description (for example: **TRIP: UNDER CURRENT**).

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 present 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 CAUTION Check that “Meager” maximum voltage is <u>no more</u> than 500V !.
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 .
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 L ₁ , L ₂ , L ₃ .
PHASE LOSS	Trips the starter if 1 or 2 phases are missing. Check line voltages is connected correctly. Check that frequency variations are between 45-65Hz.
PHASE SEQUENCE	Trips the starter if line phase sequence is wrong. Check line phase sequence, and if wrong, swap two wires on <u>line</u> side. If motor now rotates in the wrong direction, swap two wires on <u>load</u> side.
SHORTED SCR OR WRONG CONNECTION	Trips the starter when one or more motor phases are not properly connected to starter’s load terminals, in case of internal disconnection in motor winding or if any SCR is short-circuited or when motor windings are shorted. If required, may be eliminated by using generator mode (programming Aux. In PROG INPUT parameters accordingly) Note: Shorted SCR and Wrong Connection faults are not active in Generator mode. Trips the starter and prevents starting. Check with an ohmmeter between L₁-U, L₂-V, L₃-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.

Trouble Shooting

OVER TEMPERATURE

Heat-sink over-temperature. Trips the starter when heat-sink temp. rises above 85°C.
Check that motor starting is not too frequent.

EXTERNAL FAULT In Max. display Mode

Trips the starter when a N.O contact between Aux. input terminals 13, 14 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**, Press **Mode** +  simultaneously, than **Mode** + **Store** simultaneously to save the default parameters. (If Fault LED is on, press **Reset** after Wrong parameters).

* **NOTE:** When operating in Generator Mode, Shorted SCR and Wrong Connection faults are not active.

Appendix

Page	Subject
25	UL and cUL instructions, LR recommendations
26	Fuse selection
27	Motor and Starter Fault Occurrence Timing Table
28	Warranty claim sheet & Fault Inquiry
29	“Inside Delta” Description
30	Overload Trip Time (Approximate calculation)
31	Block Diagram and Notes
32	Technical Specification
33	Ordering Information
34	Dimensions and Weights

UL, cUL Installation Instructions

1. Input power and output motor field wiring shall be copper conductors, rated 75°C.
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	4 x 1.5 N2XY		
2	17	4 x 2.5 N2XY		
3	31	4 x 4 N2XY		
4	44	4 x 10 N2XY		
5	58	4 x 16 N2XY		
6	72	4 x 16 N2XY		
7	85	4 x 25 N2XY		
8	105	4 x 25 N2XY	M8	180
9	145	3 x 50 + 25 N2XY	M8	180
10	170	3 x 70 + 35 N2XY	M8	180
11	210	3 x 95 + 50 N2XY	M10	220
12	310	3 x 150 + 70 N2XY	M10	220
13	390	3 x 185 + 95 N2XY	M10	220
14	460	3 x 240 + 120 N2XY	M10	220
15	580	2 x (3x 150 + 70)N2XY	M10	220
16	820	3 x (3x 185+ 95) N2XY	M10	220

UL, cUL Installation Instructions

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 Mains Supply Of 400V)

RVS-DX	Max. thyristor I ² t (A ² Sec)	BUSSMAN		GEC ALSTOM		SIBA		FERRAZ – SHAWMUT (IEC Style 690/700V)	
		Rated (A)	P/N	Rated (A)	P/N	Rated (A)	P/N	Rated (A)	P/N
RVS – DX 8	400	30	FWP 30B	32	B210612			32	URD 000-32
RVS – DX 17	5,000	50	FWP 50B	63	B210615			63	6.6URD30D11A0063
RVS – DX 31	10,000	90	FWP 90B	100	V320063			100	6.6URD30D11A0100
RVS – DX 44	12,000	125	FWP 125A	100	X320063			100	6.6URD30D11A0100
RVS – DX 58	15,000	150	FWP 150A	125	X320065			125	6.6URD30D11A0125
RVS – DX 72	18,000	175	FWP 175A	160	B320069	200	SQB1-200	200	6.6URD30D11A0200
RVS – DX85	40,000	200	FWP 200A	200	E320371	200	SQB1-200	200	6.6URD30D11A0200
RVS – DX 105	60,000	250	FWP 250A.	250	J320375	250	SQB1-250	250	6.6URD30D11A0250
RVS – DX 145	100,000	300	FWP 300A	315	M320079	315	SQB1-315	315	6.6URD30D11A0315
RVS – DX 170	140,000	400	FWP 400A	350	Y320480	350	SQB1-350	350	6.6URD30D11A0350
RVS – DX 210	200,000	500	FWP 500A	450	D320485	450	SQB1-450	450	6.6URD30D11A0450
RVS – DN 310	600,000	700	FWP 700A	630	H320489	630	SQB1-630	630	6.6URD31D11A0630
RVS – DX 390	700,000	700	FWP 700A	800	T320591	800	SQB1-800	800	6.6URD31D11A0800
RVS – DX 460	800,000	800	FWP 800A	900	V320592	900	SQB1-900	900	6.6URD32D11A0900
RVS – DX 580	1,200,000	1000	FWP 1000A	1000	W320593	900	SQB2-900	1000	6.6URD32D11A1000
RVS – DX 820	2,000,000	1200	FWP 1200A	2X700A	2XS320590	1100	SQB2-1100	1250	6.6URD33D11A1250

- Notes:** 1. The above table is for maximum starting current of 400% of FLC, maximum starting time of 5 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 ect. 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.

Timing Occurrence Table

Timing And Occurrence	Active During			
	Start	Run	Stop	Soft Stop
Too many starts with Start Inhibit period	√			
Electronic Overload with Curve selection		√		
O/C Shear Pin (Jam)				
Starter Protection – trip immediately 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 (*).		√		
Under current adjustable time delay		√		
Phase Loss	√	√		√
Phase sequence	√			
Under voltage with adjustable time delay. Time delay is override in case of “No-Volt”.	√	√		√
Over voltage with adjustable time delay	√	√		√
Long start time (Stall protection)	√			
Shorted SCR or Wrong connection	√			√
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 - Not Available (Consult Factory)			√	
Motor Thermistor – Not Available (Consult Factory)	√	√	√	√

Warranty Claim and Fault Inquiry

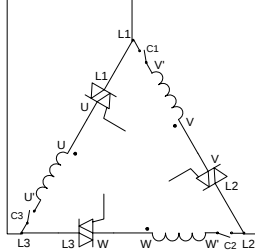
Representative Name:	Country:	Fax Number:	
Model Number And Build Options:	Example: 170 – 400 – 230 – 3 + 5 + L – S RVS-DX - - - - + + -		
Serial Number:			
Purchasing Date:			
Sale / Installation Date:			
Failure Date:			
Program Version: STRT.DX- _ _ _ _ _	Press MODE + ▽, press SELECT twice, the LCD displays the program version (e.g. STRT.DX-150802)		
Details of Fault / Fault Message:			
Define time of fault occurrence: (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:			

“Inside Delta” mode - Description

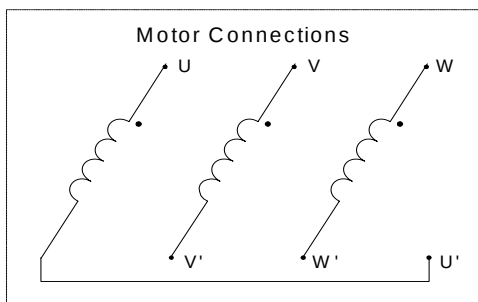
General information

- Mains current is reduced by 1.73 ($\sqrt{3}$), namely for an 160A motor, an 170A starter will be selected, to operate “In-Line”. For “Inside Delta” starter, we calculate $(160 / 1.73 =)$ and select a 105A starter.
- Less heat dissipates in the cabinet vs. the standard “In-Line” connection.

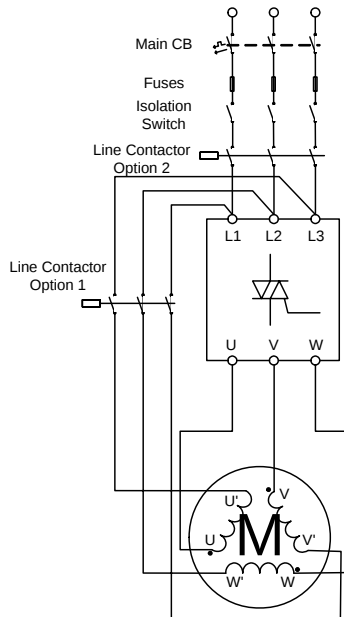
The attached drawings are for reference



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 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-DX 8	8	4	6
RVS-DX 17	17	7.5	12
RVS-DX 31	31	15	25
RVS-DX 44	44	22	38
RVS-DX 58	58	30	50
RVS-DX 72	72	37	64
RVS-DX 85	85	45	75
RVS-DX 105	105	55	95
RVS-DX 145	145	75	120
RVS-DX 170	170	90	155
RVS-DX 210	210	110	190
RVS-DX 310	310	160	275
RVS-DX 390	390	200	346
RVS-DX 460	460	250	432
RVS-DX 580	580	315	545
RVS-DX 820	820	450	778

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.



WARNING

When using Inside connection:

1. Contactor (Inside or Outside the Delta) must be used!
2. If Contactor is connected Inside the Delta, motor terminals are “live” (full voltage) even when contactor is open.



Overload 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:

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

Overload Trip setting (default 115%)

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

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

Example 1: Motor FLA = 80A, actual current = 120A,
 $I_{\%} = 120 \times 100 / 80 = 150\%$
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,
 $I_{\%} = 400 \times 100 / 80 = 500\%$
If settings are as in default then

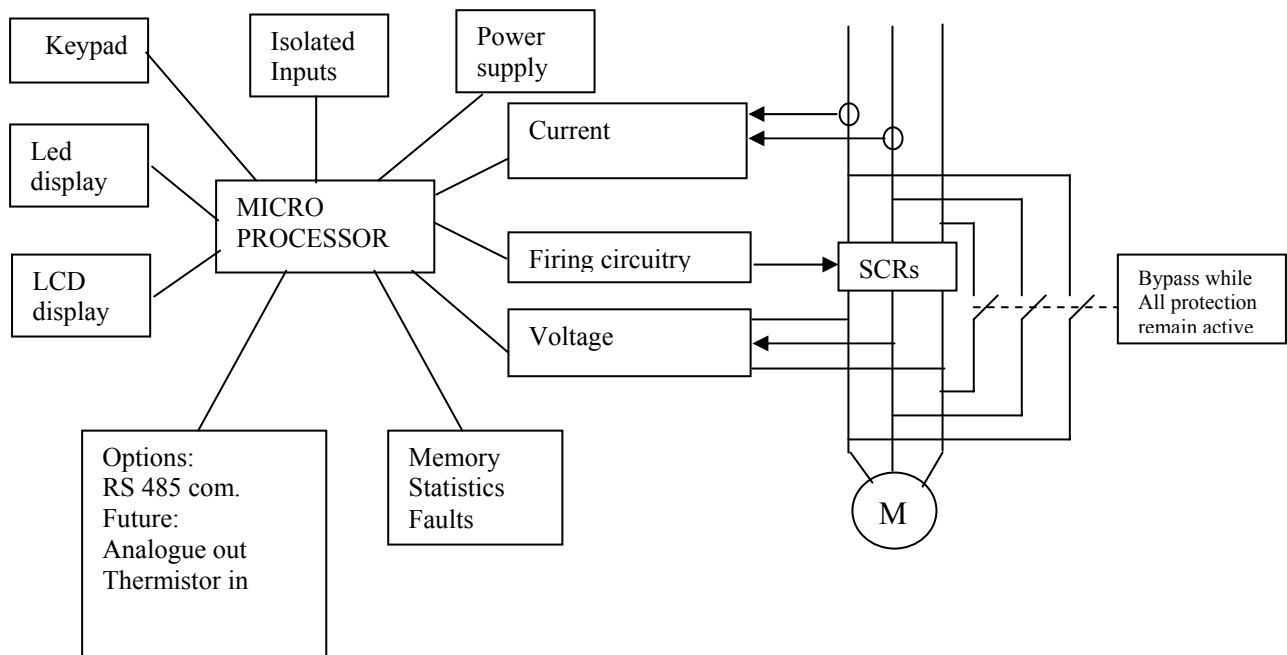
$$\text{O/L Trip Time} = \frac{1,375,000}{500^2 - 115^2} \times \frac{4}{6} = 4 \text{ sec.}$$

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

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

Block Diagram

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



Technical Specification

General Information:

Supply Voltage	Line to Line 220-600V (to be specified) + 10%-15%
Frequency	45 – 65 Hz (Fixed or variable frequency source)
Control Supply	115V or 230V (to be specified) +10% - 15%
Load	Three phases, three wires, squirrel cage induction motor.

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 (Full Load Current).
Pump and Torque Control Curves	Field selectable curves preventing Over-pressure during start and Water Hammer during stop.
Pulse Start Duration	A pulse of 80% Un, adjustable range 0.1-1 Sec, for starting high friction loads.
Initial Voltage,	10-50% Un
Initial Current	100-400% of Motor FLA
Current Limit	100-400% of Motor FLA
Acceleration Time	1-30 Sec
Deceleration Time	1-30 Sec

Motor Protection:

Too Many Starts	Maximum number of starts, range: Off or 1-10, during a time period 1-60 min.
Starts inhibit	Period of 1-60 min, during which starting is prevented, after Too Many Start fault.
Long Start Time (Stall protection)	Maximum allowable starting time 1-30 sec.
Over Current (Shear-pin)	Two operation functions: during starting trips the starter at 850% and during running at 100-850% In, both within 1 Cycle (after internal delay).
Electronic Overload (I2t)	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 50-90%, time delay 1-10 Sec
Over Voltage	Trips when main voltage increase above 110-125%, time delay 1-10 sec.
Phase Loss, Under/Over Frequency* ..	Trips when one or two phases are missing and frequency is 40Hz. or 65Hz.
Phase Sequence	Trips when phase sequence is wrong
Shorted SCR or Wrong connection	Prevents starting, trips if motor is not connected / incorrectly connected to the starter, or in case one or more SCRs have been shorted
Heat Sink Over temp	Trips when heat-sink temperature rises above 85°C.
External fault	Trips when an External Contact closes for 2 sec.
* With optional Auto Reset.	

Control:

Displays	LCD in 4 – Field selectable languages and 4 LEDs.
Keypad	6 keys for easy setting
Fault Contact	2 Contacts, 8A, 250VAC, 2000VA
Aux. Contact – Imm. or End Of Acc. ...	2 Contacts, 8A, 250VAC, 2000VA

<u>Temperatures</u>	Operating -10° to 40°C
	Storage -20° to 70°C

Standards:

Dielectric Test	2500VAC
Degree of Protection	IP 20 for frame size D1, IP 00 for frame sizes D2-D5
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.
	Designed and assembled to conform with UL508C

Normal Service Conditions:

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

Consumption Ratings:

Size D1-D2	Total starter Consumption	185VA
Size D3-D5	Total starter Consumption	210VA

Ordering Information

Example:	RVS-DX	170	- 400	-	230	- L	- S
	RVS-DX	xxx	- xxx	-	xxx	- x	- x
Starter FLC	(1)	—					
Mains voltage	(2)	—					
Control Supply	(3)	—					
Options	(4)	—					
Front panel	(5)	—					

(1) Starter FLC: 8, 17, 31, 44, 58, 72, 85, 105, 145, 170, 210, 310, 390, 460, 580, 820 Amp

(2) Mains Voltage	<u>Specify</u>	<u>For</u>
50/60Hz	400	220 - 440 Vac + 10% -15%
	480	460 - 500 Vac + 10% -15%
	600	575 - 600 Vac + 10% -15%

(3) Control Supply Voltage (terminals A1-A2) 50/60Hz	<u>Specify</u>	<u>For</u>
	115	110-120 Vac + 10% -15%
	230	220-240 Vac + 10% -15%

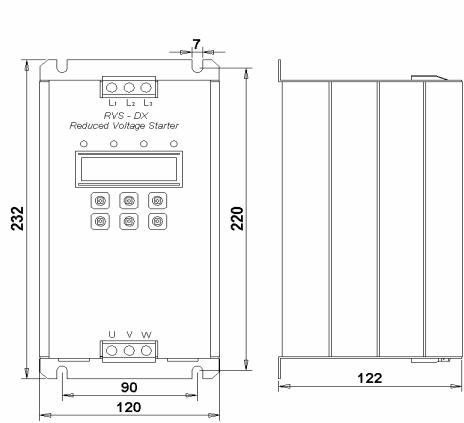
(4) Required Options	<u>Specify</u>	<u>For</u>
	0	No options
	8	Harsh environment treatment (must be factory supplied)
	L	Illuminated LCD
	R	Direct On Line operation

(5) Front Panel	<u>Specify</u>	<u>For</u>
	S	Standard

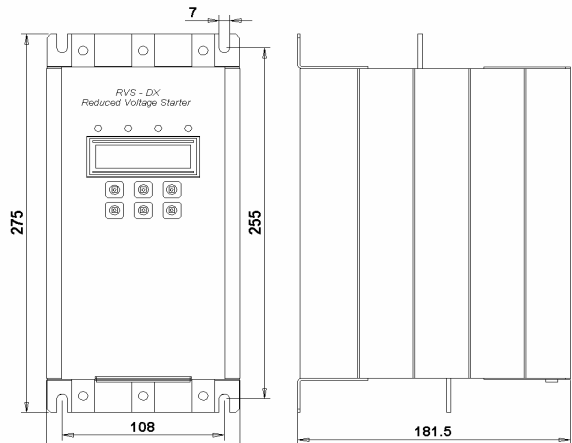
Note - Options should be factory supplied

Dimensions (mm)

RVS-DX 8, 17, 31,44

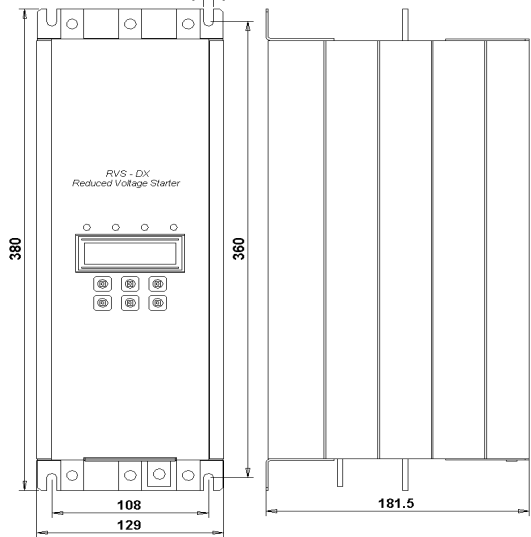


RVS-DX 58, 72

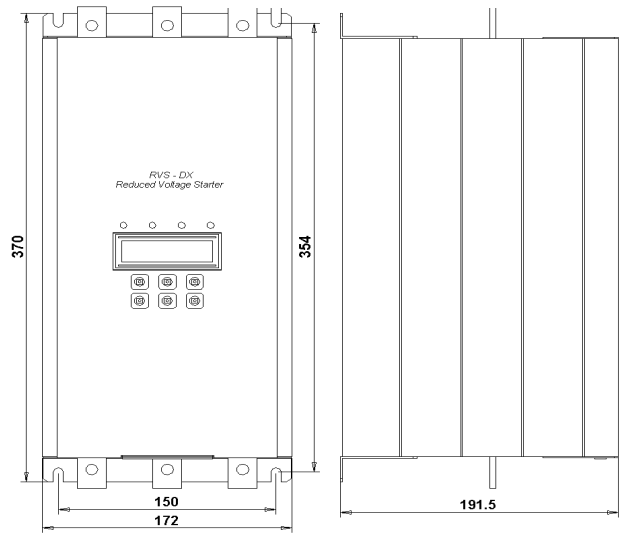


Note: Mains voltage terminals size: 8A – 58A - 16mm²
72A - 25mm²

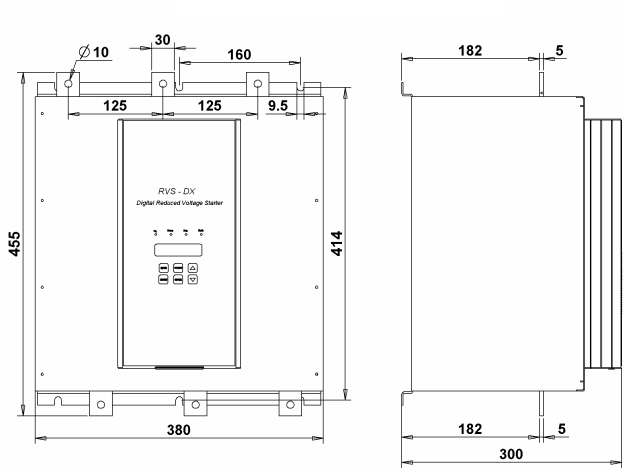
RVS-DX 85, 105



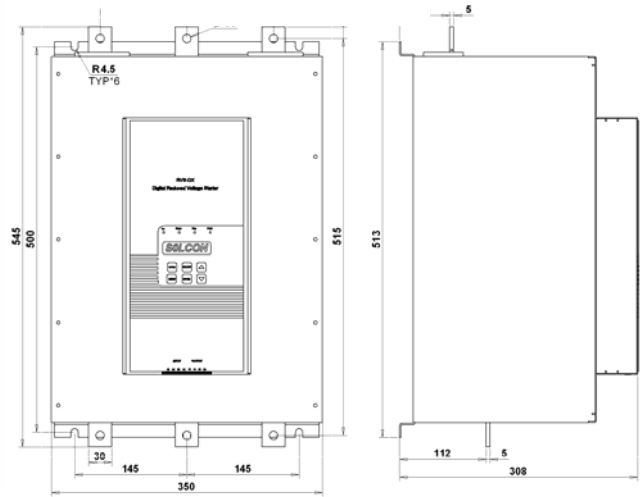
RVS-DX 145, 170



RVS-DX 210, 310

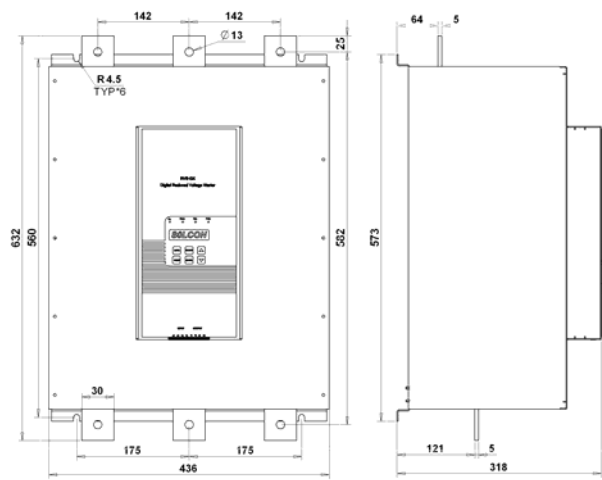


RVS-DX 390

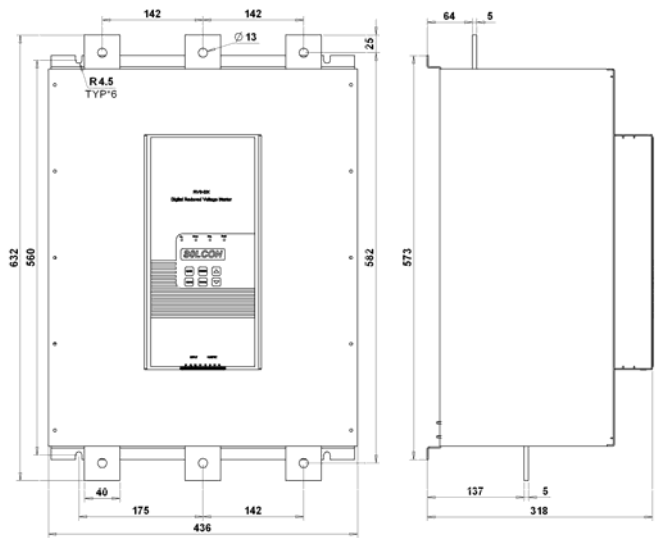


Dimensions (mm)

RVS-DX 460



RVS-DX 580



RVS-DX 820

