iStart

Digital Soft Starter with Internal ByPass
31-1100A, 208-690V

Instruction Manual

Ver. 1.0.0.0

www.solcon.com

iStart Instruction Manual

Table of Contents

1. SAFETY & WARNINGS

1.1 Safety

	**1**	Read this manual carefully before operating the equipment and follow its instructions.
	2	Installation, operation and maintenance should be in strict accordance with this manual, national codes and good practice.
	3	Installation or operation not performed in strict accordance with these instructions will void manufacturer's warranty.
	4	Disconnect all power inputs before servicing the soft-starter and/or the motor.
	5	After installation, check and verify that no parts (bolts, washers, etc) have fallen into the starter.
	6	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.

1.2 Attention

	**1**	This product was designed for compliance with IEC 60947-4-2 for class A equipment.
	2	All of the iStart models are designed to meet UL and cUL requirements.
	3	Use of the product in domestic environments may cause radio interference, in which case, the user may be required to employ additional mitigation methods.
	4	Utilization category is AC-53a or AC-53b, Form 1. For further information, see Technical Specification.

1.3 Warnings

	**1**	Internal components and PCBs are at mains potential when the iStart is connected to mains. This voltage is extremely dangerous and will cause death or severe injury if contacted.
	2	When iStart 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.
	3	The starter must be grounded to ensure correct operation, safety and to prevent damage.
	4	Check that Power Factor capacitors and overvoltage devices are not connected to the output side of the soft starter.
	5	Do not interchange line and load connections.
	6	Expert mode allows settings that can damage the starter and the motor.

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

2. TECHNICAL DATA

2.1 Introduction

The iStart is a highly sophisticated and reliable three -phase starter. It can operate both three phase and two-phase mode. iStart is designed for simple maintenance and maximum flexibility in the field.

- You can connect motors with different mains voltages to iStart:
  Frame size A, B and C: 208V to 400V
  208V to 600V

  Frame size D to H: 208V to 400V
  208V to 600V
  208V to 690V

- Communication cards are easy to connect and replace.
- Includes an internal bypass.
- You can connect an external display so that you can install iStart inside a cabinet and still monitor and program it without opening the cabinet.
- iStart's Ground Fault protection checks that the total current always remains zero. If a ground fault occurs, iStart trips.
- Includes built-in Motor Unbalance protection.
- Optional fan that can added later allows you to increase the number of starts per hour.
- Includes an event logger for start, stop, bypass open and close, and other events. Each log entry includes: time, date, voltage, current and trip state.

2.2 Rating and Frames Sizes

No.	Frame Size	FLC (A)	Dimensions WxHxD (mm)	Dimensions W/Fan WxHxD (mm)	Dimensions WxHxD (mm) 2P
	A	31	119x245x111	119x245x151	
	A	44	119x245x111	119x245x151	
	B	58	132x275x173	132x275x214	
	B	72	132x275x173	132x275x214	
	B	85	132x275x173	132x275x214	
	C	105	175x354x198	175x354x239	
	C	145	175x354x198	175x354x239	
	C	170	175x354x198	175x354x239	
	D	230			
	D	310			
	E	350			
	E	460			
	F	590			
	G	720			
	G	850			
	H	1100			

2.3 Starter Selection

Use the following criteria to select the starter:

2.3.1 ***Motor Current and Starting Conditions***

Select the starter according to motor's Full Load Ampere (FLA) that is indicated on its nameplate (even if the motor will not be fully loaded).
The iStart is designed to operate under the following maximum conditions:

Ambient Temperature [^{0}C]	Starting Current [A]	Acceleration Time [sec]
40	400%xIn	30
50	350%xIn	20

Max. Starts per Hour: four (4) starts per hour.
Note:
For very frequent starts (inching applications) the inching current should be considered as the Full Load Current (FLC) (consult factory).

2.3.2 ***Mains (Line to Line) and Control Voltage***

Frame Size	Mains (Line to Line) Voltage	Control Voltage	Fan Voltage[1]
A to C	208V to 400V, 50/60Hz, +10% -15% or 208V to 600V, 50/60Hz, +10% -15%	95-230VAC/DC, 50/60Hz, +10% -15%	**Fan is not required** 115VAC/DC, 50/60Hz, +10% -15% or 230VAC/DC, 50/60Hz, +10% -15%
D to H	208V to 400V, 50/60Hz, +10% -15% or 208V to 600V, 50/60Hz, +10% -15% or 208V to 690V, 50/60Hz, +10% -15%	115VAC, 50/60Hz, +10% -15% or 230VAC, 50/60Hz, +10% -15%	**Fan is required** 115VAC/DC, 50/60Hz, +10% -15% or 230VAC/DC, 50/60Hz, +10% -15%

[1] Fan is required for frame sizes D-H. It is not required for frame sizes A-C, but can be ordered as an option.

2.3.3 *Ordering Information*

iStart	31-	400-	230-	24-	0-	S
	Full load Current	Mains Voltage	Control Voltage	Control Input Voltage	Options	Front Panel

Full load Current		
Specify	**Description**	
Starter's FLC [A]	31, 44, 58, 72, 85, 105, 145, 170, 230, 310, 350, 460, 590, 720, 850, 980, 1100	R1 R2 R3 R4 R5 R6

Mains Voltage		
Specify	**Description**	
400	208 – 400 VAC, 50/60Hz , +10% -15%	R1
600	208 – 600 VAC, 50/60Hz , +10% -15%	R1
690	208 – 690 VAC, 50/60Hz , +10% -15%. Only available with 230A and above.	R2

Control Voltage (Terminal A1, A2)		
Specify	**Description**	
230	95-230 VAC, 50/60Hz , +10% -15% or 95-230 VDC	R1
Note:	• Control voltage cannot be modified on site.	

Control Input Voltage (Terminals 1-5)		
Specify	**Description**	
24	24 VDC/VAC +10% -15% (in this option the iStart also supplies 24VDC)	R1
230	95-230 VAC, 50/60Hz , +10% -15% or 95-230 VDC	R2
Note:	• Control input voltage cannot be modified on site.	

Options		
Specify	**Description**	
0	No options	
3M	Communication RS-485 Board (MODBUS) (1) (3)	R1
3R	Communication RS-232 Board (MODBUS) (1) (3)	R1
3P	Communication Profibus (1) (3) (D type connector)	R2
3E	Communication ProfiNet (1) (3) (RJ-45 connector)	R?
3D	Communication Device Net (1) (3) (terminal connectors)	R2
2P	2 phase control(5)	R1
D	Remote Keypad (3)	R1
4	Insulation tester (2) (3)	R2
5	Analog card – Thermistor in and Analog out (2) (3)	R2
6	3XRTD Thermal sensors (2) (3)	R2
8	Harsh environment treatment	R1
F115	Fan unit (4) 115VAC fan unit	R2
F230	Fan unit (4) 230VAC fan unit	R1
ROC	Chinese language LCD	R2
RU	Russian language LCD	R1
Notes:	(1) Only one option from 3M, 3R, 3P, 3D, 3E. (2) Only one option from: 4, 5, 6. (3) You can install these options on site. (4) You can install these options on site for frame sizes A, B and C only. (5) Factory installed option.	
Front Panel		
Specify	**Description**	
S	Standard	

3. RECOMMENDED WIRING SCHEME

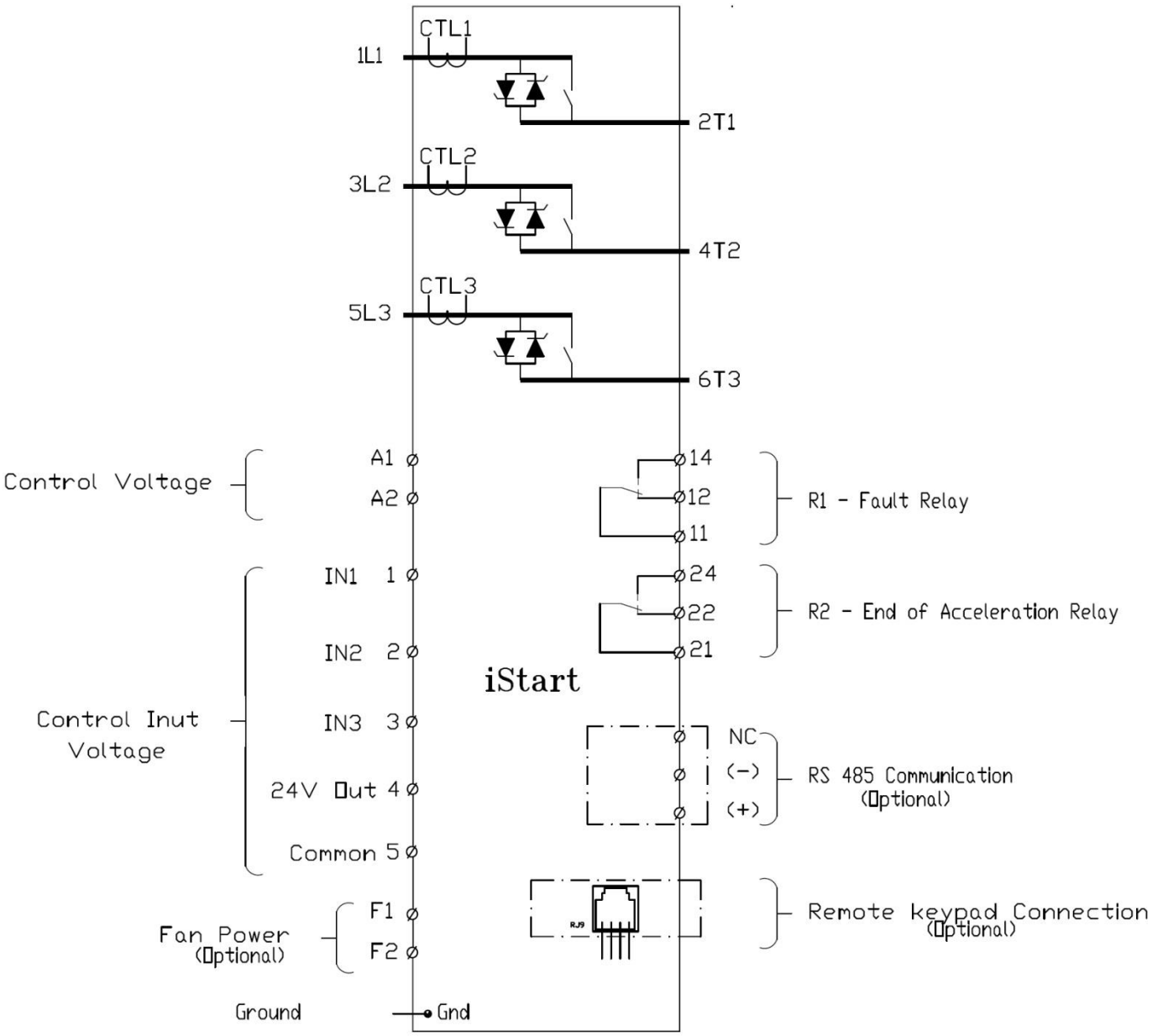
3.1 Mains and Control Description

Refer to drawing on page 10

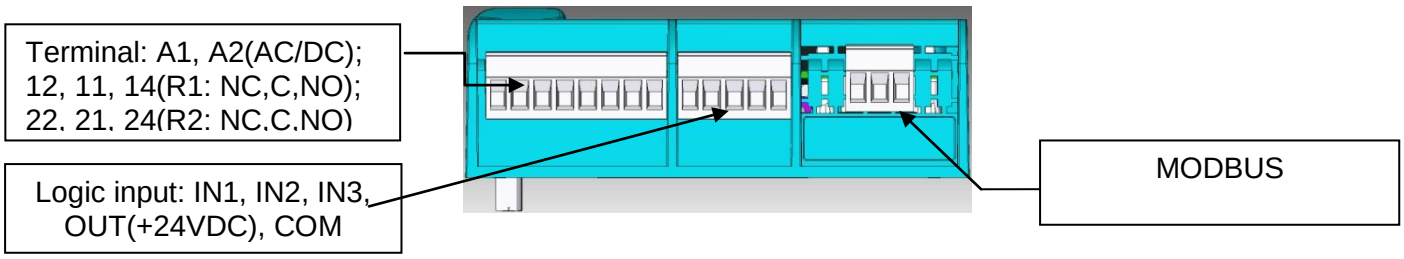
Indication	Description	Remarks
1L1, 3L2, 5L3	Connection to mains voltage up to 690V	
2T1, 4T2, 6T3	Connection to motor	
G	Connection to ground	For proper operation and for safety reasons soft iStart must be properly grounded.
Terminal A1	Control phase	95-230VAC\DC +10% -15%
Terminal A2	Control neutral (return)	
Terminal 12 (NC) Terminal 11 (C) Terminal 14 (NC)	Programmable auxiliary output relay 1	Voltage free, 8A, 250VAC, 1800VA max. The contact incorporates 0-60 seconds On & Off delays. The auxiliary output relay can be programmed to operate in the following modes: • INACTIVE • RUN IMMEDIATE Active when there is start action. • STARTING Active during the start ramp. It stops when the bypass closes. • END OF ACC Not active during the start ramp. Active when the bypass closes. • STOP • SOFT STOP Active during ramp down. • STOP IMMEDIATE Active from ramp down and continues to be active while stopped. • ALTERNATIVE ADJUST Active when motors 2, 3, or 4 receive a command. • FAULT Active while in a fault state. • WARNING Active while in a warning state.
Terminal 22 (NC) Terminal 21 (C) Terminal 24 (NC)	Programmable auxiliary output relay 2	Same as terminals 12, 11, and 14 for relay 2.

Indication	Description	Remarks
Terminal 1,2,3	24V Input – START command.	The terminals can be programmed to operate in the following modes: • INACTIVE • START • STOP • EXTERNAL TRIP • RESET • 1ST ADJUST START Start command to the 1st motor. • 2ND ADJUST START Start command to the 2nd motor. • 3RD ADJUST START Start command to the 3rd motor. • 4TH ADJUST START Start command to the 4th motor. • 1ST ADJUST STOP Soft Stop command to the 1st motor. • 2ND ADJUST STOP Soft Stop command to the 2nd motor. • 3RD ADJUST STOP Soft Stop command to the 3rd motor. • 4TH ADJUST STOP Soft Stop command to the 4th motor.

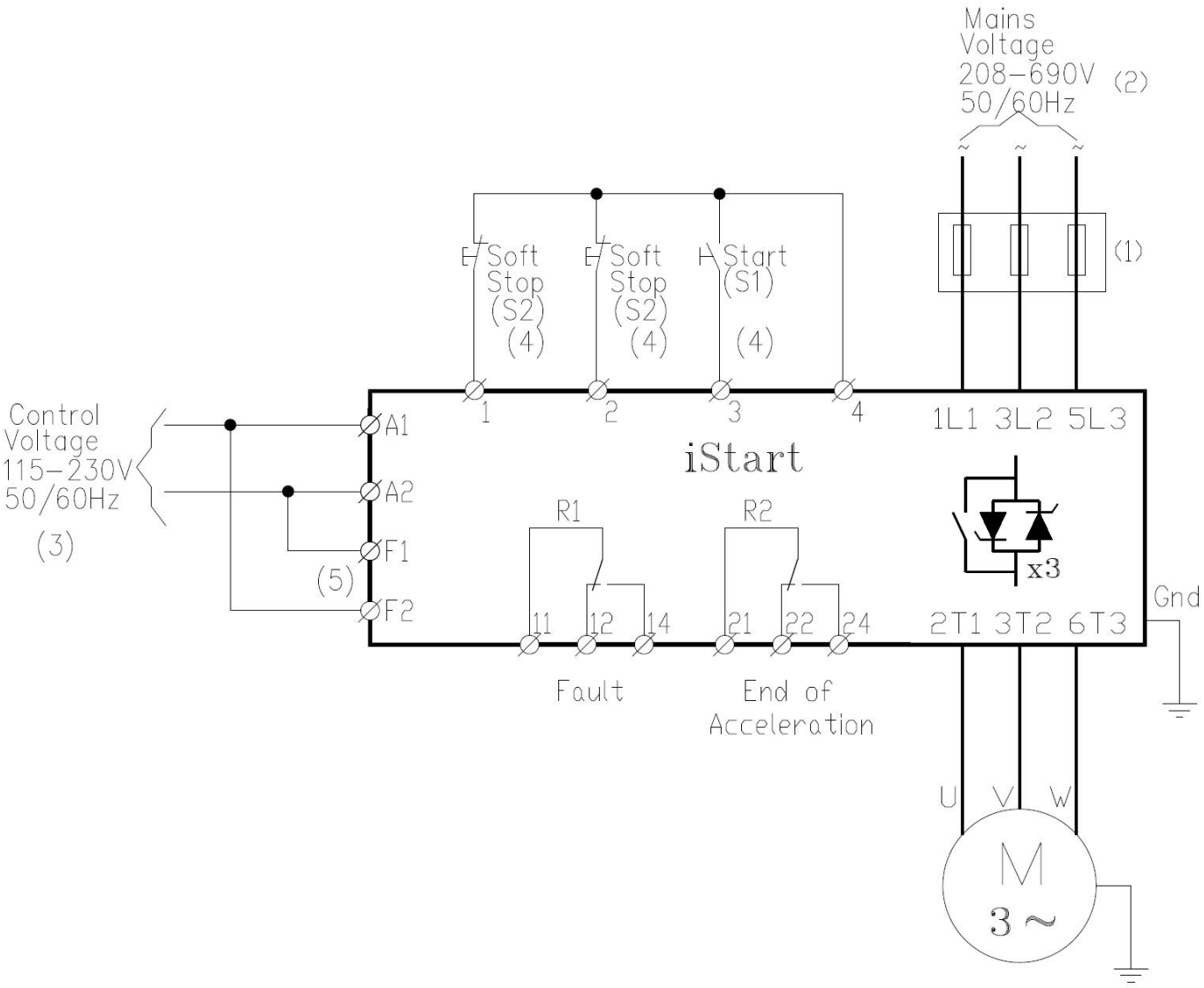
3.2 Input/Output Indication



3.2.1 ***Bottom View of the Control Module***



3.3 **Typical Wiring Scheme – In Line Connection**

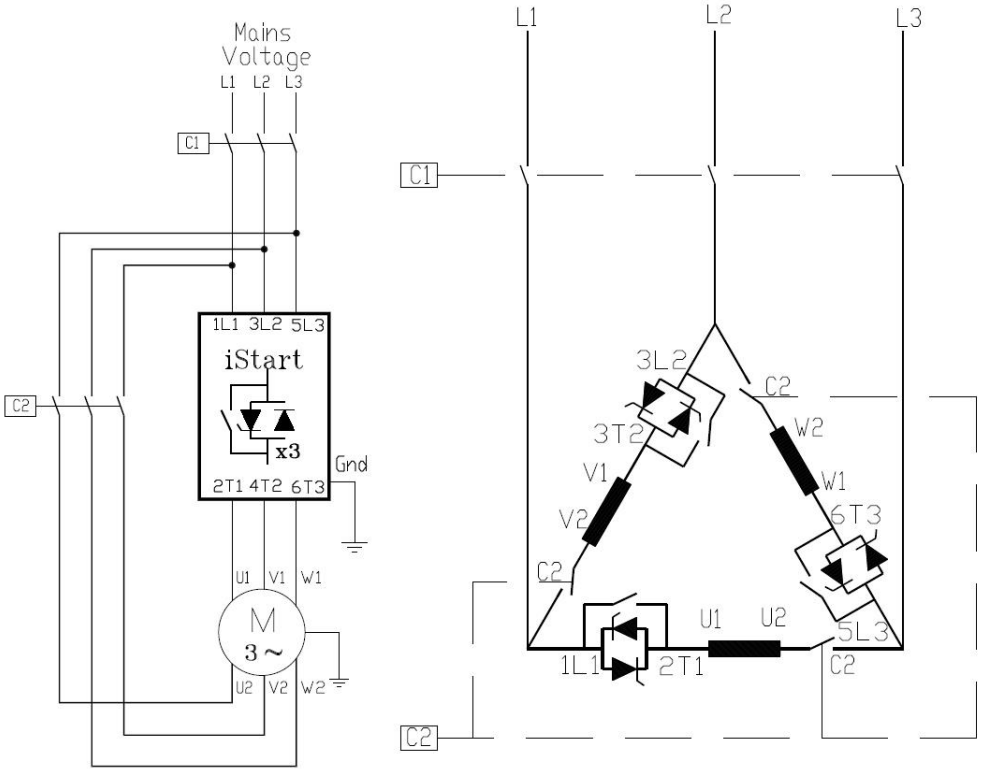


Notes:

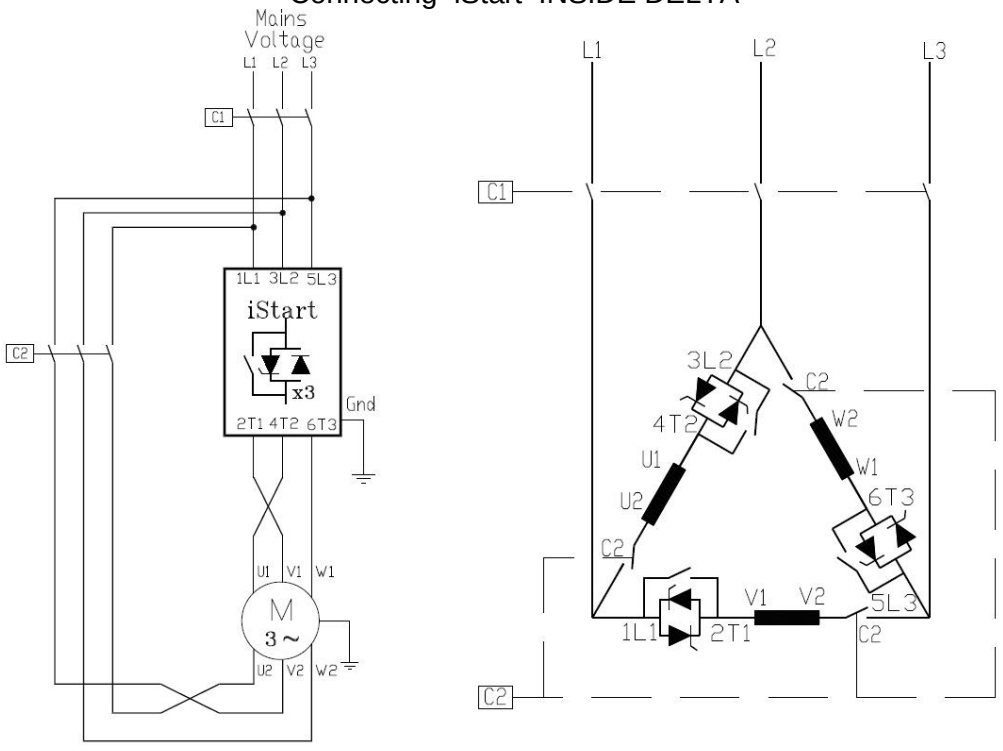
(1) – Use fuses for type 2 coordination. Refer to section 3.5.1 on page 13
(2) – Mains voltage of 208-600V available to all models. Mains voltage 208-690V available to 210-1100A.
(3) – Refer to ordering information for available control voltages.
(4) – Control inputs are shown in their default setting.
(5) – Applicable only when optional fans are installed in frame sizes A-C.

3.4 **Power Wiring Scheme for “Inside-Delta” Connection**

(IMPORTANT! - Refer to section 3.5.2 on page 14)



Connecting iStart INSIDE DELTA



Reverse speed with iStart connected INSIDE DELTA.

Notes:

When installing the iStart INSIDE DELTA. it is highly recommended to use a line contactor (C1) or contactor (C2) in order to avoid a destruction of the motor in case of a shorted SCR in the iStart.
If a contactor is connected Inside the Delta (C2) only, motor terminals are “live” (full voltage) even when contactor is open.

3.5 Wiring Notes

WARNINGS!	When mains voltage is connected to the iStart, 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 upstream of the starter.
	Power factor correction capacitors and overvoltage devices must not be installed on starters load side. When required, install capacitors or overvoltage devices on starter's line side.
	iStart is not balanced while in two-phase mode. Therefore, you cannot use a motor unbalance protection because it will always cause a trip.

3.5.1 ***Short Circuit Protection***

For "type 2 coordination", use fuses for semiconductor protection to protect the iStart from a short circuit. Fuses for semiconductor protection give excellent results because they have low I²t values and high interruption ratings.

Recommended fuse selection procedure:

(1) **Fuse rated voltage**: Choose minimum fuse rated voltage which is above the rated voltage of the mains.

(2) **Fuse rated current:** Select a fuse which is able to carry 7 times the rated iStart current for 30 seconds (this is double the maximum iStart current for the maximum acceleration time).

(3) **Fuse I²t:** Verify that the I²t value of the fuse is less than or equal to the I²t value of the thyristor in the iStart as shown in the table below.

iStart Model	Max. Thyristor I^2t [A2Sec]	iStart Model	Max. Thyristor I^2t [A2Sec]
31	15,000	310	845,000
44	15,000	350	845,000
58	236,000	460	1,130,000
72	236,000	590	1,1820,000
85	236,000	720	1,1820,000
105	304,000	850	1,1820,000
145	304,000	980	4,260,000
170	304,000	1100	4,260,000
230	135,000		

*3.5.2 **"Inside-Delta" Mode***

3.5.2.1 General Information

When the iStart is installed "Inside Delta", the individual phases of the Starter are connected in series with the individual motor windings (6 conductor connections as with the star-delta starter). The soft starter must only conduct about 67 % (=1\1.5) of the rated motor current. This ensures the use of a significantly smaller device.

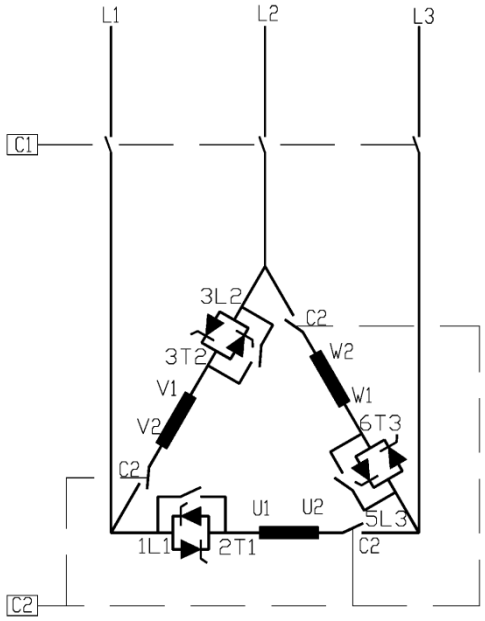
For example:
For a motor with a rated current of 1050A motor, a 1100A starter will be selected to operate "In-Line".
For "Inside Delta" starter, we calculate (1050 x 67% = 703A) and select a 720A starter.
Less heat dissipates in the cabinet vs. the standard "In-Line" connection.

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

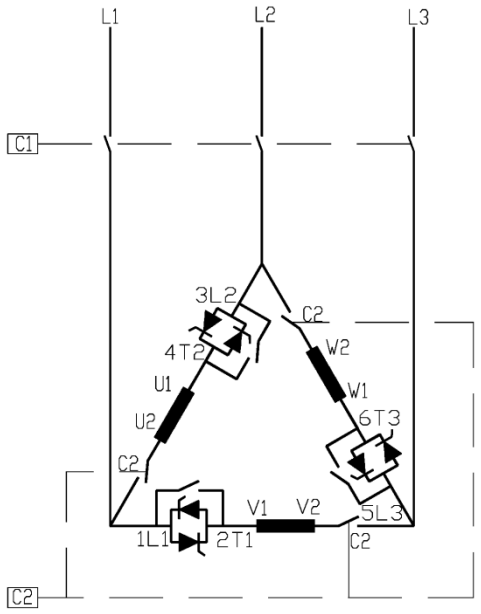
3.5.2.2 Notes on "Inside Delta" Connection

- "Inside Delta" requires 6-wires to the motor.
- Wrong motor connection will cause serious damage to the motor windings.
- When installing the iStart "inside delta" it is highly recommended to use a contactor in series to the ISTART or upstream of the motor in order to avoid a destruction of the motor in case of a shorted SCR in the ISTART.
- 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 cannot be obtained.
- When "Inside Delta" mode is configured:
  - No Pulse Start.
  - No curve selection (Curve 0 !! only).
  - No Slow Speed (Reverse and Forward).
  - No Phase sequence "Off" mode.
  - No 2-phase control.

WARNINGS!	**Beware!** Wrong connection of the starter or the motor, will seriously damage the motor.
	When using “Inside delta” connection: 1. It is highly recommended to use a contactor in series to the iSTART or upstream of motor in order to avoid a destruction of the motor in case of a shorted SCR in the iSTART. 2. If Contactor is connected Inside the Delta, motor terminals are “live” (full voltage) even when contactor is open.



iSTART connected INSIDE DELTA



Speed reverse with iSTART connected INSIDE DELTA

(1) C1 is a line contactor.
(2) C2 is an “Inside Delta” contactor.
(3) U1-U2, V1-V2, W1-W2 are motor’s windings.
(4) L1-U, L2-V, L3-W are iSTART controlled phases.

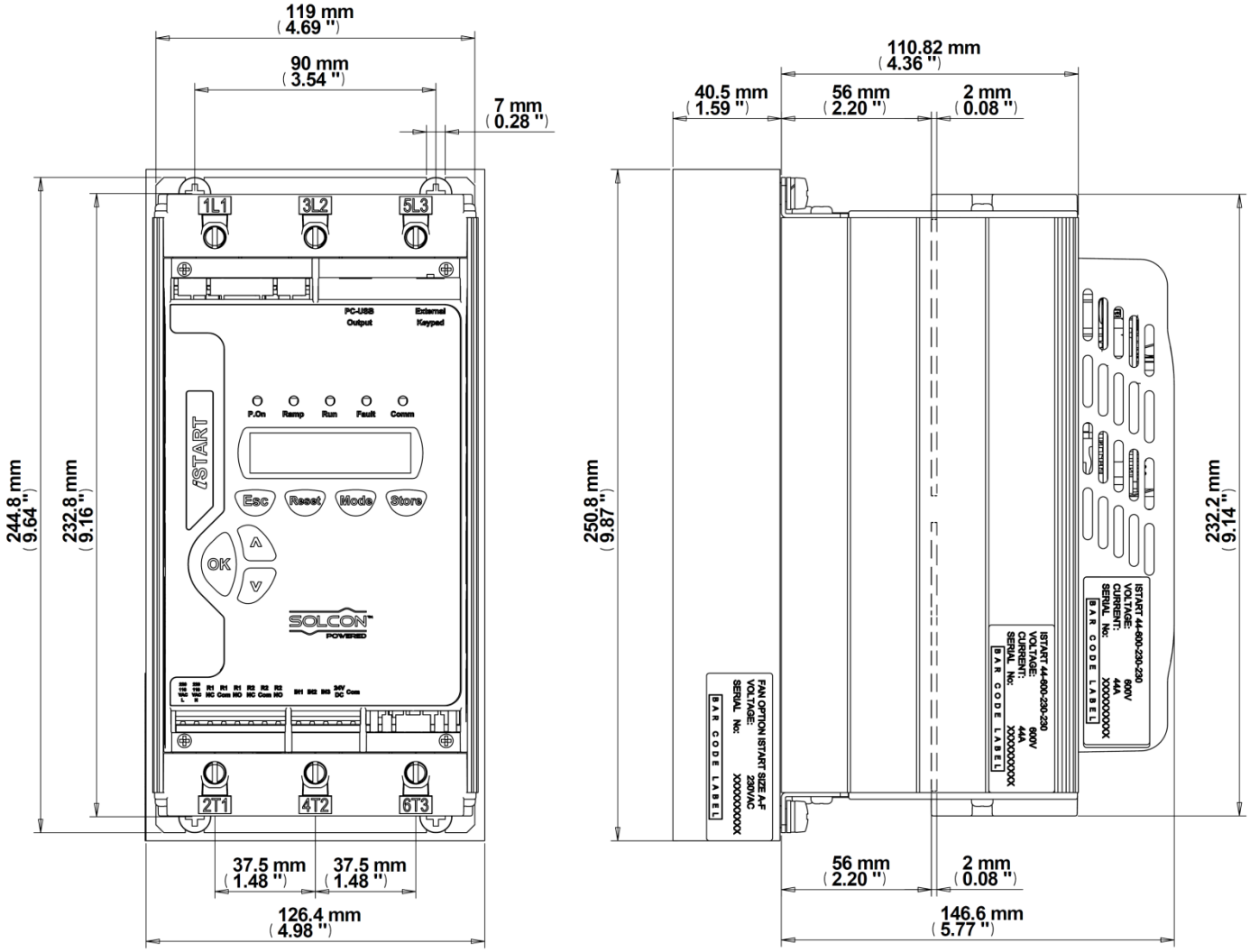
Refer also to section 3.4 on page 12.

Note:

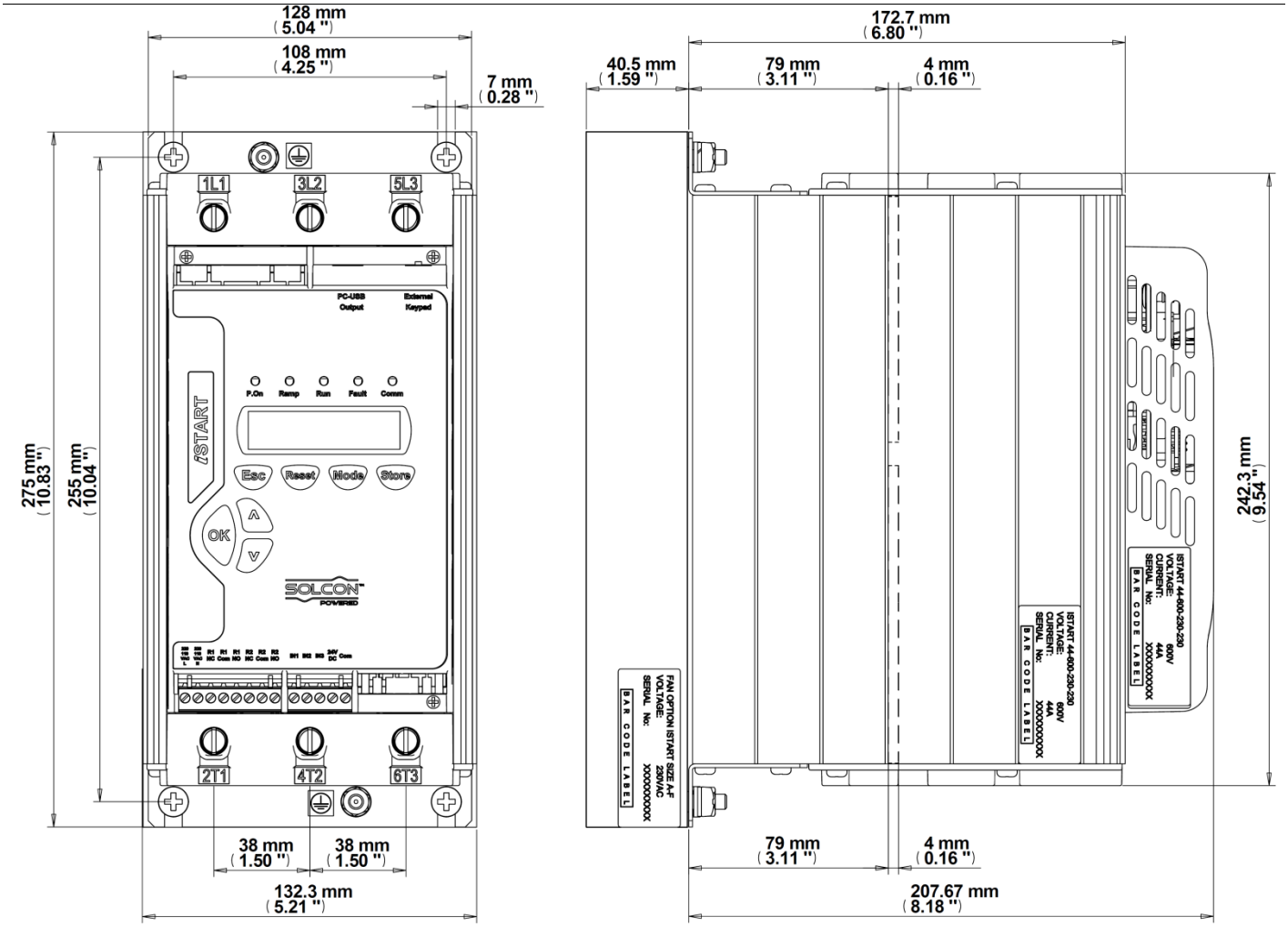
Motor terminals are marked as follows:

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

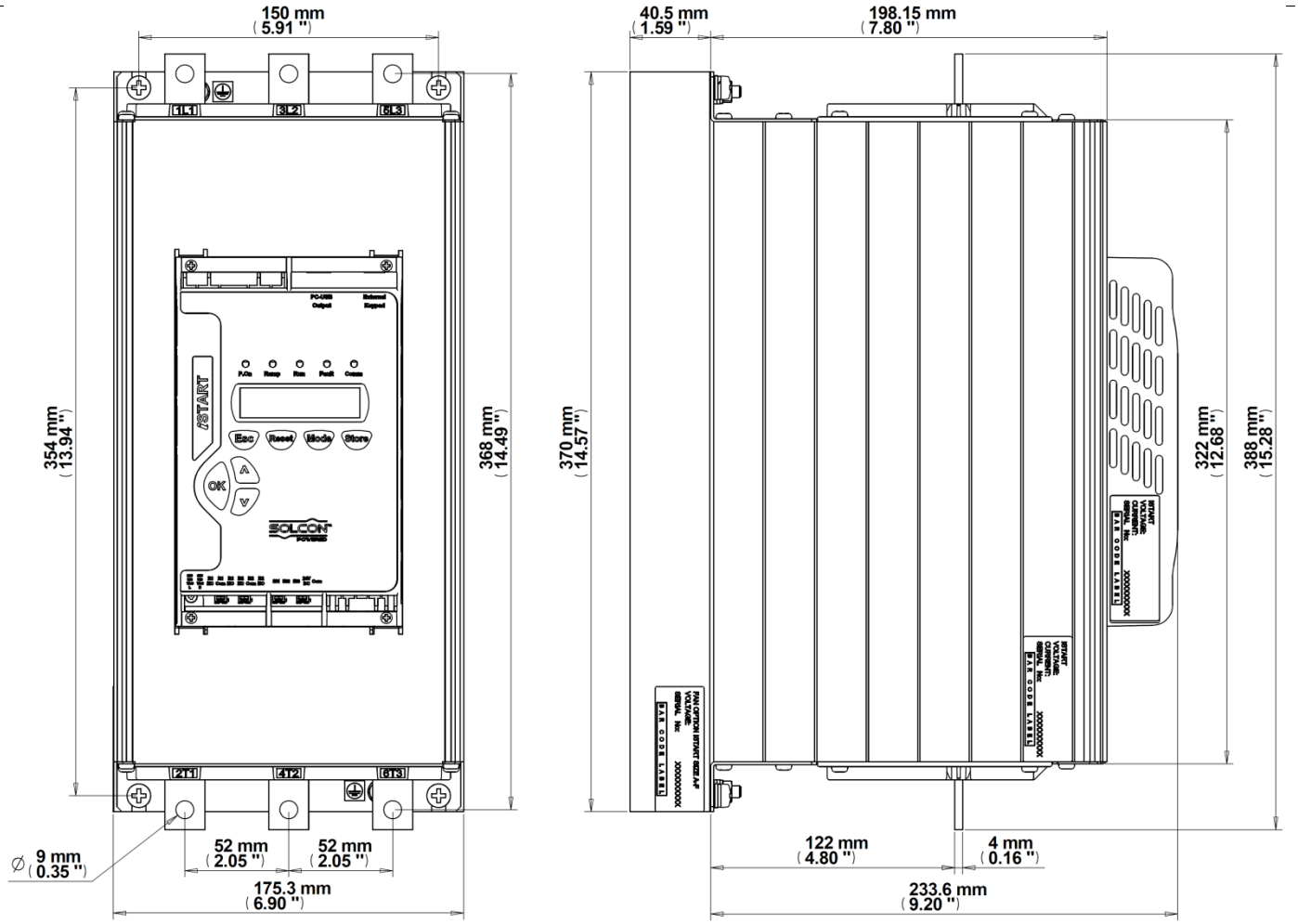
4. Dimensions



iStart Size A: 31A, 44A



iStart Size B: 58A, 72A, 85A



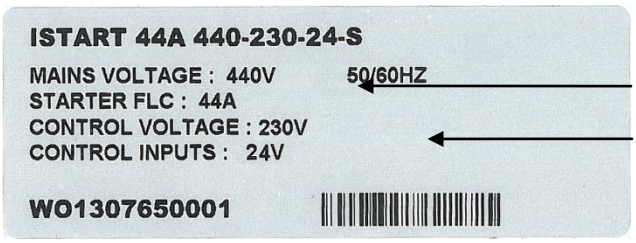
iStart Size C: 105A, 145A, 170A

5. INSTALLATION

WARNING!	Do not interchange line and load connections

5.1 Prior to Installation

Check that Motor's Full Load Ampere (FLA) is lower than, or equal to the starter's Full Load Current (FLC) and that Mains and Control voltages are as indicated on the starter's side label.
Make sure Starter's FLC≥ Motor FLA!



ISTART label - example

5.2 Mounting

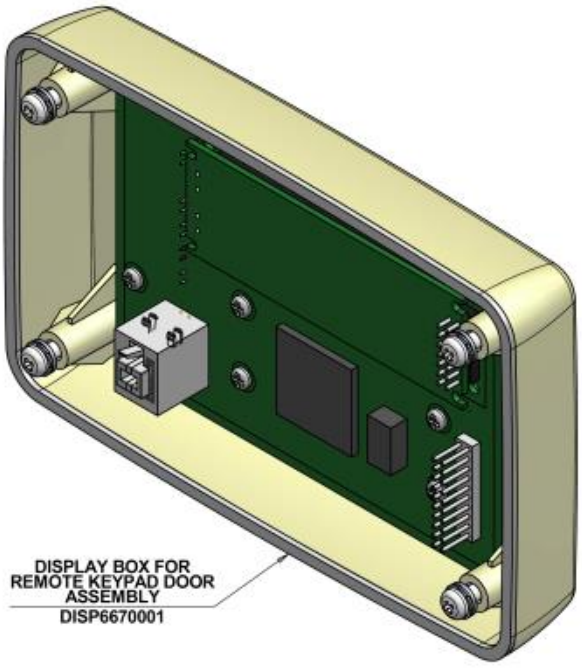
The starter must be mounted vertically. Allow sufficient space (at least 100mm) above and below the starter for suitable airflow.
It is recommended to mount the starter directly on the rear metal plate for better heat dissipation.
Note:
Do not mount the ISTART directly on the rear metal plate in case a ventilation fan or ventilation opening is on the back side of the ISTART.

Do not mount the starter near heat sources.
Surrounding air temperature in the cabinet should not exceed 50ºC.
Protect the starter from dust and corrosive atmospheres.

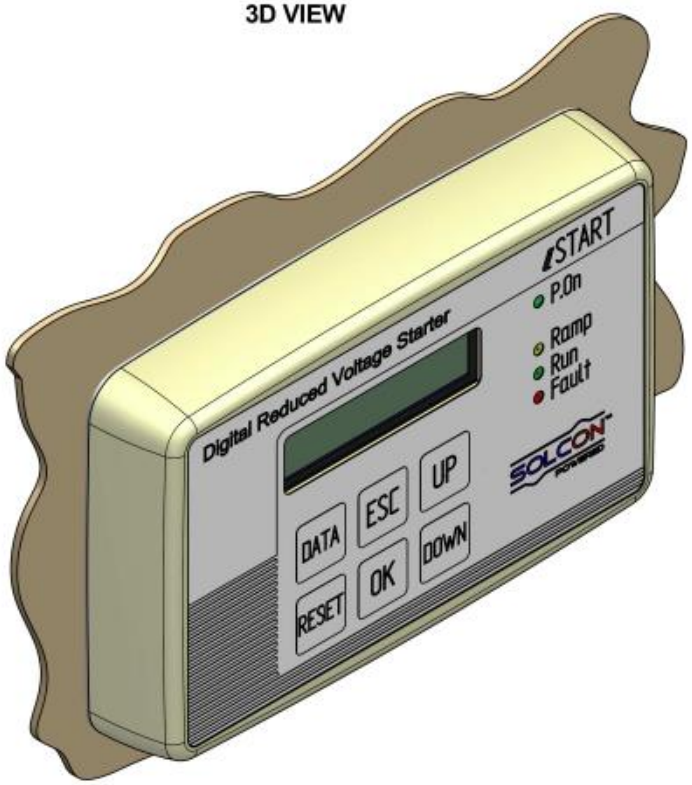
Note: For harsh environments (sewage treatment plants, etc.), it is recommended to order the starter with printed circuit board coating. Refer to section 2.3.3 on page 7 for ordering information.

5.2.1 *IP-54 Remote Keypad Installation*

3D VIEW WITHOUT DOOR

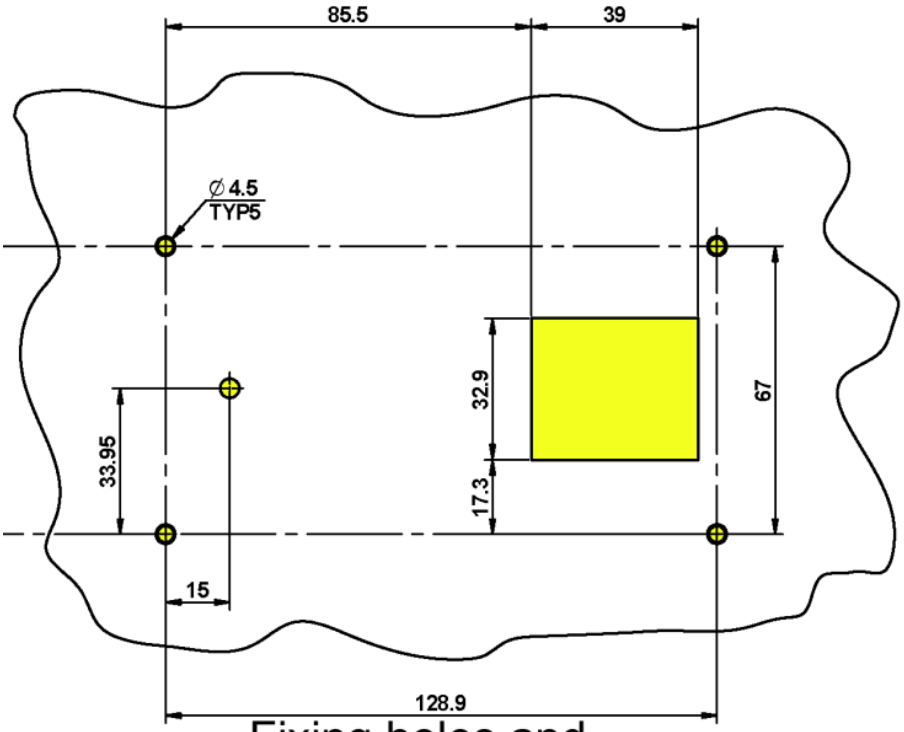


3D VIEW



REMOTE KEYPAD DOOR iSTART

DOOR FRONT VIEW



Fixing holes and opening in the door

5.3 Temperature Range & 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%.

ATTENTION!	Operating at surrounding air temp. (Inside the cabinet) higher than 50ºC 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 x In (in watts). During soft start and soft stop, heating is approximately three times the actual starting current (In watts).

Example: For a 100A motor, heat dissipation is less than 40 watts while running and during starting (for example at 350A), heat dissipation is approximately 1050 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.

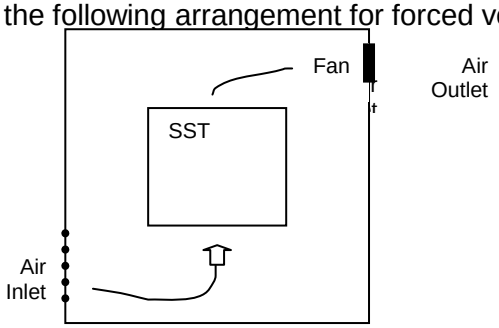
5.3.1 ***Calculating the Enclosure Size, for Non-Ventilated Metallic Enclosure***

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

Where: **Area [m^2]** - Surface area that can dissipate heat (front, sides, top).
Total heat dissipation [Watt] – The total heat dissipation of the starter and other control devices in the enclosure. If starter is frequently started, average power should be used.

5.3.2 ***Additional Ventilation***

Use the following arrangement for forced ventilation of the ISTART's enclosure:



6. CONTROL KEYPAD

The control keypad is the link between the iStart and the user.
The iStart control keypad features:

(1) Indication LEDs (*On, Ramp, Run, Fault, Comm*)
(2) Two lines of 16 alphanumeric characters each with selectable languages – English, French, German, Spanish and Turkish. Russian and Chinese characters are optional and must be pre-ordered. By default the display shows actual data.
(3) Six push-buttons (**Data**, **Reset**, **Esc**, **Enter**, Up (▲) and down (▼) keys).

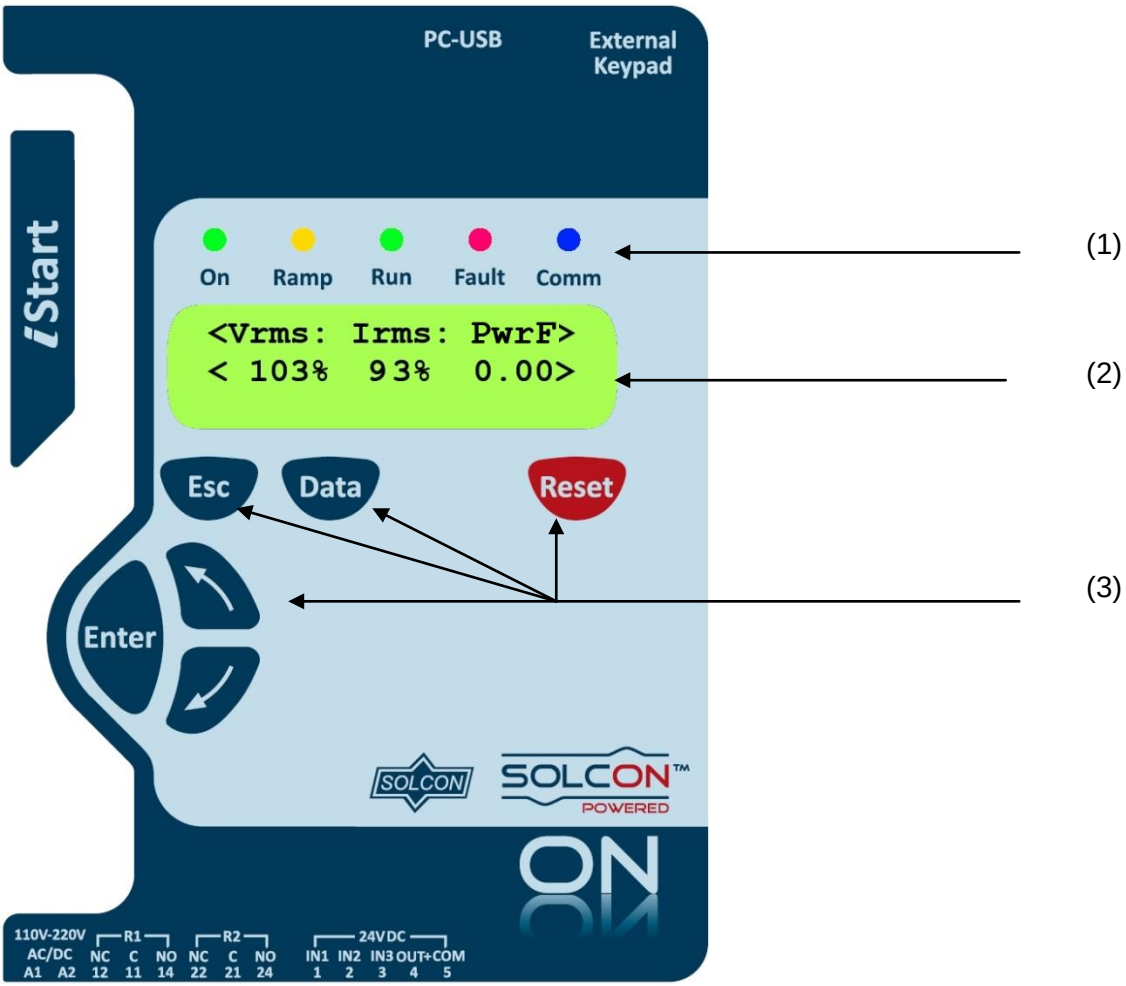


Figure 1 - iStart Control Keypad

6.1 LCD Arrangement

CURRENT LIMIT 390%

Upper line displays function.
Lower line displays setting and\or measured values.
< > indicates actual data in display mode.

6.2 Push-Buttons

Esc	• Exits the current menu and returns to the previous menu without save.
Data	• Toggles between the view of actual data and parameter settings. • Actual data appears inside arrow brackets as shown below. **<** Actual Data Type **>** **<** Actual Data Value **>** • Parameters are shown without arrow brackets. After a one minute timeout, the display returns to the actual data view.
▲	• Scrolls to the previous menu. • Allows the operator to increment adjusted values shown in the display. • Press this button once to increment one value, or continuously to rapidly increment values up to the maximum value.
▼	• Allows the operator to decrement adjusted values shown in the display. • Press this button once to decrement one value, or continuously to rapidly decrement values up to the minimum value.
Enter	• When a menu name is displayed, pressing this button drills down to the parameters for that menu. • When a parameter is displayed, pressing this button makes the parameter value editable (value blinks). Use the up/down arrows to change the value. • When the parameter value blinks, pressing Enter saves the parameter value.
Reset	• Resets the iStart after a fault has been dealt with **and** the start command has been removed (except for UNDERCURR. TRIP). This cancels the fault displayed and allows you to restart the motor.

6.3 Status LEDs

🟢	Green	*On*	Lights when the control supply voltage is connected to the iStart.
🟡	Yellow	*Ramp*	Lights during soft start, indicating that motor supply voltage is ramping up.
🟢	Green	*Run*	Lights after completion of the starting process, indicating that motor is receiving full voltage.
🔴	Red	*Fault*	Lights upon operation of any of the built-in protections. • Lights constantly when a trip occurs. • Blinks when a warning occurs.
🔵	Blue	*Comm*	Blinks when there is an active communication link.

6.4 Reviewing Parameters

- Press the **Data** key to toggle from actual data view to the parameter menus.
- Press **Esc** twice to get to the Main Parameters menu.
- Use the ▼ or ▲ keys to navigate to the parameter menu that you need.
- Press **Enter** to enter the menu.
- Use the ▼ or ▲ keys to navigate to the relevant parameter.

6.4.1 Modifying the Parameter

- Press **Enter** to enter to make the parameter value editable.
- Use the ▼ or ▲ keys to change the value.
- Press **Enter** to save the value.

6.5 Special Actions Performed in TEST/MAINTENANCE Mode

6.5.1 View Firmware Version/Version Date/Version CRC

- Press the **Data** key to toggle from actual data view to the parameter menus.
- Press **Esc** twice to get to the Main Parameters menu.
- Press and hold the ▼ key until you reach the last menu (TEST/MAINTENANCE).The LCD will display:

```
TEST/MAINTENANCE
    – **** –
```

6.5.1 Reset to Factory Default Parameters

- Press the **Data** key to toggle from actual data view to the parameter menus.
- Press **Esc** twice to get to the Main Parameters menu.
- Press and hold the ▼ key until you reach the last menu (TEST/MAINTENANCE).The LCD will display:

```
TEST/MAINTENANCE
– **** –
```

- Press **Enter**.
- Use the ▼ key to navigate to the RESET SETTING!!! menu. The LCD will display:

```
RESET SETTING!!!
ENTER TO DEFAULT
```

- Press **Enter** to enter the menu. The LCD will display:

```
RESET SETTING!!!
* * * N O * * *
```

- Press the ▲ key. The LCD will display:

```
RESET SETTING!!!
* * * Y E S * * *
```

- Press **Enter**. For a short interval, the LCD will display:

################	RESET SETTING!!!
################	SETTING DEFAULT

- Press **Esc**.

CAUTION!	RESET SETTING erases all previously modified settings and requires the operator to **reprogram** all parameters that differ from the factory default. **Note**: It is especially important to reprogram the RATED LINE VOLT. value again.

6.5.2 ***Reset Statistical Data***

- Press the **Data** key to toggle from actual data view to the parameter menus.
- Press **Esc** twice to get to the Main Parameters menu.
- Press the ▼ key until you reach the STATISTICAL DATA menu. The LCD will display:

```
STATISTICAL DATA
– **** –
```

- Press **Enter**.
- Use the ▼ key to navigate to the RESET STATISTICS!!! menu. The LCD will display:

```
RESET STATISTICS
ENTER TO RESET
```

- Press **Enter** to enter the menu. The LCD will display:

```
RESET SETTING!!!
* * * N O * * *
```

- Press the ▲ key. The LCD will display:

```
RESET SETTING!!!
* * * Y E S * * *
```

- Press **Enter**. For a short interval, the LCD will display:

```
RESET STATISTICS
SETTING DEFAULT
```

6.6 Overview of All Mode Pages and Factory Defaults[2]

MAIN PARAMETERS - **** -	START/STOP 1ST MOTOR[3]	START/STOP 2ND MOTOR	START/STOP 3RD MOTOR	START/STOP 4TH MOTOR[4]	SPECIAL FEATURES - **** -
Display and default values	Display and default values	Display and default values	Display and default values	Display and default values	Display and default values
SET LANGUAGE. ENGLISH	MOTOR FLA 44 AMP	MOTOR FLA 44 AMP	MOTOR FLA 44 AMP	MOTOR FLA 44 AMP	SLOW SPEED TORQ 0 MIN
STARTER FLC 44 AMP.	SOFT START CURVE 1 (STANDARD)	SOFT START CURVE 1 (STANDARD)	SOFT START CURVE 1 (STANDARD)	SOFT START CURVE 1 (STANDARD)	MAX SLOW TIME 30 SEC
CONNECTION TYPE LINE	PULSE TYPE PULSE DISABLE	PULSE TYPE PULSE DISABLE	PULSE TYPE PULSE DISABLE	PULSE TYPE PULSE DISABLE	SAVING ADJUST NO
RATED LINE VOLT 400 VOLT	PULSE VOLTAGE 50 % RATED VOLT	PULSE VOLTAGE 50 % RATED VOLT	PULSE VOLTAGE 50 % RATED VOLT	PULSE VOLTAGE 50 % RATED VOLT	EXTEND SETTING DISABLE
UNDER VOLTAGE 75% RATED VOLT	PULSE CURRENT 0 % FLA	PULSE CURRENT 0 % FLA	PULSE CURRENT 0 % FLA	PULSE CURRENT 0 % FLA	3 OR 2 PHASE 3 PHASE START
OVER VOLTAGE 110% RATED VOLT	PULSE RISE TIME 0.1 SEC	PULSE RISE TIME 0.1 SEC	PULSE RISE TIME 0.1 SEC	PULSE RISE TIME 0.1 SEC	
PHASE SEQUENCE IGNORE	PULSE CONST TIME 0.0 SEC	PULSE CONST TIME 0.0 SEC	PULSE CONST TIME 0.0 SEC	PULSE CONST TIME 0.0 SEC	
O/C - SHEAR PIN 400% FLA	PULSE FALL TIME 0.1 SEC	PULSE FALL TIME 0.1 SEC	PULSE FALL TIME 0.1 SEC	PULSE FALL TIME 0.1 SEC	
UNDER CURRENT 20 % FLA	INITIAL VOLTAGE 28 % RATED VOLT	INITIAL VOLTAGE 28 % RATED VOLT	INITIAL VOLTAGE 28 % RATED VOLT	INITIAL VOLTAGE 28 % RATED VOLT	
OVERLOAD CLASS IEC CLASS 10 %	INITIAL CURRENT 0 % FLA	INITIAL CURRENT 0 % FLA	INITIAL CURRENT 0 % FLA	INITIAL CURRENT 0 % FLA	
OVERLOAD PROTECT DISABLE	CURRENT LIMIT 400 % FLA	CURRENT LIMIT 400 % FLA	CURRENT LIMIT 400 % FLA	CURRENT LIMIT 400 % FLA	
MOTOR UNBALANCE 20 % FLA	ACCELERATE TIME 10 SEC	ACCELERATE TIME 10 SEC	ACCELERATE TIME 10 SEC	ACCELERATE TIME 10 SEC	
GROUND FAULT 20 % FLA	MAX START TIME 30 SEC	MAX START TIME 30 SEC	MAX START TIME 30 SEC	MAX START TIME 30 SEC	
NUMBER OF STARTS 10	SOFT STOP CURVE 1(STANDARD)	SOFT STOP CURVE 1(STANDARD)	SOFT STOP CURVE 1(STANDARD)	SOFT STOP CURVE 1(STANDARD)	
START PERIOD 10 MINUTE	DECELERATE TIME 30 SEC	DECELERATE TIME 30 SEC	DECELERATE TIME 30 SEC	DECELERATE TIME 30 SEC	
START INHIBIT 15 MINUTE	STOP FINAL TORQ 0(MIN)	STOP FINAL TORQ 0(MIN)	STOP FINAL TORQ 0(MIN)	STOP FINAL TORQ 0(MIN)	
DISPLAY MODE BASIC					
PARAMETERS LOCK LOCKED					

[2] Parameters that are available in Basic mode are in clear cells.
Parameters that are available in Professional and Expert mode, but not in Basic mode are in gray cells.
Parameters that are available in Expert mode only are in gray cells and highlighted.

[3] Basic mode only has one Start/Stop Motor menu. Professional has two and Expert has four.

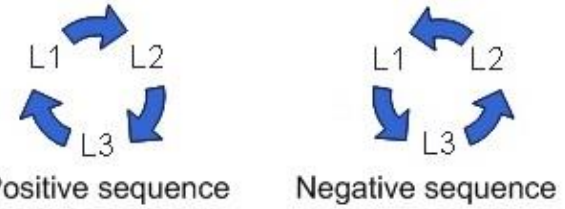
[4] START/STOP 4th MOTOR appears in Expert mode only.

FAULT PARAMETERS[5] - **** -	AUTORESET PARAMS[6] - **** -	I/O PROGRAMMING - **** -	COMM. PARAMETERS - **** -	GLOBAL PARAMETER - **** -	STATISTICAL DATA[7] - **** -
Display and default values	Display and default values	Display and default values	Display and default values	Display and default values	Display and default values
HS OVR TMP TRIP	GLOBAL AUTORESET DISABLE ALL	IN1 PROGRAMMING STOP	PROTOCOL MODBUS	SET TIME 00:00:00	TOTAL ENERGY
SHORT CIRC IGNORE	HS OVR TMP A.RESET DISABLE	IN1 STATE MAINTAIN OPEN	BAUD RATE 115200 BPS	SET DATE 01/01/2000	LAST STRT PERIOD
OVERLOAD TRIP	SHORT CIR A.RESET DISABLE	IN1 MIN ACTIVE 0.1 SEC	STOP BIT 1.0 BITS	DEFAULT DATA V/I/COS PHI	LAST STRT MAX I
UNDER CURR TRIP	OVERLOAD A.RESET DISABLE	IN1 MIN INACTIVE 0.1 SEC	PARITY CHECK NONE	LCD CONTRAST [********]	TOTAL RUN TIME
UNDER VOLT TRIP	UNDER CURR A.RESET DISABLE	IN2 PROGRAMMING SOFT STOP	SERIAL LINK NO.	LCD INTENSITY [********]	TOTAL # OF STRTS
OVER VOLT TRIP	UNDER VOLT A.RESET DISABLE	IN2 STATE MAINTAIN OPEN	COM CHANGE PARAM		LAST TRIP
PHASE LOSS TRIP	OVER VOLT A.RESET DISABLE	IN2 MIN ACTIVE 0.1 SEC	CMD VIA COMM NO		TRIP CURRENT
PHASE SEQ TRIP	PHASE LOSS A.RESET DISABLE	IN2 MIN INACTIVE 0.1 SEC	CMD VALID FOR 1.0 SEC		TOTAL # OF TRIPS
SHORTED SCR TRIP	PHASE SEQ A.RESET DISABLE	IN3 PROGRAMMING START	RESET CMD VALID NO		PREVIOUS TRIP -1
LNG STRT TM TRIP	SHORT SCR A.RESET DISABLE	IN3 STATE MAINTAIN CLOSE	COMM TIMEOUT 10.0SEC		PREVIOUS TRIP -2
SLOW SPD TM TRIP	LNG STRT TM A.RESET DISABLE	IN3 MIN ACTIVE 0.1 SEC	UPD COMM STEPS 1ST ACK THEN UPD		PREVIOUS TRIP -3
COMM T/O TRIP	SLW SPD TM A.RESET DISABLE	IN3 MIN INACTIVE 0.1 SEC			PREVIOUS TRIP -4
EXT FAULT TRIP	COMM T/O A.RESET DISABLE	INPUT POLICY VIA PRIORITY			PREVIOUS TRIP -5
WRNG PARAMS TRIP	EXT FAULT A.RESET DISABLE	INPUT PRIORITY IN1,IN2,IN3,COM			PREVIOUS TRIP -6
COMM FAILED TRIP	WRNG PARAMS A.RESET DISABLE	RLY1 ACTION FAULT			PREVIOUS TRIP -7
TOO MANY TRIP	COMM FAILED A.RESET DISABLE	RLY1 ON STATE ON=NO / OFF=NC			PREVIOUS TRIP -8
MTOR INSUL TRIP	TOO MANY A.RESET DISABLE	RLY1 ON DELAY 0.0 SEC			PREVIOUS TRIP -9
M OVR TMP TRIP	MTOR INSUL A.RESET DISABLE	RLY1 OFF DELAY 0.0 SEC			RESET STATISTICAL DATA
WRONG FREQ TRIP	M OVR TMP A.RESET DISABLE	RLY2 ACTION END OF ACC			
M.UNBALANCE TRIP	WRONG FREQ A.RESET DISABLE	RLY2 ON STATE ON=NO / OFF=NC			
GND FAULT TRIP	NO VOLTAGE A.RESET DISABLE	RLY2 ON DELAY 0.0 SEC			
NO CURRENT TRIP	M.UNBALANCE A.RESET DISABLE	RLY2 OFF DELAY 0.0 SEC			
NO CTR PWR TRIP	GND FAULT A.RESET DISABLE				
OVER CURR TRIP	NO CURRENT A.RESET DISABLE				
SHEAR PIN TRIP	NO CTR PWR A.RESET DISABLE				
	OVER CURR A.RESET DISABLE				

[5] There are three separate parameters for each FAULT PARAMETERS listing: FLT, DLY and AFTR.
[6] There are seven separate parameters for each AUTORESET PARAMS listing: MODE, TRY, 1ST, DLY, SLVD, TRY0, RNEN.
[7] Parameter viewed only when used.

FAULT PARAMETERS[5] - **** -	AUTORESET PARAMS[6] - **** -	I/O PROGRAMMING - **** -	COMM. PARAMETERS - **** -	GLOBAL PARAMETER - **** -	STATISTICAL DATA[7] - **** -
	SHEAR PIN A.RESET DISABLE				

6.6.1 *Main Parameters – page 1*

MAIN PARAMETERS - **** -			
Display and default values	**Range**	**Description**	**Remarks**
SET LANGUAGE: ENGLISH	SPANISH GERMAN FRENCH ENGLISH TURKCE RUSSIAN (Optional)	Sets Starter's language	
STARTER FLC 44 AMP	N/A	Displays the FLC (Full load current)	This parameter is not configurable.
CONNECTION TYPE LINE	LINE, INSIDE DELTA	Sets Starter's connection type.	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. Refer to section 3.5.2 on page 14 for further information
RATED LINE VOLT 400 VOLT	208-600V 190-600V	Sets rated LINE VOLTAGE.	The maximum rated voltage depends on the rated voltage of the iStart.
UNDER VOLTAGE 75% RATED VOLT	50-90%	Trips the iStart when line voltage drops below the % defined.	
OVER VOLTAGE 110% RATED VOLT	109-125%	Trips the iStart when line voltage increases above the % defined.	
PHASE SEQUENCE IGNORE	POSITIVE/ NEGATIVE/ IGNORE		Sets the PHASE SEQUENCE of the soft starter. Allows to start the motor in POSITIVE sequence of the mains OR in the NEGATIVE sequence of the mains or, when set to IGNORE, in both sequences. 

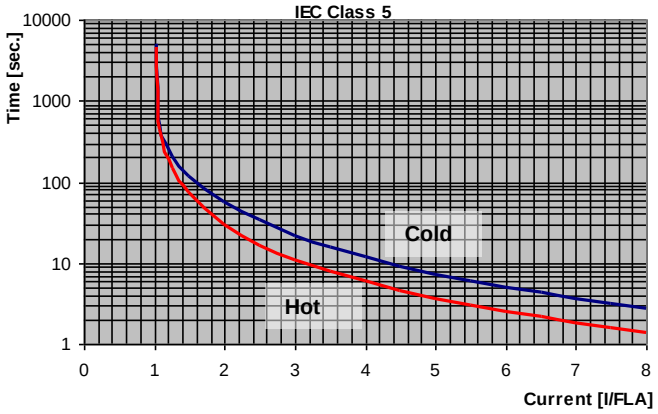
<table>
<tr><td>MAIN PARAMETERS
- **** -</td><td colspan="3"></td></tr>
<tr><td>Display and default values</td><td>Range</td><td>Description</td><td>Remarks</td></tr>
<tr><td>O/C SHEAR PIN
400% FLA</td><td>100%-400%
<u>Note:</u>
The range of the INITIAL VOLTAGE can be extended to 850% by using the EXTEND SETTING.</td><td>Sets OVERCURRENT SHEAR PIN protection.</td><td>Operational during run time only.
<u>Note:</u>
This protection is not intended to replace fast acting fusser to protect from short current!</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>UNDER CURRENT
20 % FLA</td><td>0%-90%</td><td>Sets minimum allowed current.</td><td>Operational during run time only.
If the current drops to this level a trip will occur.</td></tr>
<tr><td>OVERLOAD CLASS
IEC CLASS 10</td><td>IEC CLASS 5/
IEC CLASS 10/
IEC CLASS 20/
IEC CLASS 30/
NEMA CLASS 5/
NEMA CLASS 10/
NEMA CLASS 20/
NEMA CLASS 30/</td><td>Sets OVERLOAD curve.</td><td>Sets OVERLOAD CLASS characteristics
Sets OVERLOAD PROTECT functionality.
The iStart allows motor protection according to IEC class 5 or 10 or according to NEMA class 10, 20 or 30.
Tripping curves are shown in section 6.6.1.2 on page 33.
The OVERLOAD protection incorporates a THERMAL CAPACITY register that calculates heating minus dissipation of the motor.
The iStart trips when the register fills up. (THERMAL CAPACITY=100%)
The time constant, in seconds, for cool down after overload trip is:
<table>
<tr><th>Class</th><th>10</th><th>20</th><th>30</th></tr>
<tr><td>IEC</td><td>320</td><td>640</td><td>-</td></tr>
<tr><td>NEMA</td><td>280</td><td>560</td><td>840</td></tr>
</table>
</td></tr>
<tr><td>OVERLOAD PROTECT
DISABALE</td><td>DISABLE/
ENABLE WHILE RUN/
ENABLE ALWAYS</td><td></td><td>The overload protection can be set to protect the motor as set in the OVERLOAD PROTECT parameter:
ENABLE ALWAYS – motor is protected at all time.
ENABLE WHILE RUN – motor is protected only when in Run.
DISABLE – motor is not overload protected by the soft starter.
<u>Note:</u>
In order to restart after OVERLOAD trip, the thermal register should be 50% or less.</td></tr>
<tr><td>MOTOR UNBALANCE
20 % FLA</td><td>10 - 100 % of Motor FLA.
Increments of 1%</td><td>Sets the motor unbalance protection</td><td>Current unbalance is the ratio between the highest and lowest current of the motor.
Unbalance = I_2 / I_1 (Limited to: Unbalance <= 100%)
Where: I_2 = highest current, I_1= lowest current .</td></tr>
<tr><td>GROUND FAULT
20 % FLA</td><td>1 – 60% of FLA.
Increments of 1%</td><td>Sets the allowed ground fault level</td><td>iStart calculates the sum of I_1, I_2 and I_3. A trip occurs when the ground fault exceeds the GROUND FAULT LEVEL</td></tr>
</table>

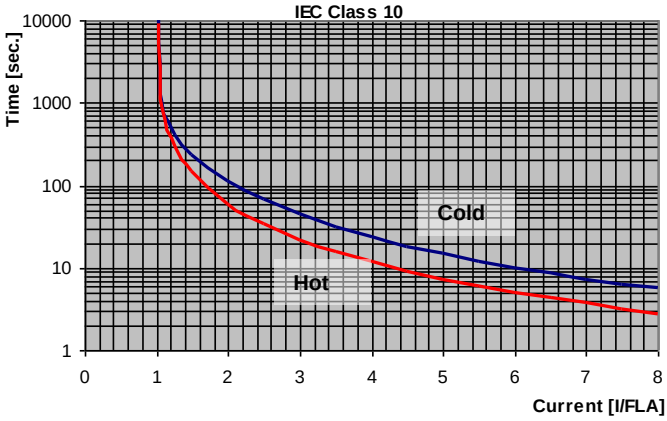
MAIN PARAMETERS - **** -			
Display and default values	**Range**	**Description**	**Remarks**
NUMBER OF STARTS 10 START PERIOD 10 START INHIBIT 15 MINUTE	Off, 1-10 1-60 minutes 1-60 minutes	These three parameters work together to set the number of starts allowed during a defined time period	If NUMBER OF STARTS is off, then there is no limit. When a NUMBER OF STARTS is set, then START PERIOD sets the length of time during which you cannot exceed the NUMBER OF STARTS. If you reach the NUMBER OF STARTS during the START PERIOD, iStart waits the START INHIBIT time until it allows the next start.
DISPLAY MODE BASIC	BASIC PROFESSIONAL EXPERT	Sets the display mode	EXPERT is visible only while in Professional or Expert display mode To go from Basic to Expert, you must first change to Professional mode. **WARNING!** **Operator's Responsibility!** Expert mode allows settings that can damage the starter and the motor.
PARAMETERS LOCK LOCKED	LOCKED/ NOT LOCKED	Locks or unlocks parameter modifications.	The software lock prevents undesired parameter modification. When locked, the LCD displays the following when you press **Enter** or the▼ ▲ keys: UNAUTHORIZED ACCESS

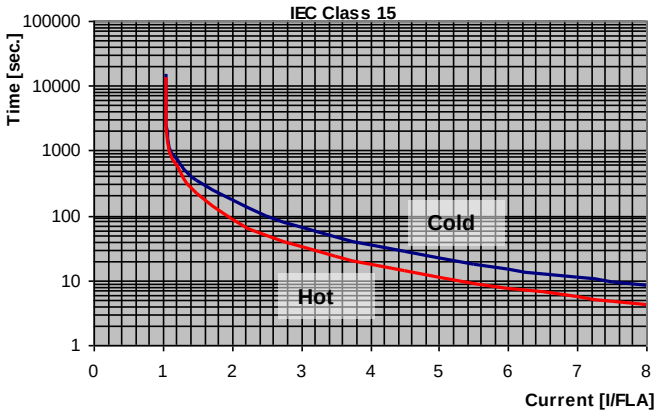
6.6.1.1 Tripping Curves of the Integrated Overcurrent Protection

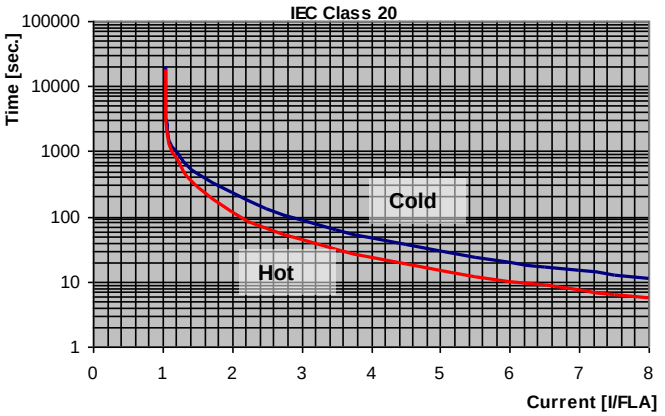
The iStart allows motor protection according to IEC class C1, C2, C3, C4 or C5 (TD = 0.05 – 1.00) OR according to NEMA class U1, U2, U3, U4 or U5 (TD = 0.50 – 15.00).

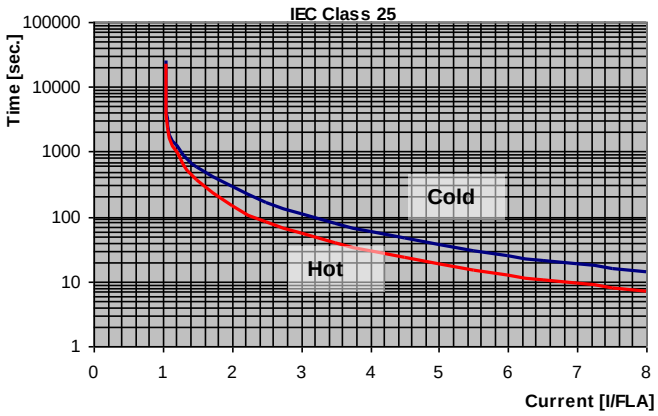
IEC Class OVERCURRENT curves

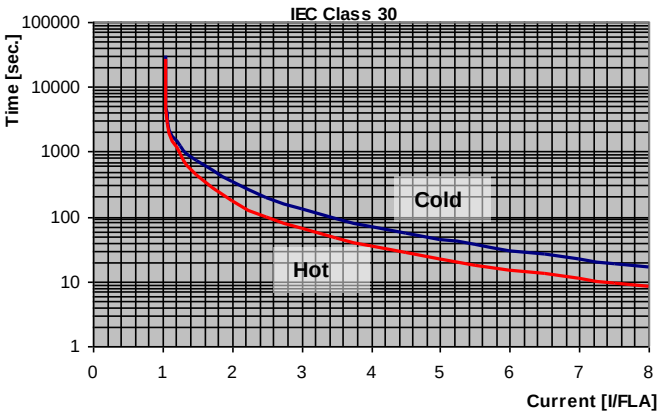




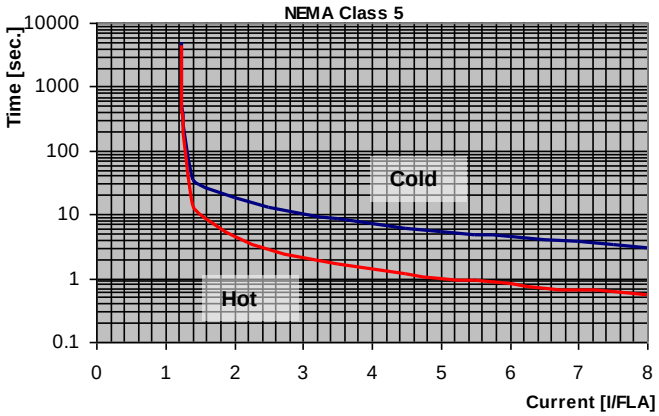


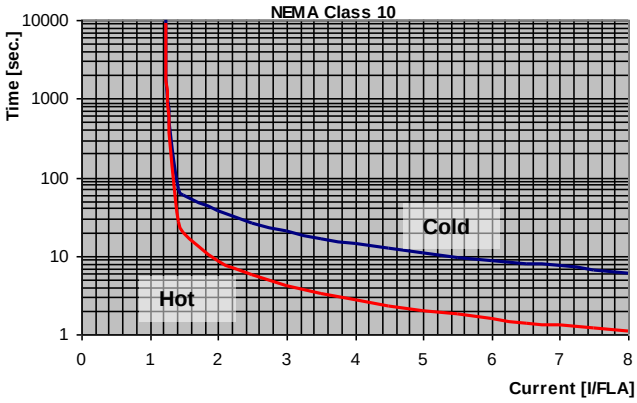


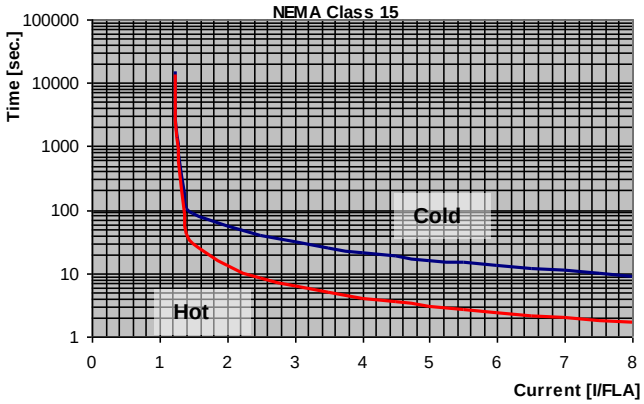


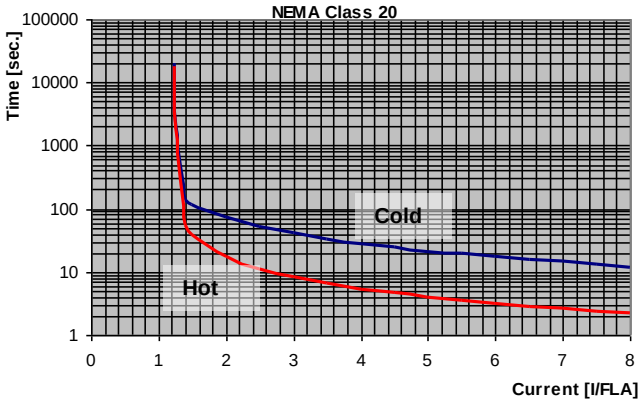


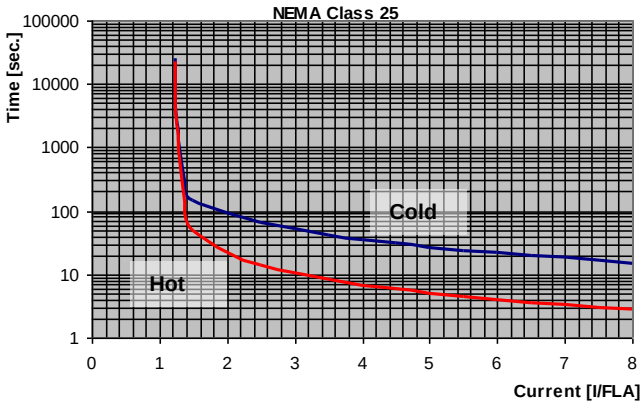
NEMA Class OVERCURRENT curves

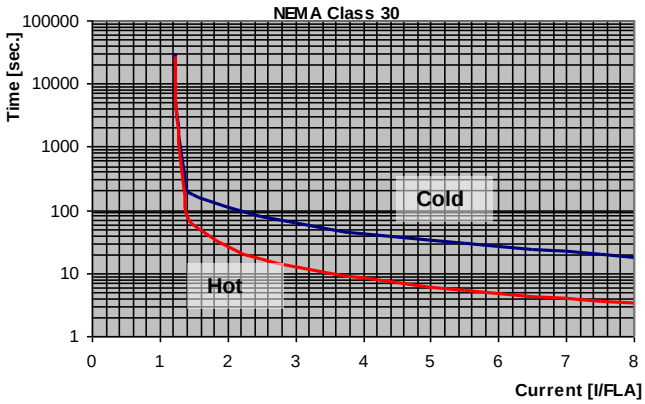








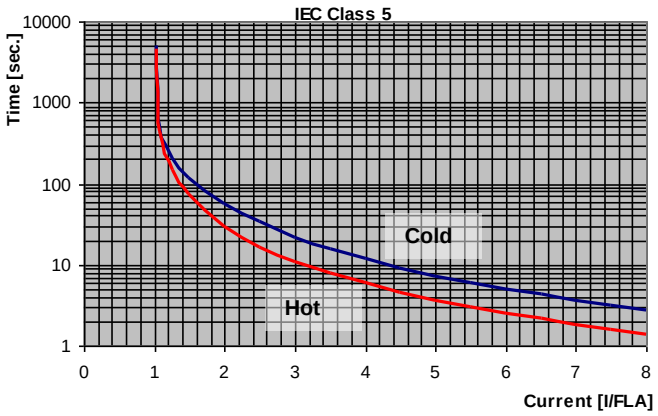


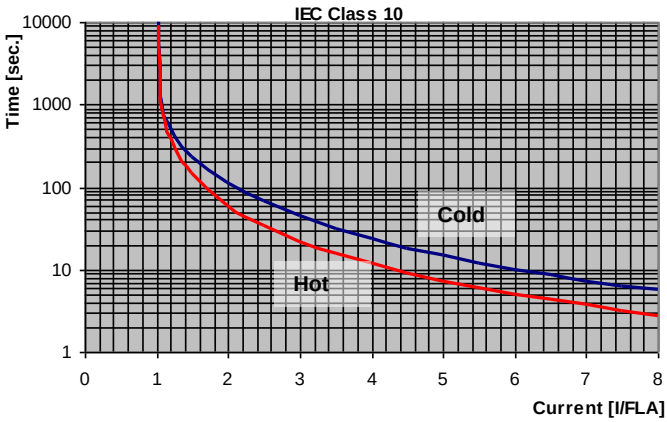


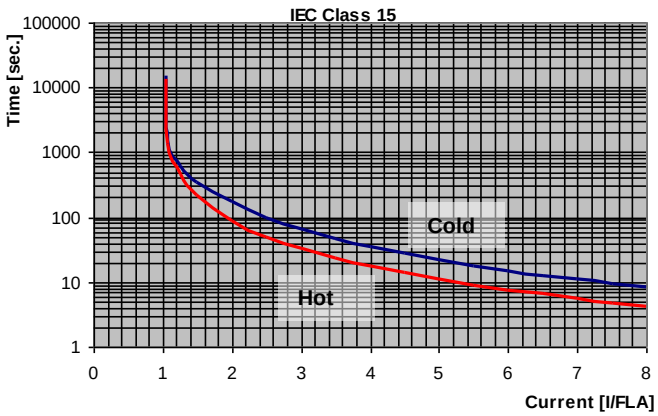
6.6.1.2 Tripping Curves of the Integrated Overload Protection

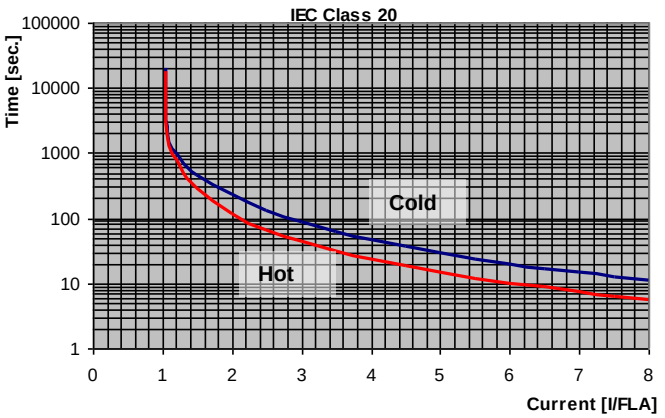
The iStart allows motor protection according to IEC class 5, 10, 15, 20, 25 or 30 OR according to NEMA class 5, 10, 15, 20, 25 or 30.

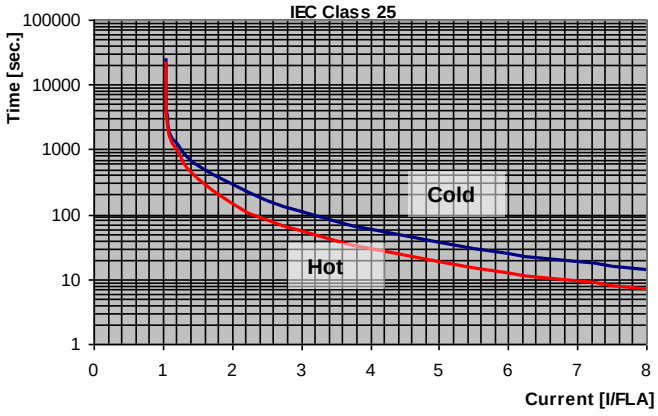
IEC Class OVERLOAD curves

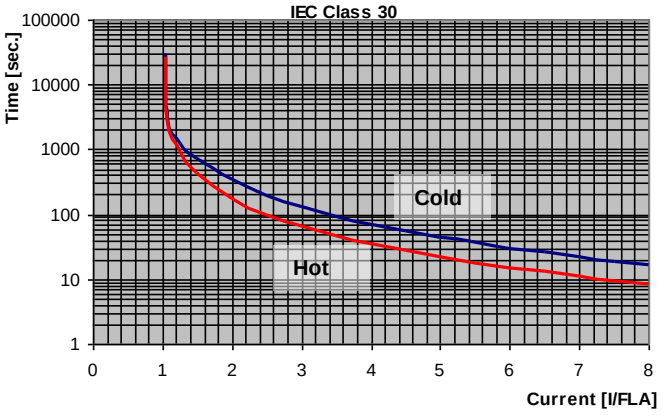




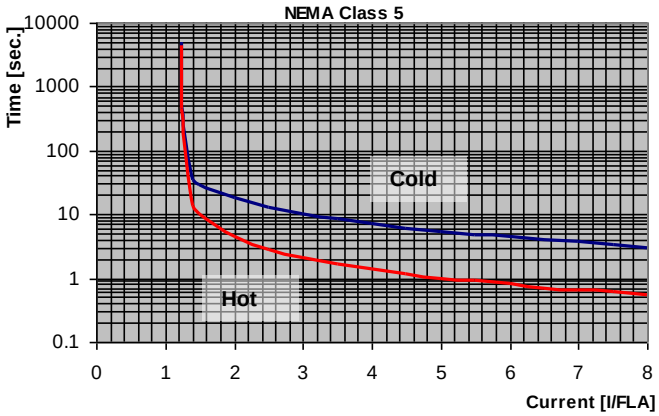


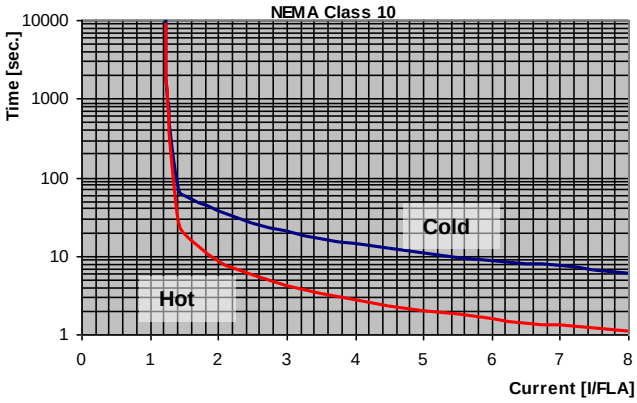


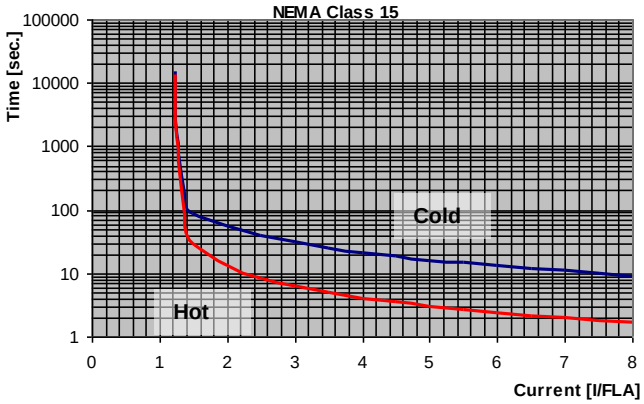


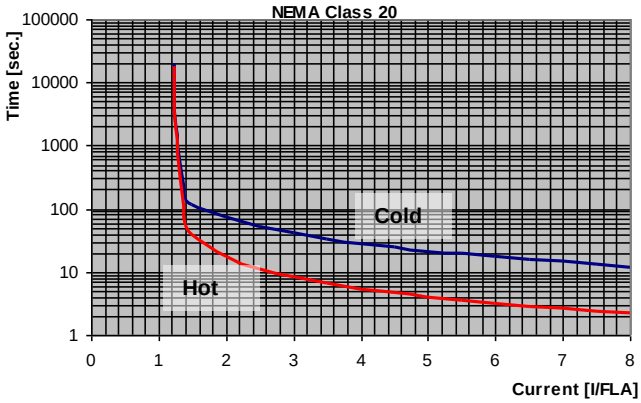


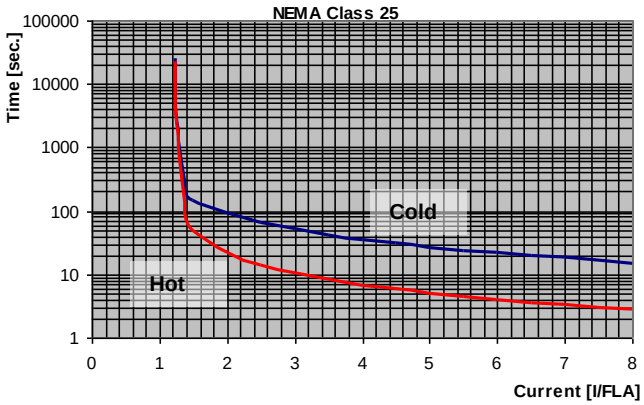
NEMA Class OVERLOAD curves

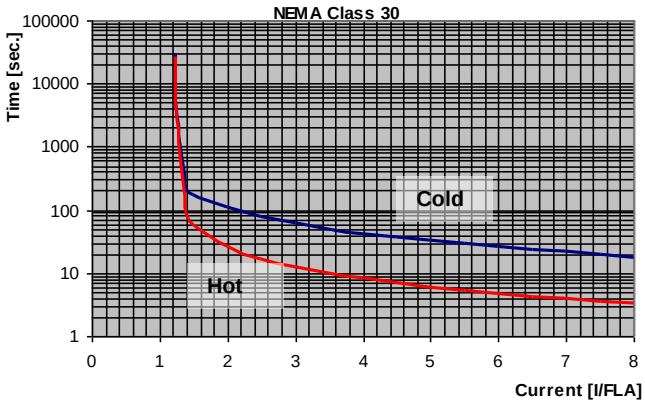








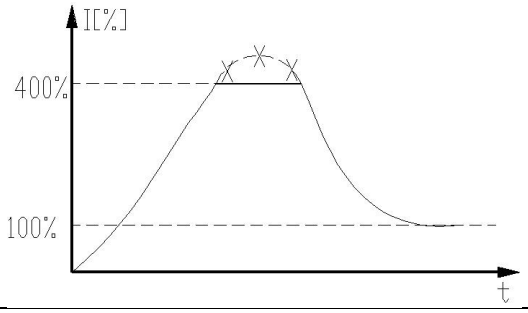


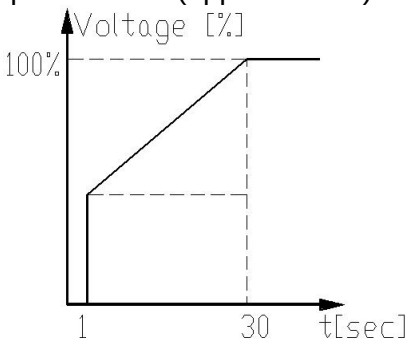
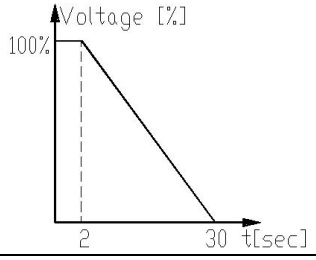


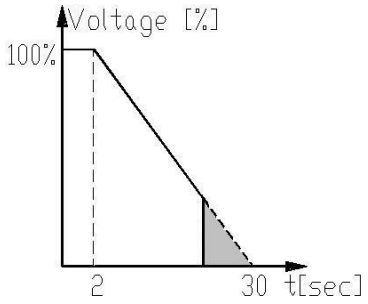
6.6.2 *Start/Stop Motor[8] – page 2 of Basic (pages 2-3 of Professional, pages 2-5 of Expert)*

START/STOP MOTOR			
Display and default values	**Range**	**Description**	**Remarks**
MOTOR FLA 44 AMP	50%-100% of STARTER FLC	Sets iSTART's FLA (Full Load Ampere)	Should be programmed as shown on the motor's name plate. **Note:** When the iStart is installed Inside Delta, set MOTOR FLA = <*rated motor current*>/1.73.
SOFT START CURVE 1(STANDARD)	9 !! - DOL - !! 5 !! TORQUE !! 4 !! PUMP 3 !! 3 !! PUMP 2 !! 2 !! PUMP 1 !! 1 – STANDARD - 0 !! GENERATOR !!	Sets starter's SOFT START CURVE.	When iStart is connected "Inside-Delta", only CURVE 1 is applied.
PULSE TYPE PULSE DISABLE	CURRENT PULSE E. VOLTAGE PULSE E. VOLTAGE DISABLE		**Expert only.**
PULSE VOLT 0% RATED VOLT	50-99% RATED VOLT		**Expert only**.
PULSE CURRENT 0% FLA	0-700% FLA		**Expert only**.
PULSE RISE TIME 0.1 SEC	0 – 5.0 SEC.		**Expert only**.
PULSE CONST TIME 0.0 SEC	0 – 10.0 SEC.	Sets starter's PULSE START TIME. PULSE START level is 80% Un.	**Expert only**. Intended to start high friction loads, requiring high starting torque for a short time. **Note:** When iStart is connected "Inside-Delta", PULSE START can not be activated.
PULSE FALL TIME 0.1 SEC	0 – 5.0 SEC.		**Expert only**.
INITIAL VOLTAGE 10 % RATED VOLT	28-45% **Note:** The range of the INITIAL VOLTAGE can be extended to 25-60% by using the EXTEND SETTING.	Sets the starting voltage of the motor. The motor's **torque** is directly proportional to the square of the voltage.	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, because the INITIAL VOLTAGE setting overrides CURRENT LIMIT setting). A setting that is too low may result in prolonged time until the motor begins to turn. In general, this setting should ensure that the motor begins turning immediately after the start signal.

[8] Parameters that are available in Basic mode are in clear cells.
Parameters that are available in Professional and Expert mode, but not in Basic mode are in gray cells.
Parameters that are available in Expert mode only are in gray cells and highlighted.

START/STOP MOTOR			
Display and default values	**Range**	**Description**	**Remarks**
INITIAL CURRENT 0 % FLA	0-400%	Sets the starting current of the motor.	**Professional and Expert only**.
CURRENT LIMIT 400 % FLA	100-400% **Note:** The range of the CURRENT LIMIT can be extended to 70-400% by using the EXTEND SETTING as described in section as described in section 6.6.3.1 on page 42.	Sets motor's highest current during starting.	A high setting that is too will cause greater current to be drawn from mains and faster acceleration. A setting that is too low may prevent the motor from completing the acceleration process and reaching full speed. In general, this setting should be set to a high enough value to prevent stalling. **Note:** CURRENT LIMIT does not operate during Run and Soft stop. 

START/STOP MOTOR			
Display and default values	**Range**	**Description**	**Remarks**
ACCELERATE TIME 10 SEC	1-30sec. **Note:** Range can be extended to 1-90sec. by using the EXTEND SETTING.	Sets ACCELERATION TIME of the motor.	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:** Since CURRENT LIMIT overrides ACCELERATE TIME, when CURRENT LIMIT is set low, starting time will be longer than the preset ACCELERATE TIME. When motor reaches full speed before voltage reaches nominal, ACCELERATE TIME setting is overridden, causing voltage to quickly ramp-up to nominal. Using starting curves 2, 3, 4 prevents quick ramp up.
MAX START TIME 30 SEC	1-30sec. **Note:** Range can be extended to 1-250sec.by using the EXTEND SETTING.	Sets MAXIMUM START TIME	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.
SOFT STOP CURVE 1(STANDARD)	9 !! - DOL - !! 5 !! TORQUE !! 4 !! PUMP 3 !! 3 !! PUMP 2 !! 2 !! PUMP 1 !! 1 – STANDARD - 0 !! GENERATOR !!	Sets starter's SOFT STOP CURVE.	Refer to section 6.6.2.2 on page 40
DECELERATE TIME 30 SEC	0 – 30sec. **Note:** Range can be extended to 90sec. by using the EXTEND SETTING.	Sets DECELERATION TIME of the motor.	Used for controlled deceleration of high friction loads. Determines motor's voltage ramp down time. 

START/STOP MOTOR			
Display and default values	**Range**	**Description**	**Remarks**
STOP FINAL TORQUE 0 (MIN)	0(MIN) - 10(MAX)	Sets FINAL TORQUE during Soft Stop.	Determines torque towards end of SOFT STOP. If current is still flowing after speed is softly reduced to zero, increase FINAL TORQUE setting. 

6.6.2.1 Soft Start Parameters

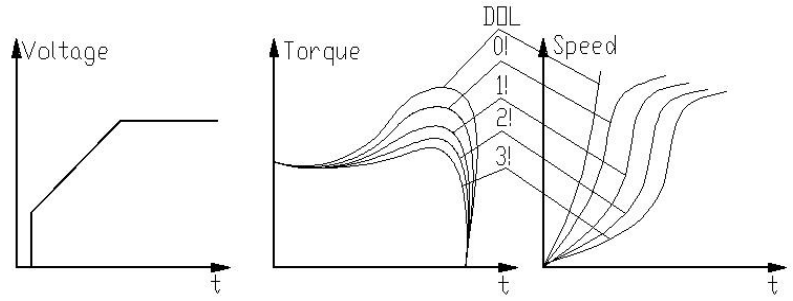
The iStart incorporates 5 “Starting Curves”, enabling selection of the suitable torque curve.

Start Curve 0 – Only use curve 0 when a SHORTED SCR fault occurs **and** only after you tested and made sure that the SCRs, motor and motor connections are not faulty.

Start Curve 1 – Standard curve (default). The most stable and suitable curve for the motor, prevents prolonged starting and motor overheating.

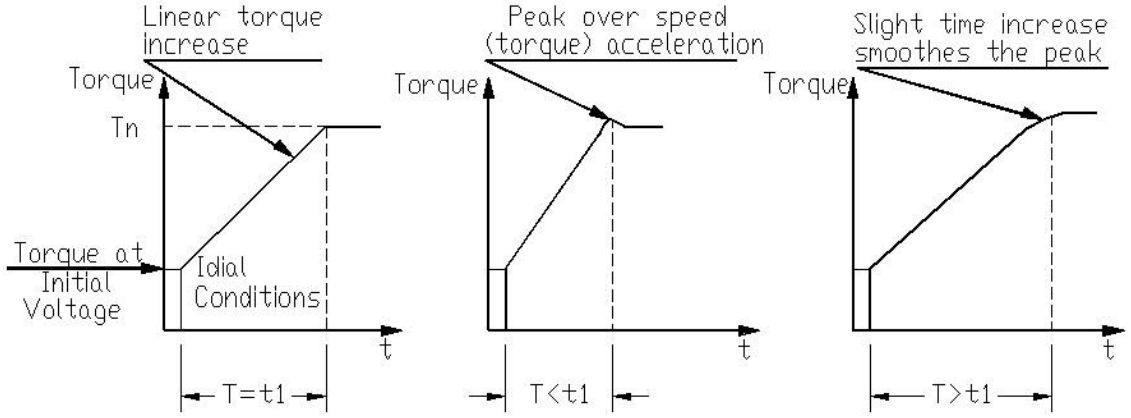
Note:
When iStart is connected “Inside-Delta”, only CURVE 1 is applied.

Start curves 2-4 - “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 2, 3, 4 – During acceleration, before reaching peak torque, the Pump Control Program automatically controls the voltage ramp-up, thereby reducing peak torque.



Choice of three pump control acceleration curves: 1!, 2!, 3!, 4!

Start Curve 5 (Torque) – Torque Controlled acceleration, provides a smooth time controlled torque ramp for the motor and the pump.



Start Curve 9 (DOL) – Direct Online closes the bypass and connects the motor directly.

Note:
Always start with Start Curve 1. If towards end of acceleration, peak torque is too high (pressure is too high), proceed to Curve 2, 3, 4 or 5.

6.6.2.2 Soft Stop Parameters

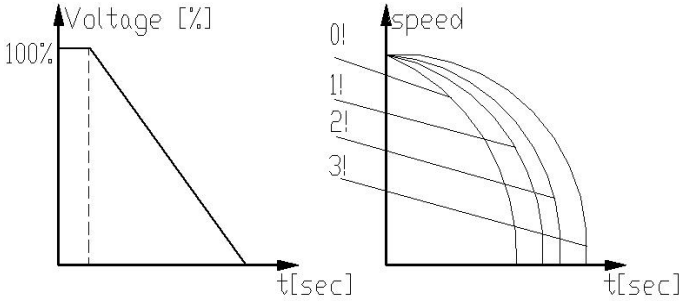
The iStart incorporates 5 “Starting Curves”, enabling selection of the suitable torque curve.:

Start Curve 0 – Only use curve 0 when a SHORTED SCR fault occurs **and** only after you tested and made sure that the SCRs, motor and motor connections are not faulty.

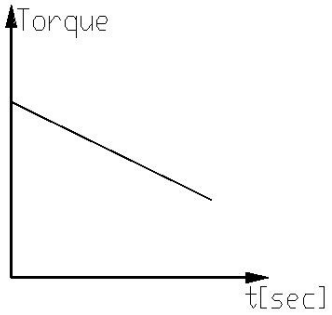
Stop Curve 1 – Standard curve (default) – voltage is linearly reduced from nominal to zero.
This is the most stable and suitable curve for the motor, preventing prolonged stopping and motor overheating.

Stop curves 2, 3, 4 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.
During the deceleration process, when voltage is decreasing, motor torque can fall below load torque abruptly (instead of smoothly decreasing speed to zero), thus closing the valve and causing Water Hammer.
Curves 2, 3 and 4 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 you use Stop Curve 1 for all standard applications (not pumps).
To reduce Water Hammer, select STOP CURVE 2, than 3 or 4.



Curve 5 - Torque Curve - Provides linear deceleration of the torque. In certain loads, linear torque deceleration can result in close to linear speed deceleration.
The iStart Torque Control does not require any external torque or speed sensor (tacho-gen., etc.).



Curve 9 (DOL) – Direct Online closes the bypass and connects the motor directly.

WARNING!	When operating in SOFT START CURVE 1 motor must be loaded, otherwise, vibration may occur towards the end of the soft start process.

6.6.3 *Special Features[9] – page 6 of Professional and Expert Only*

SPECIAL FEATURES PARAMETERS			
Display and default values	**Range**	**Description**	**Remarks**
SLOW SPEED TORQ 0 MIN	1(MIN) – 10(MAX)	Sets SLOW SPEED TORQUE.	**Note:** When iStart is connected "Inside-Delta" SLOW SPEED TORQUE is not available.
MAX SLOW TIME 30 SEC	1–30sec. **Note:** Range can be extended to 250sec. by using the EXTEND SETTING.	Sets maximum time for SLOW SPEED TORQUE operation.	
SAVING ADJUST NO	YES/ NO		
EXTEND SETTING DISABLE	DISABLE/ ENABLE	Enables wider range of parameter settings.	**For use in very special occurrences.** **Do not set to ENABLE unless starter is significantly larger then motor**! See the detailed explanation on the next page.
3 OR 2 PHASE 3 PHASE START	3 PHASE START IGNOR PHASE 1 IGNOR PHASE 2 IGNOR PHASE 3	Defines which phases to use.	If there is a problem with one of the phases, you can short-circuit the problematic phase and set iStart to ignore that phase (operate in 2-phase mode).

[9] Parameters that are available in Basic mode are in clear cells.
Parameters that are available in Professional and Expert mode, but not in Basic mode are in gray cells.
Parameters that are available in Expert mode only are in gray cells and highlighted.

6.6.3.1 Extend Setting

Parameter	EXTEND SETTING Disabled	EXTEND SETTING Enabled
INITIAL VOLTAGE	28-45%	25-60%
CURRENT LIMIT	100-400%	70-400%
ACCELERATION TIME	1-30 seconds	1-90 seconds
DECELERATION TIME	0-30 seconds	0-90 seconds
MAX. START TIME	1-30 seconds	1-250 seconds
PHASE LOSS Y/N	Yes(1)	Yes/No(1)
MAX SLOW TIME	1-30 seconds	1-250 seconds
O/C or WRONG CON protection in Inside Delta mode.	Protection active in normal set(2)	Protection active in high set(2)
OVERLOAD TRIP protection.	OVERLOAD TRIP will be active after Run LED is Lit. (Motor is at full voltage) (3)	OVERLOAD TRIP will be active after MAX. START TIME has elapsed. (3)

Notes:

(1) Refer to section 6.6.3.2 on page 43. See PHASE LOSS protection and refer to the warning below.

(2) Refer to section 8 on page 65. See O/C or WRONG CON protection.

(3) In order to avoid OVERLOAD TRIP in special cases (very high inertia loads), where at the end of the acceleration process, although motor is at full voltage (the **Run** LED is lit) and the current does not reduce to nominal, set EXTEND SETTING to ENABLE causing the OVERLOAD TRIP to be active only after MAX. START TIME has elapsed.

WARNING! **Operator's Responsibility!**	1. EXTEND SETTING is for use in very special applications only! **Do not** set EXTEND SETTING to ENABLE unless iStart is significantly larger than the motor! When you use EXTEND SETTING for the iStart, **you must** be extremely careful to avoid damaging the motor or iStart. 2. Only cancel PHASE LOSS protection when the operator is sure that no real phase loss exists and PHASE LOSS protection is activated. This situation can occur in rare cases when there is no real fault, but the iStart recognizes unusual behaviour, like when THDV (Total Harmonic Distortion in Voltage) in the network is high. If this is a true case of PHASE LOSS, then after you cancel PHASE LOSS protection the motor will single phase and most likely be tripped by the overload protection mechanism.

6.6.3.2 2 Phase Operation

To move to 2 phase operation, you must perform the following actions:

- Short between mains and the motor the phase that you want to short as follows:

Phase to Short	Connection on the iStart
Phase 1	1L1 to 2T1
Phase 2	3L2 to 4T2
Phase 3	5L3 to 6T3

- Enter the SPECIAL FEATURES menu and set 3 OR 2 PHASE to ignore the phase that you disconnected.
- Enter the START/STOP MOTOR menu and set SOFT START CURVE to 0, then set the SOFT STOP CURVE to 0. If there is more than one motor connected to the iStart, repeat in all of the START/STOP MOTOR menus.
- Enter the FAULT PARAMETERS menu and set M.UNBALANCE FLT to IGNORE.
- While still in the FAULT PARAMETERS menu, set GND FAULT FLT to IGNORE.
- Start each of the motors and make sure that they start. If you forgot a step, the start will ramp up, but not complete.

6.6.4 *Fault Parameters[10] – Page 3 of Basic (page 5 of Professional and page 7 of Expert)*

FAULT PARAMETERS - **** -		
Display and Default Values	**Range**	**Description**
HS OVR TMP FLT TRIP	IGNORE TRIP WARNING TRIP + WARNING	This parameter determines what to do if the temperature of the heat sink in the iStart exceeds the maximum allowed.
HS OVR TMP DLY 0.1 SEC	0.1 – 60.0 SEC	The time needed to enter the fault state.
HS OVR TMP AFTR 0.1 SEC	0.1 – 60.0 SEC	The time needed to exit the fault state.
SHORT CIRC FLT IGNORE	IGNORE TRIP WARNING TRIP + WARNING	This parameter determines what to do if there is a short circuit.
SHORT CIRC DLY 0.1 SEC	0.1 – 60.0 SEC	The time needed to enter the fault state.
SHORT CIRC AFTR 0.1 SEC	0.1 – 60.0 SEC	The time needed to exit the fault state.
OVERLOAD FLT TRIP	IGNORE TRIP WARNING TRIP + WARNING	This parameter determines what to do if there is an overload.
OVERLOAD DLY 0.1 SEC	0.1 – 60.0 SEC	The time needed to enter the fault state.
OVERLOAD AFTR 0.1 SEC	0.1 – 60.0 SEC	The time needed to exit the fault state.
UNDER CURR FLT TRIP	IGNORE TRIP WARNING TRIP + WARNING	This parameter determines what to do if there is an under current state.
UNDER CURR DLY 5.0 SEC	0.1 – 60.0 SEC	The time needed to enter the fault state.
UNDER CURR AFTR 0.1 SEC	0.1 – 60.0 SEC	The time needed to exit the fault state.
UNDER VOLT FLT TRIP	IGNORE TRIP WARNING TRIP + WARNING	This parameter determines what to do if there is an under volt state.
UNDER VOLT DLY 5.0 SEC	0.1 – 60.0 SEC	The time needed to enter the fault state.
UNDER VOLT AFTR 0.1 SEC	0.1 – 60.0 SEC	The time needed to exit the fault state.
OVER VOLT FLT TRIP	IGNORE TRIP WARNING TRIP + WARNING	This parameter determines what to do if there is an over volt state.

[10] Parameters that are available in Basic mode are in clear cells.
Parameters that are available in Professional and Expert mode, but not in Basic mode are in gray cells.
Parameters that are available in Expert mode only are in gray cells and highlighted.

FAULT PARAMETERS - **** -		
Display and Default Values	**Range**	**Description**
OVER VOLT DLY 0.1 SEC	0.1 – 60.0 SEC	The time needed to enter the fault state.
OVER VOLT AFTR 0.1 SEC	0.1 – 60.0 SEC	The time needed to exit the fault state.
PHASE LOSS FLT TRIP	IGNORE TRIP WARNING TRIP + WARNING	This parameter determines what to do if 1 or 2 phases are missing. **Notes:** If iStart trips on PHASE LOSS do the following: (1) Verify that phase voltages are within the required range of the voltages. (2) If you are sure that no real phase loss exists, you can set PHASE LOSS to WARNING or IGNORE. This situation can occur in rare cases when there is no real fault but the iStart recognizes unusual behaviour like when Total Harmonic Distortion in Voltage (THDV) in the network is high. (3) If this is a true case of PHASE LOSS, then after setting PHASE LOSS to WARNING or IGNORE, the motor will single phase and most likely be tripped by the over load protection mechanism. (4) Phase loss might not be detected in a motor operating under a light load.
PHASE LOSS DLY 0.1 SEC	0.1 – 60.0 SEC	The time needed to enter the fault state.
PHASE LOSS AFTR 0.1 SEC	0.1 – 60.0 SEC	The time needed to exit the fault state.
PHASE SEQ FLT TRIP	IGNORE TRIP WARNING TRIP + WARNING	This parameter determines what to do if there is a fault with the sequence of the phases.
PHASE SEQ DLY 0.1 SEC	0.1 – 60.0 SEC	The time needed to enter the fault state.
PHASE SEQ AFTR 0.1 SEC	0.1 – 60.0 SEC	The time needed to exit the fault state.
SHORTED SCR FLT TRIP	IGNORE TRIP WARNING TRIP + WARNING	This parameter becomes operational after the START signal. It determines what to do if one of these occur: • The motor is not properly connected to the starter's load terminals. • When internal disconnection in the motor winding is detected. • When one or more SCRs have been shorted.
SHORTED SCR DLY 0.1 SEC	0.1 – 60.0 SEC	The time needed to enter the fault state.
SHORTED SCR AFTR 0.1 SEC	0.1 – 60.0 SEC	The time needed to exit the fault state.
LNG STRT TM FL TRIP	IGNORE TRIP WARNING TRIP + WARNING	This parameter determines what to do if there is a long start.
LNG STRT TM DLY 0.1 SEC	0.1 – 60.0 SEC	The time needed to enter the fault state.

FAULT PARAMETERS - **** -		
Display and Default Values	**Range**	**Description**
LNG STRT TM AFTR 0.1 SEC	0.1 – 60.0 SEC	The time needed to exit the fault state.
SLOW SPD TM FLT TRIP	IGNORE TRIP WARNING TRIP + WARNING	This parameter determines what to do if the motor speed is too slow.
SLOW SPD TM DLY 0.1 SEC	0.1 – 60.0 SEC	The time needed to enter the fault state.
SLOW SPD TM AFTR 0.1 SEC	0.1 – 60.0 SEC	The time needed to exit the fault state.
COMM T/O FLT TRIP	IGNORE TRIP WARNING TRIP + WARNING	This parameter determines what to do if a communication timeout causes a fault.
COMM T/O DLY 0.1 SEC	0.1 – 60.0 SEC	The time needed to enter the fault state.
COMM T/O AFTR 0.1 SEC	0.1 – 60.0 SEC	The time needed to exit the fault state.
EXT FAULT FLT TRIP	IGNORE TRIP WARNING TRIP + WARNING	This parameter determines what to do if there is an external trip.
EXT FAULT DLY 0.1 SEC	0.1 – 60.0 SEC	The time needed to enter the fault state.
EXT FAULT AFTR 0.1 SEC	0.1 – 60.0 SEC	The time needed to exit the fault state.
WRNG PARAMS FLT TRIP	IGNORE TRIP WARNING TRIP + WARNING	This parameter determines what to do if one of the values for an iStart parameter is outside of the defined limits for that parameter. To solve this problem, return iStart to the default settings, then reprogram it with all of the settings that you had before the fault occurred.
WRNG PARAMS DLY 0.1 SEC	0.1 – 60.0 SEC	The time needed to enter the fault state.
WRNG PARAMS AFTR 0.1 SEC	0.1 – 60.0 SEC	The time needed to exit the fault state.
COMM FAILED FLT TRIP	IGNORE TRIP WARNING TRIP + WARNING	This parameter determines what to do if there is a communication failure.
COMM FAILED DLY 0.1 SEC	0.1 – 60.0 SEC	The time needed to enter the fault state.
COMM FAILED AFTR 0.1 SEC	0.1 – 60.0 SEC	The time needed to exit the fault state.
TOO MANY FLT TRIP	IGNORE TRIP WARNING TRIP + WARNING	This parameter determines what to do if there are too many starts within the defined time period.
TOO MANY DLY 0.1 SEC	0.1 – 60.0 SEC	The time needed to enter the fault state.

FAULT PARAMETERS - **** -		
Display and Default Values	**Range**	**Description**
TOO MANY AFTR 0.1 SEC	0.1 – 60.0 SEC	The time needed to exit the fault state.
MTOR INSUL FLT TRIP	IGNORE TRIP WARNING TRIP + WARNING	This parameter determines what to do if the wiring insulation causes a fault. Applicable only if optional insulation PCB and resistor unit are installed and connected. Insulation testing is enabled only when motor is not running and after 60 seconds in the *Stop* state. While the motor is running, the value of the insulation resistance shown in the actual data display is the last measured value prior to starting of the motor. While testing, if the insulation level drops below fault level, MOTOR INSUL will display and the insulation alarm relay will be energized. The *Fault* LED on the control keypad of the iStart will blink. If the insulation level will return to normal for more than 60 seconds the fault will automatically reset. While testing, if the insulation level drops below the fault level, MOTOR INSUL will display and the fault relay of the iStart will go to the fault position (as programmed in the I/O PROGRAMMING PARAMETERS). The *Fault* LED on the front of the iStart will light. In this status, the motor can not be started. If the insulation level returns to normal, the iStart will not automatically reset.
MTOR INSUL DLY 0.1 SEC	0.1 – 60.0 SEC	The time needed to enter the fault state.
MTOR INSUL AFTR 0.1 SEC	0.1 – 60.0 SEC	The time needed to exit the fault state.
M OVR TMP FLT TRIP	IGNORE TRIP WARNING TRIP + WARNING	This parameter determines what to do if the external temperature sensor generates a fault.
M OVR TMP DLY 0.1 SEC	0.1 – 60.0 SEC	The time needed to enter the fault state.
M OVR TMP AFTR 0.1 SEC	0.1 – 60.0 SEC	The time needed to exit the fault state.
WRONG FREQ FLT TRIP	IGNORE TRIP WARNING TRIP + WARNING	This parameter determines what to do if the current is the wrong frequency .
WRONG FREQ DLY 0.1 SEC	0.1 – 60.0 SEC	The time needed to enter the fault state.
WRONG FREQ AFTR 0.1 SEC	0.1 – 60.0 SEC	The time needed to exit the fault state.

FAULT PARAMETERS - **** -		
Display and Default Values	**Range**	**Description**
M.UNBALANCE FLT TRIP	IGNORE TRIP WARNING TRIP + WARNING	This parameter determines what to do if the phases at the motor are unbalanced.
M.UNBALANCE DLY 1.0 SEC	1.0 – 60.0 SEC	The time needed to enter the fault state.
M.UNBALANCE AFTR 0.1 SEC	0.1 – 60.0 SEC	The time needed to exit the fault state.
GND FAULT FLT TRIP	IGNORE TRIP WARNING TRIP + WARNING	This parameter determines what to do if there is a ground fault.
GND FAULT DLY 0.1 SEC	0.1 – 60.0 SEC	The time needed to enter the fault state.
GND FAULT AFTR 0.1 SEC	0.1 – 60.0 SEC	The time needed to exit the fault state.
NO CURRENT FLT TRIP	IGNORE TRIP WARNING TRIP + WARNING	This parameter determines what to do if there is an over current state
NO CURRENT DLY 0.1 SEC	0.1 – 60.0 SEC	The time needed to enter the fault state.
NO CURRENT AFTR 0.1 SEC	0.1 – 60.0 SEC	The time needed to exit the fault state.
NO CTR PWR FLT TRIP	IGNORE TRIP WARNING TRIP + WARNING	This parameter determines what to do if there is a short circuit.
NO CTR PWR DLY 0.1 SEC	0.1 – 60.0 SEC	The time needed to enter the fault state.
NO CTR PWR AFTR 0.1 SEC	0.1 – 60.0 SEC	The time needed to exit the fault state.
OVER CURR FLT TRIP	IGNORE TRIP WARNING TRIP + WARNING	This parameter determines what to do if there is a short circuit.
OVER CURR DLY 0.1 SEC	0.1 – 60.0 SEC	The time needed to enter the fault state.

FAULT PARAMETERS - **** -		
Display and Default Values	**Range**	**Description**
OVER CURR AFTR 0.1 SEC	0.1 – 60.0 SEC	The time needed to exit the fault state.
SHEAR PIN FLT TRIP	IGNORE TRIP WARNING TRIP + WARNING	This parameter determines what to do if over current may have broken or weakened the virtual shear pin.
SHEAR PIN DLY 0.1 SEC	0.1 – 60.0 SEC	The time needed to enter the fault state.
SHEAR PIN AFTR 0.1 SEC	0.1 – 60.0 SEC	The time needed to exit the fault state.
WELDED CON. FLT TRIP	IGNORE TRIP WARNING TRIP + WARNING	This parameter determines what to do if there is current when the iStart is in the stop state.
WELDED CON. DLY 0.1 SEC	0.1 – 60.0 SEC	The time needed to enter the fault state.
WELDED CON. AFTR 0.1 SEC	0.1 – 60.0 SEC	The time needed to exit the fault state.

6.6.5 *AUTORESET PARAMS[11] – Page 4 of Basic (page 6 of Professional and page 8 Expert)*

AUTORESET PARAMS - **** -		
Display and Default Values	**Range**	**Description**
GLOBAL AUTORESET DISABLE ALL	DISABLE ALL ENABLE ALL	**DISABLE ALL** = The Autoreset feature is disabled for all faults, regardless of what is defined for the fault. **ENABLE ALL** = The Autoreset feature is enabled. It is defined for each fault separately.

AUTORESET PARAMS - **** -		
Display and Default Values	**Range**	**Description**
{FaultName} MODE AUTO RESET OFF	A.RESET DISABLE	iStart will not automatically reset after the fault occurs.
	WAIT UNTIL SOLVD	iStart automatically resets after the fault condition ends.
	WAIT # SECOND	iStart waits # seconds, then checks if the fault condition ended. If yes, iStart automatically resets. If the fault condition still exists, it rechecks every # seconds. X can be 10, 20, 30, 40 or 50.
	WAIT # MINUTE	iStart waits # minutes, then checks if the fault condition ended. If yes, iStart automatically resets. If the fault condition still exists, it rechecks every # minutes. X can be 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 30 or 45.
	WAIT 1 HOUR	iStart waits 1 hour, then checks if the fault condition ended. If yes, iStart automatically resets. If the fault condition still exists, it rechecks every hour.
{FaultName} TRY ALWAYS AUTORESET	ALWAYS DO A. RST	iStart automatically resets indefinitely.
	ONLY: # TRIES	iStart automatically resets until the # of tries is reached. The TRY0 parameter determines whether a successful reset initializes the tries counter. # is a value from 1 – 100.
{FaultName} 1ST 1.0 SEC	0.0 – 900.0 SEC	iStart waits the amount of time defined before trying to reset for the first time. The next time this fault occurs, the DLY parameter will define the delay. There are two exceptions to this rule: 1. The RESET command is received. 2. TRY0 = YES **and** iStart enters the RUN state.
{FaultName} SLVD 10.0 SEC	0.0 – 60.0 SEC	After the fault is solved, iStart waits the time defined before attempting to reset.

[11] Parameters that are available in Basic \mode are in clear cells.
Parameters that are available in Professional and Expert mode, but not in Basic mode are in gray cells.
Parameters that are available in Expert mode only are in gray cells and highlighted.

AUTORESET PARAMS - **** -		
Display and Default Values	**Range**	**Description**
{FaultName} DLY 10.0 SEC	0.0 – 900.0 SEC	After the 1st attempt to reset, iStart waits the amount of time defined before trying to reset again.
{FaultName} TRY0 YES	YES NO	YES initializes the counter for the number of tries when a reset is successful. NO defines that the number of reset tries is finite. Once this number is reached the only way to reset the fault and enable start is to press the RESET button on the control panel. **Pressing the RESET button initializes all reset counters, not just for the reset counter of the specific fault**.
{FaultName} RNEN DISABLE DUR STRT	ENABLE DUR START DISABLE DUR STRT	ENABLE DUR START enables reset during start (while a start is in progress). DISABLE DUR STRT disables the reset operation during start (while a start is in progress).

6.6.6 *I/O Programming Parameters[12] – Page 5 of Basic (7 of Professional and 9 of Expert)*

I/O PROGRAMMING PARAMETERS		
Display and Default Values	**Range**	**Description**
IN1 PROGRAMMING STOP	INACTIVE	This input is ignored.
	START	Start the motor.
	STOP	Stop the motor.
	SOFT STOP	Soft Stop the motor. **Note**: In multistart mode the WHICH MOTOR parameters define which motor to start.
	EXTERNAL TRIP	Receive a trip command from an external source.
	RESET	Reset the iStart when it is tripped. **Note**: The reset does not take place while the start command is being given.
	START=1,STOP=0	• Start when a command is received. • Stop when no command is received.
	START=1,S.STOP=0	• Start when a command is received. • Soft Stop when no command is received. **Note**: In multistart mode the WHICH MOTOR parameters define which motor to start.
	START 1ST ADJUST	Start 1st motor.
	START 2ND ADJUST	Start 2nd motor.
	START 3RD ADJUST	Start 3rd motor.
	START 4TH ADJUST	Start 4th motor.
	S.STOP 1ST ADJ.	Soft Stop 1st motor.
	S.STOP 2ND ADJ.	Soft Stop 2nd motor.
	S.STOP 3RD ADJ.	Soft Stop 3rd motor.
	S. STOP 4TH ADJ.	Soft Stop 4th motor.
	WHICH MOTOR BIT0 WHICH MOTOR BIT1	The two parameters work together to define which motor the following commands are for: • START • STOP • SOFT STOP • START=1,STOP=0 • START=1,S.STOP=0 BIT1, BIT0 → Motor 0 , 0 → 1 0 , 1 → 2 1 , 0 → 3 1 , 1 → 4
	SLOW FORWARD	iStart will start the motor at slow speed in the forward direction.
	SLOW REVERSE	iStart will start the motor at slow speed in reverse.
	ENERGY SAVER	Supply voltage to the motor decreases (lowering the rotating magnetic field intensity), thus reducing the reactive current and copper/iron losses. Activated when the motor has a light load for a long time.
	NO ENERGY SAVER	Cancels the Energy Saver.

[12] Parameters that are available in Basic \mode are in clear cells.
Parameters that are available in Professional and Expert mode, but not in Basic mode are in gray cells.
Parameters that are available in Expert mode only are in gray cells and highlighted.

I/O PROGRAMMING PARAMETERS		
Display and Default Values	**Range**	**Description**
IN1 STATE MAINTAIN OPEN	MAINTAIN CLOSE MAINTAIN OPEN MOMENTARY CLOSE MOMENTARY OPEN	This setting defines what state creates a command.
IN1 MIN ACTIVE 0.1 SEC	0.1 – 0.5 SEC (increments of 0.1 SEC)	Delay until the ACTIVE command takes effect. **Note:** Range can be extended to 1.0 SEC by using the EXTEND SETTING.
IN1 MIN INACTIVE 0.1 SEC	0.1 – 0.5 SEC (increments of 0.1 SEC)	Delay until the INACTIVE command takes effect. **Note:** Range can be extended to 1.0 SEC by using the EXTEND SETTING.
IN2 PROGRAMMING SOFT STOP	Same as IN1 PROGRAMMING	Same as IN1 PROGRAMMING for input 2.
IN2 STATE MAINTAIN OPEN	MAINTAIN CLOSE MAINTAIN OPEN MOMENTARY CLOSE MOMENTARY OPEN	Same as IN1 STATE for input 2.
IN2 MIN ACTIVE 0.1 SEC	0.1 – 0.5 SEC (increments of 0.1 SEC)	Same as IN1 MIN ACTIVE for input 2.
IN2 MIN INACTIVE 0.1 SEC	0.1 – 0.5 SEC (increments of 0.1 SEC)	Same as IN1 MIN INACTIVE for input 2.
IN3 PROGRAMMING START	Same as IN1 PROGRAMMING	Same as IN1 PROGRAMMING for input 3.
IN3 STATE MAINTAIN CLOSE	MAINTAIN CLOSE MAINTAIN OPEN MOMENTARY CLOSE MOMENTARY OPEN	Same as IN1 STATE for input 3.
IN3 MIN ACTIVE 0.1 SEC	0.1 – 0.5 SEC (increments of 0.1 SEC)	Same as IN1 MIN ACTIVE for input 3.
IN3 MIN INACTIVE 0.1 SEC	0.1 – 0.5 SEC (increments of 0.1 SEC)	Same as IN1 MIN INACTIVE for input 3.
INPUT POLICY	LAST CMD ACTIVE	When commands arrive from different inputs, the last command is one that is implemented.
	FIRST CMD ACTIVE	When commands arrive from different inputs, the first command is one that is implemented. **Note**: If commands from more than one input arrive at the same time, the input with the higher priority is implemented. Refer to the INPUT PRIORITY parameter
	VIA PRIORITY	When commands arrive from different inputs, the command coming from the input with the highest priority is the one that is implemented. The priority is determined by the INPUT PRIORITY parameter.
INPUT PRIORITY IN1,IN2,IN3,COM		Priority goes from left (highest) to right (lowest).

I/O PROGRAMMING PARAMETERS		
Display and Default Values	**Range**	**Description**
RLY1 ACTION FAULT	INACTIVE	
	RUN IMMEDIATE	Active when there is start action.
	STARTING	Active during the start ramp. It stops when the bypass closes.
	END OF ACC	Not active during the start ramp. Active when the bypass closes.
	STOP	
	SOFT STOP	Active during ramp down.
	STOP IMMEDIATE	Active from ramp down and continues to be active while stopped.
	NOT 1ST MOTOR	Active when motors 2, 3, or 4 are to be acted upon.
	FAULT	Active while in a fault state.
	WARNING	Active while in a warning state.
RLY1 ON STATE ON=NO / OFF=NC	ON=NO / OFF=NC ON=NC / OFF=NO	Defines the ON state of the Relay 1. If it is Normally Open (NO) or Normally Closed (NC).
RLY1 ON DELAY 0.0 SEC	0.0 – 60.0 SEC	Sets the delay until for the ON command to take effect.
RLY1 OFF DELAY 0.0 SEC	0.0 – 60.0 SEC	Sets the delay time for the OFF command to take effect.
RLY2 ACTION END OF ACC	INACTIVE RUN IMMEDIATE STARTING END OF ACC STOP SOFT STOP STOP IMMEDIATE NOT 1ST MOTOR FAULT WARNING	Same as RLY1 ACTION for Relay 2.
RLY2 ON STATE ON=NO / OFF=NC	ON=NO / OFF=NC ON=NC / OFF=NO	Same as RLY1 ON STATE for Relay 2.
RLY2 ON DELAY 0.0 SEC	0.0 – 60.0 SEC	Same as RLY1 ON DELAY for Relay 2
RLY2 OFF DELAY 0.0 SEC	0.0 – 60.0 SEC	Same as RLY1 OFF DELAY for Relay 2.

6.6.7 *Statistical Data – page 11*

STATISTICAL DATA - **** -		
Display and default values	**Range**	**Description**
TOTAL ENERGY 0 KWH		Displays total energy drawn by the motor in KWH.
LAST STRT PERIOD 0SEC		Displays last starting time in seconds. Starting time is the duration until motor's current reaches nominal.
LAST STRT MAX I 0 % FLA		Displays last starting maximum starting current.
TOTAL RUN TIME 0 HOURS		Displays Motor's total run time.
TOTAL # OF STRTS 0		Displays total number of starts.
LAST TRIP NO FAULT		Displays motor's last trip cause.
TRIP CURRENT 0 % FLA		Displays motor's current when motor was tripped by the iStart.
TOTAL # OF TRIPS 0		Displays total number of trips.
PREVIOUS TRIP -1 NO FAULT		Displays the motor's trip history.
PREVIOUS TRIP -9 NO FAULT		
PREVIOUS TRIP -9 NO FAULT		
PREVIOUS TRIP -9 NO FAULT		
PREVIOUS TRIP -9 NO FAULT		
PREVIOUS TRIP -9 NO FAULT		
PREVIOUS TRIP -9 NO FAULT		
PREVIOUS TRIP -9 NO FAULT		
PREVIOUS TRIP -9 NO FAULT		
RESET STATISTICA		

6.7 Event Logger – page 8 for Basic (page 11 for Professional, page 12 for Expert)

The event log displays up to 100 events. The current event is not recorded.
01 is the most recent event, **02** the next most recent…**99** the next to oldest event and **00** is the oldest event.

6.7.1 Event Summary

The top level menu shows two lines.

- Line 1 displays the event number and type.
- Line 2 displays the date (dd/mm) and time (HH:MM:SS).

```
EVENT:07 STOP
05/07  16:43:02
```

The example above shows:

- Event 07 was a STOP command.
- The event occurred on the 5th of July at 16:43:02.

Event Type	Description	Remarks
START 1	Start	
START 2	Start	
START 3	Start	
START 4	Start	
STOP 1	Stop	
STOP 2	Stop	
STOP 3	Stop	
STOP 4	Stop	
SOFT START	Soft Stop	
	Brakes	Not currently implemented.
	Clock	
	Control Power On	
	Control Power Off	
	Slow Motor (Forward)	
	Slow Motor (Reverse)	
	Motor Idle	
	Run	
	Trip	
	Empty	Log record is empty. Not enough events occurred since the last log reset.

To see details, press the **Enter** key.

6.7.2 ***Event Details***

The details level menu shows two lines.

- Line 1 is a constant repetition of the event number, date and time.
- Line 2 is a scrollable display. Use the ▼ or ▲ keys to navigate to additional details of the event.

```
(07)  05/07  16:43
OPER: STOP
```

```
(07)  05/07  16:43
FAULT: NO FAULT
```

```
(07)  05/07  16:43
CURRENT PH1:    0%
```

Order	Details Code	Description	Range	Remarks
1	OPER:	Operation		
2	FAULT			
3	CURR P1	Phase 1 current		
	VOLT P1	Phase 1 voltage		
	MAX CURR P1	Phase 1 voltage		
4	CURR P2	Phase 2 current		
	VOLT P2	Phase 2 voltage		
	MAX CURR P2	Phase 2 voltage		
5	CURR P3	Phase 3 current		
	VOLT P3	Phase 3 voltage		
	MAX CURR P3	Phase 3 current		

6.8 Actual Data View

Actual data is always displayed inside arrow brackets to show that you are viewing data and not setting parameters. Press the ▼ or ▲ keys to browse between the different types of data.

Display	Description	Syntax Example
`<  - TRIP -  >` `< - NO FAULT - >`	When there is a trip, the **- TRIP -** view displays as the default data view.	
`<WARNING 02/03>` `<  OVERLOAD  >`	Displays line voltage and frequency. Frequency is displayed after start command only. **Syntax**: • XX refers to the order of the faults shown on the second line. 01 is the least recent fault. The highest number is the most recent fault. • YY refers to the total number of warnings that are active at that moment. • ZZZZZZ represents the name of the fault. Refer to □ on page 43 for details on each warning.	`<WARNING XX/YY>` `<  ZZZZZZ  >`
`< V1: V2: V3:>` `< 0% 0% 0%>`	Displays the line voltage and frequency. Frequency is displayed after start command only.	
`< I1: I2: I3:>` `< 0% 0% 0%>`	Displays the operating current in each of the three phases as a percentage of motor FLA (Full Load Ampere).	
`<Vrms:Irms:PwrF:>` `< 0% 0% 0.00>`		

6.8.1 Default Data View

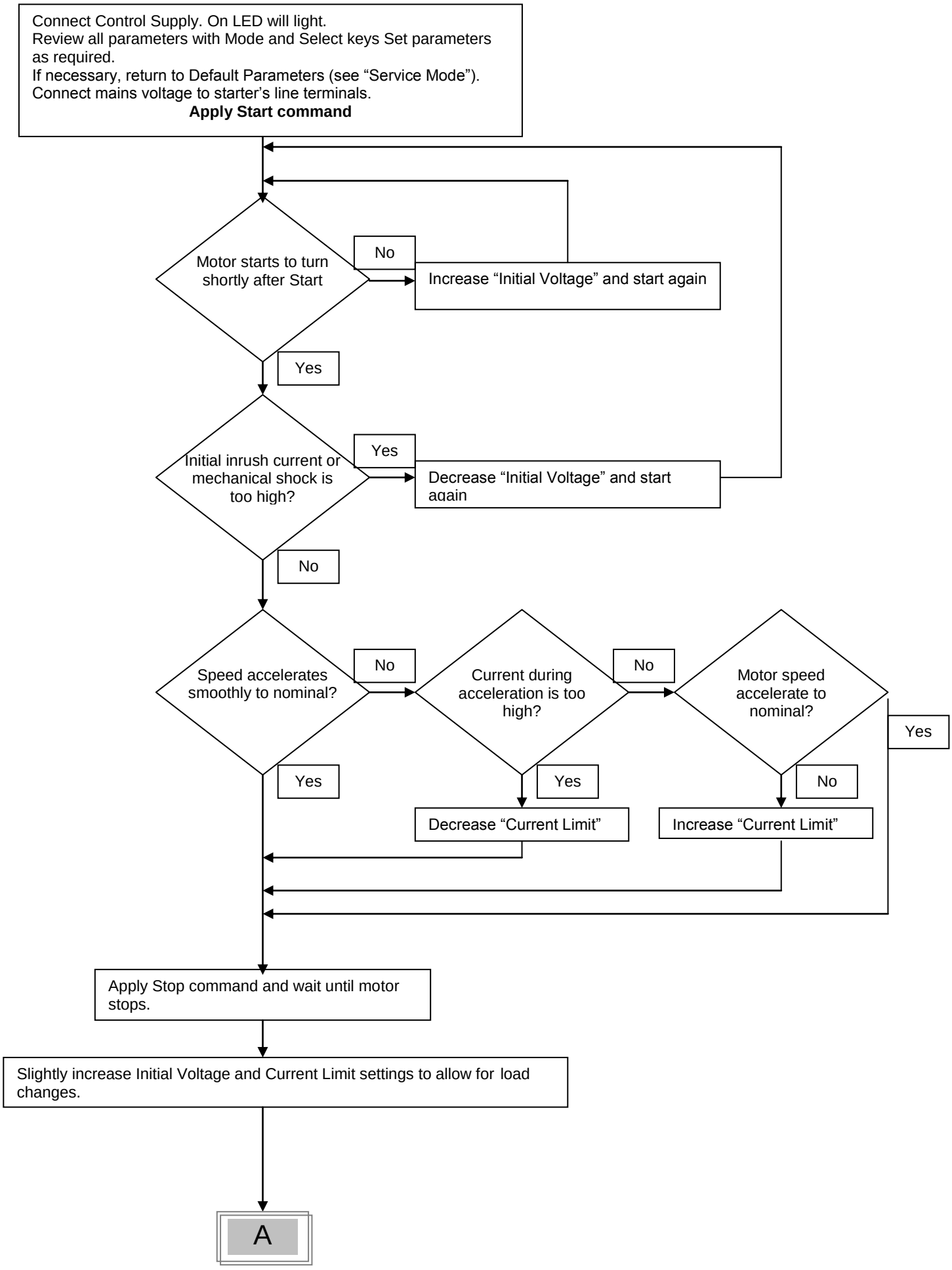
You can set any of the views to be the default when there is no trip. To do this, select the view and press the **Enter** key. Alternately, you can set the default in the GLOBAL PARAMETERS > DEFAULT DATA parameter setting.

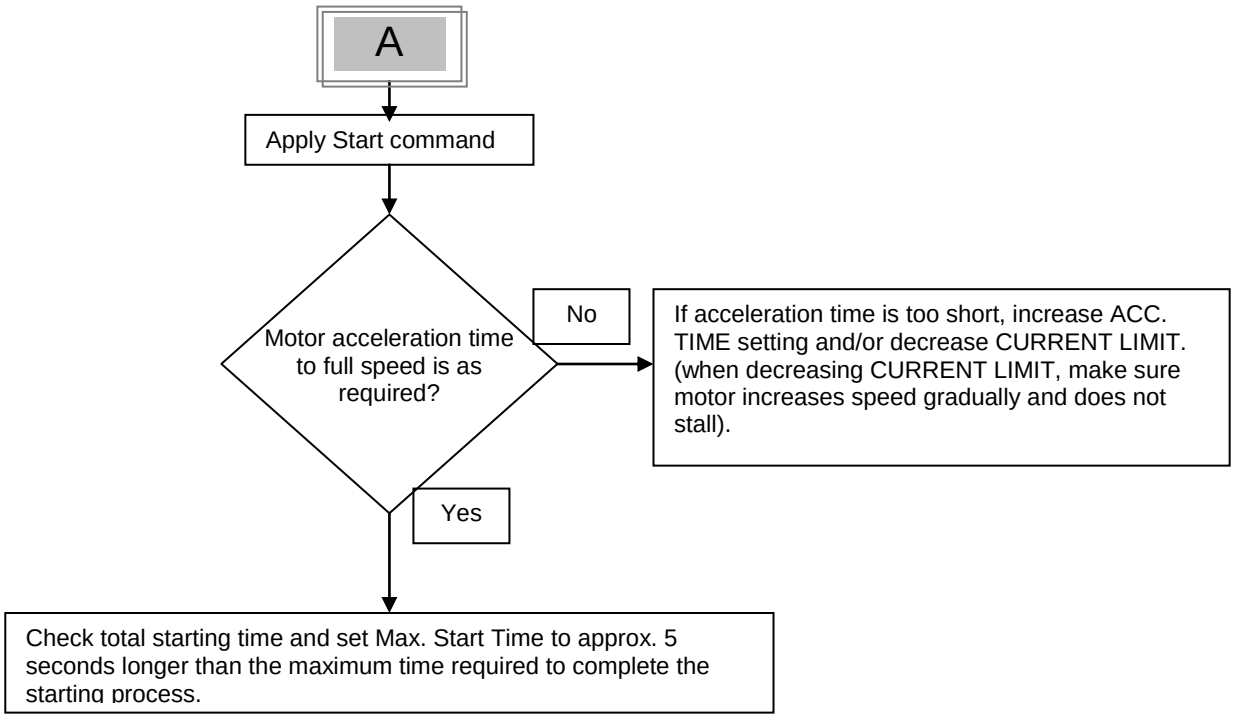
7. Starting Procedure

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.

	**1**	When mains voltage is connected to the iStart, 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 (upstream) the starter.
	2	Power factor correction capacitors or overvoltage protection devices must not be installed on starters load side. When required, install it on starter's line side.
	3	When using "Inside delta" connection, wrong connection of the starter or the motor, will seriously damage the motor; therefore make sure motor is connected properly!
	4	Do not interchange line and load connections
	5	Before starting the motor verify its rotation direction. If needed, disconnect the rotor from the mechanical load and verify the right rotation direction.
	6	Prior to Start up procedure make sure that line voltage and control voltage match the ones shown on the starter's name plate.
	7	When start signal is initiated and a motor is not connected to load terminals, the SHORT SCR or WRONG CONNECTION protection will be activated.

7.1 Standard Starting Procedure

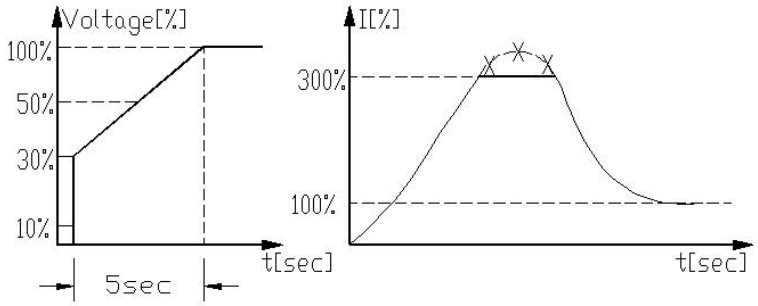



A
Apply Start command
Motor acceleration time to full speed is as required?
No
If acceleration time is too short, increase ACC. TIME setting and/or decrease CURRENT LIMIT. (when decreasing CURRENT LIMIT, make sure motor increases speed gradually and does not stall).
Yes
Check total starting time and set Max. Start Time to approx. 5 seconds longer than the maximum time required to complete the starting process.

7.2 Examples of Starting Curves

7.2.1 ***Light Load-Pumps, Fans, Etc.***

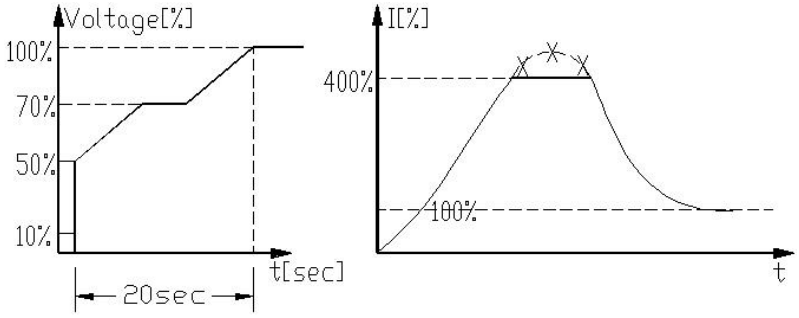
INITIAL VOLTAGE – set to 30% (Factory Default)
CURRENT LIMIT – set 300%
ACCELERATION TIME – set 5 sec



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.

7.2.2 ***High Inertia Loads – Fans, Centrifuges, Etc.***

INITIAL VOLTAGE – set 50%
CURRENT LIMIT – set 400%
ACCELERATION TIME – set 20 sec

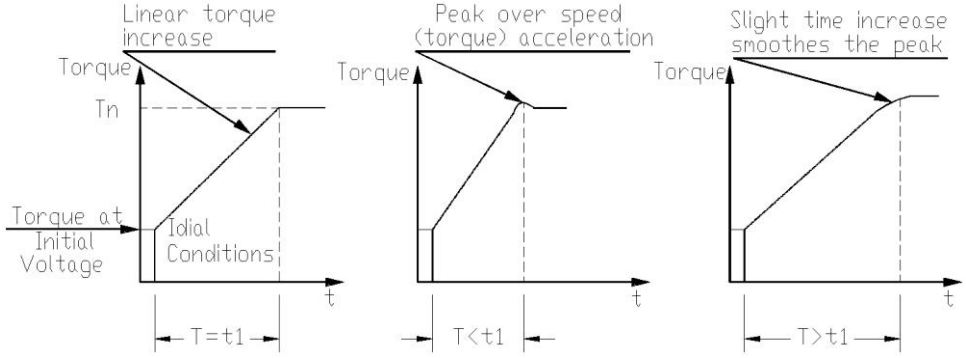


Voltage and current increase until current reaches CURRENT LIMIT. The voltage is held at this value until motor is close to nominal speed, then current will begin to decrease. The iStart continues to ramp-up the voltage until reaching nominal. Motor speed smoothly accelerates to full speed.

*7.2.3 **Choosing a Suitable Pump Curve (Centrifugal Pumps)***

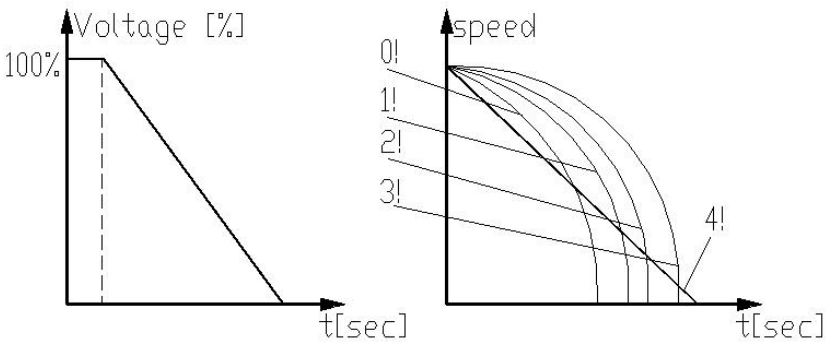
7.2.3.1 Starting Curve

- Adjust MAIN PARAMETERS as necessary (FLA, FLC, etc..)
- Set STARTING CURVE, ACCELERATION TIME, CURRENT LIMIT, and INITIAL VOLTAGE to their default values (curve 1, 10 sec., 400% and 30% respectively).
- 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 2!).
- Set START CURVE 2!, increase ACCELERATION TIME to 15 seconds and reduce CURRENT LIMIT to 350%. Start the pump and watch the pressure gauge while the pump starts.
- In most cases, overshooting is reduced. If the overshoot persists, increase ACCELERATION TIME to 25 seconds (confirm with motor manufacturer) and try again.
- If the overpressure persists, increase START CURVE setting to 3!, or 4!. Each increase in START CURVE setting will reduce the Peak Torque, thus, reducing the overpressure and preventing the “Pressure Surge” during start.
- To increase starting time above these maximums, employ “Special Starting” for these techniques (Consult factory).



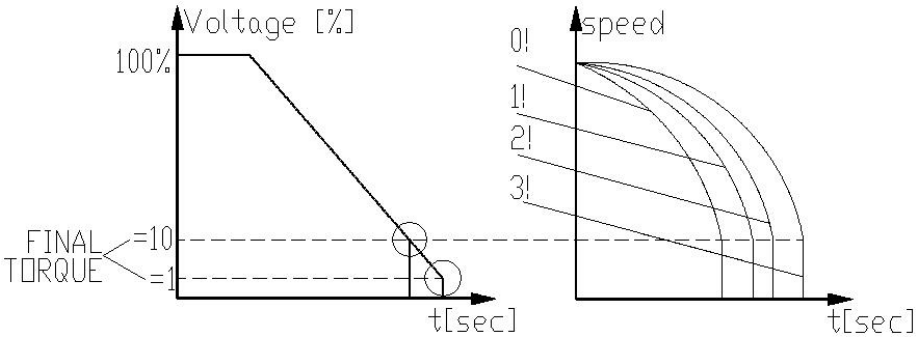
7.2.3.2 Stopping Curve

- Adjust MAIN PARAMETERS as necessary (FLA, FLC, etc..)
- Set STOP CURVE and DECELERATION TIME, to their default values (curve 0, 10 sec., respectively).
- 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).
- Select STOP CURVE 2, 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.
- 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.
- If the “Water Hammer” persists, increase STOP CURVE setting to 3!, or 4!. Each increase in STOP CURVE will reduce the abrupt stop of the pump, thus, preventing the “Water Hammer” phenomenon.



7.2.3.3 Final Torque During Soft-Stopping a Pump Motor

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. 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



8. TROUBLESHOOTING

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

Fault Message	Cause and Troubleshooting
TOO MANY START	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.* *For more information on adjusting START PERIOD and START INHIBIT refer to section 6.6.2 on page 35.*
LONG START TM	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.* *For more information on FLC & FLA refer to section 6.6.1 on page 28 (MAIN PARAMETERS).* *For more information on adjusting START PARAMETERS refer to section 6.6.2 on page 35.*
SHEAR PIN CURR **or** **O/C SHEAR PIN**	Trips the starter when: Instantaneously when current exceeds 8.5 x Starter FLC (not programmable). During starting when current exceed 8.5 x Motor FLA (not programmable). During running when current exceeds 100-400%, or 100-850% with EXTEND SETTING (programmable value). 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.* *For more information on FLC,FLA & O/C –* SHEAR PIN *refer to section 6.6.1 on page 28 (MAIN PARAMETERS).* **CAUTION** Check that "Megger" maximum voltage is no more 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.* *For more information on FLC, FLA & OVERLOAD settings refer to section 6.6.1 on page 28 (MAIN PARAMETERS).*
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 L1, L2, L3.* *For more information on UNDER CURRENT settings refer to section 6.6.1 on page 28 (MAIN PARAMETERS).*

Fault Message	Cause and Troubleshooting
UNDER VOLTAGE or NO 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 L1, L2, L3. When voltage drops to zero, the starter trips immediately with no delay.* For more information on UNDER VOLTAGE settings refer to section 6.6.1 on page 28 (MAIN PARAMETERS).
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, L2, L3.* *For more information on OVER VOLTAGE settings refer to section 6.6.1 on page 28 (MAIN PARAMETERS).*
PHASE LOSS	Trips the starter if 1 or 2 phases are missing. • *Check voltages are within the required range voltages and frequency is within the range of 45-65Hz.* • *If all previous actions are do not solve the problem and the you are sure that no real phase loss exists, you can set PHASE LOSS Y/N protection to NO. This situation can occur in rare cases when there is no real fault but the iStart recognizes unusual behaviour like when Total Harmonic Distortion in Voltage (THDV) in the network is high.* • *If this is a true case of PHASE LOSS then after setting PHASE LOSS Y/N protection to NO the motor will single phase and most likely be tripped by the over load protection mechanism.* • *Phase loss might not be detected in motor operating under a light load.* *For PHASE LOSS protection setting refer to section 6.6.3.2 on page 43.*
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.*
SHORT CIRCUIT	Trips the soft iStart when connected Inside Delta and Wrong connection or if over current is detected by the iStart. *Verify that the motor is not stalled or shorted and check cables and wiring.* *Verify that motor and iStart are connected exactly as shown in section 3.5.2.2 page 14.* *If circuitry is 100% confirmed it is possible to start when EXTEND SETTING are ENABLED. Refer to* section 6.6.3.1 on page 33*. If a fault occurs again consult the factory. The operator is advised to try operating one time only. Note that it is useless to try starting in this mode more than once.*

Fault Message	Cause and Troubleshooting
S. SCR OR WR. 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. *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 bypass). 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.* *If required, may be eliminated by using generator mode (programming AUX. IN PROG INPUT parameters accordingly)* *For more information on programming AUX. IN PROG INPUT refer to section 6.6.6 on page 52 (I/O PROGRAMMING PARAMETERS).* ***Note**:* *Shorted SCR and Wrong Connection faults are not active in Generator mode.*
HS OVR TMP	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	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.* *For more information on programming AUX. IN PROG INPUT refer to section 6.6.6 on page 52 (I/O PROGRAMMING PARAMETERS).*
SLOW SPEED TM	Slow speed time is exceeded. *Check the settings of MAX SLOW TIME.* *For more information on programming MAX SLOW TIME refer to section 0 on page 41 (SPECIAL FEATURES PARAMETERS).* ***Note:*** *Motor and iStart may be overheated when operating at slow speed for an extended period.*
WRONG PARAMS	Parameters not transferred from RAM to EEPROM or vice versa. After replacing the EPROM with a new software version or after power up. *To solve this problem, return iStart to the default settings, then reprogram it with all of the settings that you had before the fault occurred.* *(If Fault LED is on, press **Reset** after WRONG PARAMETERS).*
WRONG FREQUENCY	Trips the soft starter when mains voltage frequency is not within the limits of 45-65Hz. *Check mains frequency*.

8.1 Blank RMA Form

Return Material Authorization Form-"RMA" - Fault Report – Non/ Warranty Claim

After Sales Service Department
E-mail: tech.support@solcon.com Tel. + 972 – 77-7711130, 972-77-7711123 Fax. + 972 – 77-7711140

Equipment Model:			
Equipment Serial no.:			
Report date			
Date of equipment sale		Date of installation	
Representing Firm			
Contact person			
Telephone number		Fax number	
Email address			
Application			
Starter Rating			
Motor current rating (motor Label)			
Number of starts per hour			
Special installation / ambient factors (°C)			
Type of Fault Reported & time of occurrence (during start, after start, during soft stop, end of soft stop, ON B.P. closing, when …			
Last Start Period		Total Number Of Trips	
Last Start Max. I		Starter FLC	
Total Run Time		Motor FLC	
Total Number Of Starts		Initial Voltage	
Last Trip		Acceleration Time	
Trip Current		Current Limit	
Remarks			
By Distributor: We declare that product has been correctly applied, installed and operated, in accordance with Solcon's written instructions, appropriate codes, regulations and good practice, within the limits of rated capacity and normal usage.		Warranted repair/replacement	

To be completed By Solcon Service Dept.:

Return Material Authorization Number	
Date	
Authorized by	

9. TECHNICAL SPECIFICATIONS

Supply Voltage	Line to Line 208-600V (to be specified) + 10%-15% for all models
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,	5-80% Un
Initial Current	100-400% of Motor FLA
Current Limit	100-500% of Motor FLA
Acceleration Time	1-90 Sec
Deceleration Time	1-90 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. (1-250sec. in EXTEND SETTING)
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 (I^2t)	Adjustable IEC and MEMA curves.
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 45Hz. 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
R1, R2	2 Contacts, 8A, 250VAC, 2000VA

Temperatures: Operating -10˚ to 50˚C. For higher ratings consult factory.
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.
Humidity	95% at 50˚C or 98% at 45˚C.

Control Power Consumption

The approx. consumption of iStart soft starters is as follows:

Model	Electronic	Fan Module Consumption
44	35VA	50VA
85	35VA	50VA
170	35VA	50VA

Notes: