This manual must be read thoroughly and always stored near the softstarter.
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1. **Safty & 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

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>2</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>3</strong></td>
<td>The starter must be grounded to ensure correct operation, safety and to prevent damage.</td>
</tr>
<tr>
<td><strong>4</strong></td>
<td>Check that Power Factor capacitors and overvoltage devices are not connected to the output side of the soft starter.</td>
</tr>
<tr>
<td><strong>5</strong></td>
<td>Do not interchange line and load connections.</td>
</tr>
<tr>
<td><strong>6</strong></td>
<td>Expert mode allows settings that can damage the starter and the motor.</td>
</tr>
</tbody>
</table>

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

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 I: 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

Table 1 Housing sizes

<table>
<thead>
<tr>
<th>Frame Size</th>
<th>FLA (A)</th>
<th>Dimensions WxHxD (mm)</th>
<th>Dimensions W/Fan WxHxD (mm)</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>17</td>
<td>122x245x147</td>
<td>127x251x188</td>
<td>3.175 Kg (for fan: +1.33 Kg)</td>
</tr>
<tr>
<td>A</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>44</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>58</td>
<td>132x275x208</td>
<td>132x276x249</td>
<td>5.23 Kg (for fan: +1.38 Kg)</td>
</tr>
<tr>
<td>B</td>
<td>72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>85</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>105</td>
<td>175x388x234</td>
<td>175x388x275</td>
<td>10.89 (for fan: +1.925 Kg)</td>
</tr>
<tr>
<td>C</td>
<td>145</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>170</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>230</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>310</td>
<td>375x644x275</td>
<td></td>
<td>37 Kg</td>
</tr>
<tr>
<td>D</td>
<td>350</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>430</td>
<td>375x644x285</td>
<td></td>
<td>38 Kg</td>
</tr>
<tr>
<td>F</td>
<td>515</td>
<td>480x691x300</td>
<td></td>
<td>47 Kg</td>
</tr>
<tr>
<td>G</td>
<td>590</td>
<td>480x791x300</td>
<td></td>
<td>56 Kg</td>
</tr>
<tr>
<td>G</td>
<td>690</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>720</td>
<td>510x791x305</td>
<td></td>
<td>60 Kg</td>
</tr>
<tr>
<td>H</td>
<td>850</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>960</td>
<td>559x815x316</td>
<td></td>
<td>85 Kg</td>
</tr>
<tr>
<td>I</td>
<td>1100</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.3 Technical Data - 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:
### Table 2 Maximum conditions

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>400%×In</td>
<td>30</td>
</tr>
<tr>
<td>50</td>
<td>350%×In</td>
<td>20</td>
</tr>
</tbody>
</table>

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

#### Table 3 Mains and control voltage

<table>
<thead>
<tr>
<th>Frame Size</th>
<th>Mains (Line to Line) Voltage</th>
<th>Control Voltage</th>
<th>Fan Voltage&lt;sup&gt;1&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>A to C</td>
<td>208V to 400V, 50/60Hz, +10% - 15% or 208V to 600V, 50/60Hz, +10% - 15%</td>
<td>95-230VAC/DC, 50/60Hz, +10% - 15%</td>
<td>Fan is not required 115VAC/DC, 50/60Hz, +10% - 15% or 230VAC/DC, 50/60Hz, +10% - 15%</td>
</tr>
<tr>
<td>D to I</td>
<td>208V to 400V, 50/60Hz, +10% - 15% or 208V to 600V, 50/60Hz, +10% - 15% or 208V to 690V, 50/60Hz, +10% - 15%</td>
<td>115VAC, 50/60Hz, +10% - 15% or 230VAC, 50/60Hz, +10% - 15%</td>
<td>Fan is required 115VAC/DC, 50/60Hz, +10% - 15% or 230VAC/DC, 50/60Hz, +10% - 15%</td>
</tr>
</tbody>
</table>
3. Recommended Wiring Scheme

3.1 Mains and Control Description

<table>
<thead>
<tr>
<th>Indication</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1L1, 3L2, 5L3</td>
<td>Connection to mains voltage up to 690V</td>
<td></td>
</tr>
<tr>
<td>2T1, 4T2, 6T3</td>
<td>Connection to motor</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>Connection to ground</td>
<td>For proper operation and for safety reasons soft iStart must be properly grounded.</td>
</tr>
<tr>
<td>Terminal A1</td>
<td>Control phase</td>
<td>95-230VAC\DC +10% -15%</td>
</tr>
<tr>
<td>Terminal A2</td>
<td>Control neutral (return)</td>
<td></td>
</tr>
<tr>
<td>Terminal 12 (NC)</td>
<td>Terminal 11 (C)</td>
<td>Programmable auxiliary output relay 1</td>
</tr>
</tbody>
</table>
| Terminal 14 (NC) |                                       | 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. |
## Recommended Wiring Scheme

### Terminal 22 (NC)
Terminal 21 (C)
Terminal 24 (NC)

Programmable auxiliary output relay 2

Same as terminals 12, 11, and 14 for relay 2.

<table>
<thead>
<tr>
<th>Terminal 1,2,3</th>
<th>24V Input – START command.</th>
<th>The terminals can be programmed to operate in the following modes:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>24V Input – START command.</td>
<td>• INACTIVE&lt;br&gt;• START&lt;br&gt;• STOP&lt;br&gt;• EXTERNAL TRIP&lt;br&gt;• RESET&lt;br&gt;• 1ST ADJUST START&lt;br&gt;Start command to the 1st motor.&lt;br&gt;• 2ND ADJUST START&lt;br&gt;Start command to the 2nd motor.&lt;br&gt;• 3RD ADJUST START&lt;br&gt;Start command to the 3rd motor.&lt;br&gt;• 4TH ADJUST START&lt;br&gt;Start command to the 4th motor.&lt;br&gt;• 1ST ADJUST STOP&lt;br&gt;Soft Stop command to the 1st motor.&lt;br&gt;• 2ND ADJUST STOP&lt;br&gt;Soft Stop command to the 2nd motor.&lt;br&gt;• 3RD ADJUST STOP&lt;br&gt;Soft Stop command to the 3rd motor.&lt;br&gt;• 4TH ADJUST STOP&lt;br&gt;Soft Stop command to the 4th motor.</td>
</tr>
</tbody>
</table>
3.2 Input/Output Indication

3.2.1 Bottom View of the Control Module

Terminal: A1, A2(AC/DC); 12, 11, 14(R1: NC,C,NO); 22, 21, 24(R2: NC,C,NO)

Logic input: IN1, IN2, IN3, OUT(+24VDC), COM

Figure 1  Control inputs and outputs

MODBUS

Figure 2  View on tax-connections
3.3 Typical Wiring Scheme – In Line Connection and internal 24V source

Figures:

- Figure 3: Connection Diagram

Notes:

1. Use fuses for type 2 coordination. Mains voltage of 208-600V available to all models. Mains voltage 208-690V available to 210-1100A.
2. Refer to ordering information for available control voltages.
3. Control inputs are shown in their default setting.
4. Applicable only when optional fans are installed in frame sizes A-C.
3.4 Typical Wiring Scheme – In Line Connection and external 24V source

Notes:

6. Use fuses for type 2 coordination. Refer to section
7. Mains voltage of 208-600V available to all models. Mains voltage 208-690V available to 210-1100A.
8. Refer to ordering information for available control voltages.
9. Control inputs are shown in their default setting.
10. Applicable only when optional fans are installed in frame sizes A-C.
3.5  Wiring Notes

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.

3.6  Power Wiring Scheme for „Inside-Delta“ Connection

![Diagram of Connecting iStart INSIDE DELTA](image-url)

Figure 4  Connecting iStart 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.

<table>
<thead>
<tr>
<th>Wrong connection of the iStart or the motor may seriously damage the motor</th>
</tr>
</thead>
<tbody>
<tr>
<td>When using INSIDE DELTA it is highly recommended to use a line contactor (C1) or contactor (C2) in order to avoid possible damage to the motor if an SCR is short circuited in the iStart</td>
</tr>
<tr>
<td>Even when the inside delta contactor (C2) is open, motor terminals are “live” (full voltage) even when the contactor is open</td>
</tr>
</tbody>
</table>
3.7 Option Card Connections

3.7.1 Analog I/O (Option 5)

- Connect the Thermistor Input between P1.4 and P1.5.
- Connect Analog Output between P1.1 (High) and P1.2 (Low).
- Leave P1.3 disconnected.
- Connect the shielded wire to P1.3.

![Figure 6 Analag I/O (option 5)]

3.7.2 Analog I/O (Option 6)

Each analog input port is separate and defined independently.

- For connector P1:
  Connect the PT100 resistor between P1.1 and P1.2.
  Connect P1.2 and P1.3 without any resistance (short-circuit).

- For connector P2:
  Connect the PT100 resistor between P2.1 and P2.2.
  Connect P2.2 and P2.3 without any resistance (short-circuit).

- For connector P3:
  Connect the PT100 resistor between P3.1 and P3.2.
  Connect P3.2 and P3.3 without any resistance (short-circuit).

![Figure 7 Analag I/O (option 6)]
Thermal Inputs
The iStart can accept inputs from the RTD - Platinum 100 Ohm (Pt100) type of thermal sensors. This is a three-wire measurement system that is used to compensate for cable resistance.

Notes:
11. AWG#18 wires must be used. Do not exceed the maximum length of 100m.
12. Shielded cables must be used. Connect shield to external ground.
13. For RTD, the maximum cable resistance allowed is 25 Ohm.
14. LCD displays temperature in degrees Celsius for RTD.
15. If one or more sensors are not used, leave the relevant terminals open. The Actual Data display for this sensors will be “---” (Three dashes).

3.7.3 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:
16. **Fuse rated voltage**: Choose minimum fuse rated voltage which is above the rated voltage of the mains.
17. **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).
18. **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.
### 3.7.4 „Inside-Delta” Mode

#### 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 $(1050 \times 67\% = 703A)$ 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.

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.
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.
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.

Note:
Motor terminals are marked as follows:

<table>
<thead>
<tr>
<th>ASA (USA)</th>
<th>BS</th>
<th>VDE</th>
<th>IEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 - T4</td>
<td>A1-A2</td>
<td>U - X</td>
<td>U1 - U2</td>
</tr>
<tr>
<td>T2 - T5</td>
<td>B1-B2</td>
<td>V - Y</td>
<td>V1 - V2</td>
</tr>
<tr>
<td>T3 - T6</td>
<td>C1-C2</td>
<td>W - Z</td>
<td>W1 - W2</td>
</tr>
</tbody>
</table>
4. **Installation**

4.1 **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!

4.2 **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.

---

Do not interchange line and load connections

---

iStart label - example

---

Make sure Starter’s FLC ≥ Motor FLA!

Make sure Control voltage is right!
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 50°C. Protect the starter from dust and corrosive atmospheres.

Note:
For harsh environments (sewage treatment plants, etc.), it is recommended to order the starter with printed circuit board coating. Remote Keypad Installation
4.3 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%.

![Figure 10 Dimensions for installing the remote keypad](image)

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.

4.3.1 Calculating the Enclosure Size, for Non-Ventilated Metallic Enclosure

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

Where: \text{Area [m}^2\text{]} - Surface area that can dissipate heat (front, sides, top).

\text{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.

4.3.2 Additional Ventilation

Use the following arrangement for forced ventilation of the iStart’s enclosure:

![Ventilation Diagram]
4.4 Installing an Option Card

Option cards are either factory installed or sent separately for customer upgrade. If you perform your own upgrade make sure to read and perform the preinstallation instructions in section 4.4.1.

4.4.1 Preinstallation Instructions for Installing an Option Card

Step 1: Make sure that you have the following available:
- A cutter
- ESD ground protection
- The option card. Do Not remove the option card from its antistatic bag yet.

Step 2: Shut down all power to the iStart unit (mains and control voltage).

Step 3: Disconnect all cables and connectors that are attached to the control panel.

4.4.2 Opening the Control Panel

Step 1: Remove the 4 screws that hold the plastic housing of the iStart control panel to the power unit.

Step 2: Ground yourself with ESD protection.

Step 3: Remove the 6 screws that hold the PCB card to the plastic housing of the control panel.

4.4.3 Removing the Connector Cover

Before you insert the option card, you must cut off the part of the housing that covers option card connections. For analog cards, cut off the covering at the top of the plastic housing. For communication cards, cut off the covering at the bottom of the plastic housing.
4.4.4 Inserting the Option Card and Closing the Unit

Step 1: Remove the PCB card and turn it over.
Step 2: Remove the option card from the antistatic bag.
Step 3: Detach the connector from the option card.
Step 4: If you are installing the Thermistor in and Analog out card, set the dip switches. Setting the Thermistor In and Analog Out Option Card. You can use a pen or pencil to do this.
Step 5: Attach the option card to the correct header connector. Make sure that it is firmly attached. Use J1 for the analog option cards and J6 for the communication option cards.
Step 6: Put the PCB card back in the plastic housing of the iStart control panel.
Step 7: Replace the 6 screws that hold the PCB card to the plastic housing.
Step 8: Reconnect the connector that you removed in step 3.
Step 9: Put the plastic housing back on the power unit and replace the 4 screws that hold it in place.
Step 10: Reconnect all cables and connectors that you removed.

Step 11: Add the connections to the relevant option card. Option Card Connections

**Figure 12** Location of the header connectors J1 and J6

**Figure 13** Inserting an option card - overview
4.5 Setting the Thermistor In and Analog Out Option Card (Option 5)

The Analog option contains two independent parts: Thermistor Input and Actual Data Output.

The operator can place one or more PTC or NTC thermistors on the motors windings or other critical areas. The operator is responsible for using the thermal sensors according the manufacturer’s instructions.

The Analog Output enables the output of the following types of actual data:

- Vrms - Voltage (RMS value). This is the default output.
- Irms - Current (RMS value)
- Power factor
- Power

Step 1: Remove the orange plastic that covers the dip switches.
Step 2: Set the dip switches according to the setting that you need.

Dip switch settings
Current (0 – 20mA / 4 – 20mA)

<table>
<thead>
<tr>
<th>SW</th>
<th>SW1</th>
<th>SW2</th>
<th>SW3</th>
<th>SW4</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
</tr>
</tbody>
</table>

Voltage (0 – 10V)

<table>
<thead>
<tr>
<th>SW</th>
<th>SW1</th>
<th>SW2</th>
<th>SW3</th>
<th>SW4</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
</tr>
</tbody>
</table>

Step 3: Make sure that control power and mains voltage are off.
Step 4: Install the analog card.
Step 5: Set the parameters:
19. Turn on control power, press the DATA key once, followed by the down key. This will take you to the following menu:

```
ANALOG OPTION
THERMISTOR INPUT
```

20. Press ENTER. This will take you to the following menu:

```
OUTPUT OPTION
Vrms OUTPUT
```

21. Select the desired analog output. The next parameter will be the CURRENT RANGE.

22. Set the CURRENT RANGE. The options are:

23. 0-20mA

24. 4-20mA

**Important:** When using the card in VOLTAGE mode, you must set this parameter to 0-20mA.

25. The next parameter is THERMISTOR TYPE. Set the PTC (default) or NTC.

26. The next parameter is LIMIT RESISTANCE. If the resistance exceeds the max/min resistance defined, the iStart will trip. You can set this parameter from 100 Ohm to 30000 Ohm.

## 4.6 Setting the Analog Option – 3XRTD Thermal Sensor Option Card (Option 6)

The Analog option enables the placement of up to 3 RTD thermal sensors on the motor’s winding or other critical areas. The thermal sensors must be of the PT100 type. The operator is responsible for using the thermal sensors according to the manufacturer’s instructions.

**Step 1:** Make sure that control power and mains voltage are off.

**Step 2:** Install the analog card.
Step 3: Turn on control power, press the DATA key once, followed by the down key. This will take you to the following menu:

<table>
<thead>
<tr>
<th>ANALOG OPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEMP.RELAY-3IN</td>
</tr>
</tbody>
</table>

Step 4: Press ENTER.

This will take you to the following menu:

<table>
<thead>
<tr>
<th>MAX TEMPERATURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>120 C</td>
</tr>
</tbody>
</table>

Step 5: Set the maximum temperature. This parameter determines the maximum measured temperature allowed. If the temperature exceeds the max/min temperature defined, the iStart will trip. You can set this parameter from -20°C to 200°C.

Step 6: Connect the PT100 between P1.1 and P1.2, and connect P1.2 and P1.3 without any resistance (short-circuit). If P2 and P3 are in use, do the same for them.

Step 7: In order to see the RTD reading, press DATA and use the arrows until you see the RTD TEMPERATURE screen as in the example below:

<RTD TEMPERATURE>
<54C  54C  54C>

If all three inputs are not connected, the missing sensor(s) will display as --- as in the example below:

<RTD TEMPERATURE>
<- - -       - - -  54C>
## 4.7 PT100 [°C/Ω] Table

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>-50</td>
<td>80.31</td>
<td>40</td>
<td>115.54</td>
</tr>
<tr>
<td>-45</td>
<td>82.29</td>
<td>45</td>
<td>117.47</td>
</tr>
<tr>
<td>-40</td>
<td>84.27</td>
<td>50</td>
<td>119.4</td>
</tr>
<tr>
<td>-35</td>
<td>86.25</td>
<td>55</td>
<td>121.32</td>
</tr>
<tr>
<td>-30</td>
<td>88.22</td>
<td>60</td>
<td>123.24</td>
</tr>
<tr>
<td>-25</td>
<td>90.19</td>
<td>65</td>
<td>125.16</td>
</tr>
<tr>
<td>-20</td>
<td>92.16</td>
<td>70</td>
<td>127.07</td>
</tr>
<tr>
<td>-15</td>
<td>94.12</td>
<td>75</td>
<td>128.98</td>
</tr>
<tr>
<td>-10</td>
<td>96.09</td>
<td>80</td>
<td>130.89</td>
</tr>
<tr>
<td>-5</td>
<td>98.04</td>
<td>85</td>
<td>132.8</td>
</tr>
<tr>
<td>0</td>
<td>100</td>
<td>90</td>
<td>134.7</td>
</tr>
<tr>
<td>5</td>
<td>101.95</td>
<td>95</td>
<td>136.6</td>
</tr>
<tr>
<td>10</td>
<td>103.9</td>
<td>100</td>
<td>138.5</td>
</tr>
<tr>
<td>15</td>
<td>105.85</td>
<td>105</td>
<td>140.39</td>
</tr>
<tr>
<td>20</td>
<td>107.79</td>
<td>110</td>
<td>142.29</td>
</tr>
<tr>
<td>25</td>
<td>109.73</td>
<td>150</td>
<td>157.31</td>
</tr>
<tr>
<td>30</td>
<td>111.67</td>
<td>200</td>
<td>175.84</td>
</tr>
<tr>
<td>35</td>
<td>113.61</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5. **Settings – 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. Push-buttons (esc, reset, mode, store, ok, up (▲) and down (▼) keys).

![Figure 15  Front panel](image)

5.1 **LCD Arrangement**

<table>
<thead>
<tr>
<th>CURRENT LIMIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>390%</td>
</tr>
</tbody>
</table>

Upper line displays function.

Lower line displays setting and/or measured values.

< > indicates actual data in display mode.
### 5.2 Push-Buttons

Table 6 Control elements

<table>
<thead>
<tr>
<th>Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Esc</td>
<td>Exits the current menu and returns to the previous menu without save.</td>
</tr>
<tr>
<td>Data</td>
<td>Toggles between the view of actual data and parameter settings. Actual data appears inside arrow brackets as shown below. &lt; Actual Data Type &gt; &lt; Actual Data Value &gt; Parameters are shown without arrow brackets. After a one minute timeout, the display returns to the actual data view.</td>
</tr>
<tr>
<td>▲</td>
<td>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.</td>
</tr>
<tr>
<td>▼</td>
<td>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.</td>
</tr>
<tr>
<td>Enter</td>
<td>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.</td>
</tr>
<tr>
<td>Reset</td>
<td>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.</td>
</tr>
</tbody>
</table>
5.3 Status LEDs

<table>
<thead>
<tr>
<th>Color</th>
<th>Display elements</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>On</td>
<td>Lights when the control supply voltage is connected to the iStart.</td>
</tr>
<tr>
<td>Yellow</td>
<td>Ramp</td>
<td>Lights during soft start, indicating that motor supply voltage is ramping up.</td>
</tr>
<tr>
<td>Green</td>
<td>Run</td>
<td>Lights after completion of the starting process, indicating that motor is receiving full voltage.</td>
</tr>
<tr>
<td>Red</td>
<td>Fault</td>
<td>Lights upon operation of any of the built-in protections. - Lights constantly when a trip occurs. - Blinks when a warning occurs.</td>
</tr>
<tr>
<td>Blue</td>
<td>Comm</td>
<td>Blinks when there is an active communication link.</td>
</tr>
</tbody>
</table>

5.4 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.

5.4.1 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.
5.5 Special Actions Performed in TEST/MAINTENANCE Mode

5.5.1 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
     ****
```

5.5.2 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:
5.5.3 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:

<table>
<thead>
<tr>
<th>STATISTICAL DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>_ ***** _</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>RESET STATISTICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENTER TO RESET</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>RESET SETTING!!!</th>
</tr>
</thead>
<tbody>
<tr>
<td>* * * N O * * *</td>
</tr>
</tbody>
</table>

- Press the ▲ key. The LCD will display:

<table>
<thead>
<tr>
<th>RESET SETTING!!!</th>
</tr>
</thead>
<tbody>
<tr>
<td>* * * Y E S * * *</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>RESET STATISTICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SETTING DEFAULT</td>
</tr>
</tbody>
</table>
## 5.6 Overview of All Mode Pages and Factory Defaults

### Table 8 Menu Description

<table>
<thead>
<tr>
<th>MAIN PARAMETERS</th>
<th>START/STOP 1ST MOTOR</th>
<th>START/STOP 2ND MOTOR</th>
<th>START/STOP 3RD MOTOR</th>
<th>START/STOP 4TH MOTOR</th>
<th>SPECIAL FEATURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display and default values</td>
<td>Display and default values</td>
<td>Display and default values</td>
<td>Display and default values</td>
<td>Display and default values</td>
<td>Display and default values</td>
</tr>
<tr>
<td>SET LANGUAGE. ENGLISH</td>
<td>MOTOR FLA 44 AMP</td>
<td>MOTOR FLA 44 AMP</td>
<td>MOTOR FLA 44 AMP</td>
<td>MOTOR FLA 44 AMP</td>
<td>SLOW SPEED TORQ 0 MIN</td>
</tr>
<tr>
<td>STARTER FLC 44 AMP.</td>
<td>SOFT START CURVE 1 (STANDARD)</td>
<td>SOFT START CURVE 1 (STANDARD)</td>
<td>SOFT START CURVE 1 (STANDARD)</td>
<td>SOFT START CURVE 1 (STANDARD)</td>
<td>MAX SLOW TIME 30 SEC</td>
</tr>
<tr>
<td>CONNECTION TYPE LINE</td>
<td>PULSE TYPE PULSE DISABLE</td>
<td>PULSE TYPE PULSE DISABLE</td>
<td>PULSE TYPE PULSE DISABLE</td>
<td>PULSE TYPE PULSE DISABLE</td>
<td>SAVING ADJUST NO</td>
</tr>
<tr>
<td>RATED LINE VOLT 400 VOLT</td>
<td>PULSE VOLTAGE 50% RATED VOLT</td>
<td>PULSE VOLTAGE 50% RATED VOLT</td>
<td>PULSE VOLTAGE 50% RATED VOLT</td>
<td>PULSE VOLTAGE 50% RATED VOLT</td>
<td>EXTEND SETTING DISABLE</td>
</tr>
<tr>
<td>UNDER VOLTAGE 75% RATED VOLT</td>
<td>PULSE CURRENT 0% FLA</td>
<td>PULSE CURRENT 0% FLA</td>
<td>PULSE CURRENT 0% FLA</td>
<td>PULSE CURRENT 0% FLA</td>
<td>3 OR 2 PHASE</td>
</tr>
<tr>
<td>OVER VOLTAGE 110% RATED VOLT</td>
<td>PULSE RISE TIME 0.1 SEC</td>
<td>PULSE RISE TIME 0.1 SEC</td>
<td>PULSE RISE TIME 0.1 SEC</td>
<td>PULSE RISE TIME 0.1 SEC</td>
<td>3 PHASE START</td>
</tr>
<tr>
<td>PHASE SEQUENCE IGNORE</td>
<td>PULSE CONST TIME 0.0 SEC</td>
<td>PULSE CONST TIME 0.0 SEC</td>
<td>PULSE CONST TIME 0.0 SEC</td>
<td>PULSE CONST TIME 0.0 SEC</td>
<td></td>
</tr>
<tr>
<td>O/C - SHEAR PIN 400% FLA</td>
<td>PULSE FALL TIME 0.1 SEC</td>
<td>PULSE FALL TIME 0.1 SEC</td>
<td>PULSE FALL TIME 0.1 SEC</td>
<td>PULSE FALL TIME 0.1 SEC</td>
<td></td>
</tr>
<tr>
<td>UNDER CURRENT 20% FLA</td>
<td>INITIAL VOLTAGE 28% RATED VOLT</td>
<td>INITIAL VOLTAGE 28% RATED VOLT</td>
<td>INITIAL VOLTAGE 28% RATED VOLT</td>
<td>INITIAL VOLTAGE 28% RATED VOLT</td>
<td></td>
</tr>
<tr>
<td>OVERLOAD CLASS IEC CLASS 10%</td>
<td>INITIAL CURRENT 0% FLA</td>
<td>INITIAL CURRENT 0% FLA</td>
<td>INITIAL CURRENT 0% FLA</td>
<td>INITIAL CURRENT 0% FLA</td>
<td></td>
</tr>
<tr>
<td>OVERLOAD PROTECT DISABLE</td>
<td>CURRENT LIMIT 400% FLA</td>
<td>CURRENT LIMIT 400% FLA</td>
<td>CURRENT LIMIT 400% FLA</td>
<td>CURRENT LIMIT 400% FLA</td>
<td></td>
</tr>
<tr>
<td>Setting</td>
<td>Accelerate Time</td>
<td>Accelerate Time</td>
<td>Accelerate Time</td>
<td>Accelerate Time</td>
<td></td>
</tr>
<tr>
<td>---------------------------------</td>
<td>-----------------</td>
<td>-----------------</td>
<td>-----------------</td>
<td>-----------------</td>
<td></td>
</tr>
<tr>
<td>Motor Unbalance 20% FLA</td>
<td>10 sec</td>
<td>10 sec</td>
<td>10 sec</td>
<td>10 sec</td>
<td></td>
</tr>
<tr>
<td>Ground Fault 20% FLA</td>
<td>Max Start Time 30 sec</td>
<td>Max Start Time 30 sec</td>
<td>Max Start Time 30 sec</td>
<td>Max Start Time 30 sec</td>
<td></td>
</tr>
<tr>
<td>Number of Starts 10</td>
<td>Soft Stop Curve 1 (Standard)</td>
<td>Soft Stop Curve 1 (Standard)</td>
<td>Soft Stop Curve 1 (Standard)</td>
<td>Soft Stop Curve 1 (Standard)</td>
<td></td>
</tr>
<tr>
<td>Start Period 10 Minute</td>
<td>Decelerate Time 30 sec</td>
<td>Decelerate Time 30 sec</td>
<td>Decelerate Time 30 sec</td>
<td>Decelerate Time 30 sec</td>
<td></td>
</tr>
<tr>
<td>Start Inhibit 15 Minute</td>
<td>Stop Final Torq 0 (MIN)</td>
<td>Stop Final Torq 0 (MIN)</td>
<td>Stop Final Torq 0 (MIN)</td>
<td>Stop Final Torq 0 (MIN)</td>
<td></td>
</tr>
<tr>
<td>Display Mode</td>
<td>Basic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parameters Lock</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Locked</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Settings – Control Keypad</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>---------------------------</td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>FAULT PARAMETERS</strong></td>
<td><strong>AUTORESET PARAMETERS</strong></td>
<td><strong>I/O PROGRAMMING</strong></td>
<td><strong>COMM. PARAMETERS</strong></td>
<td><strong>GLOBAL PARAMETERS</strong></td>
<td><strong>STATISTICAL DATA</strong></td>
</tr>
<tr>
<td>Display and default values</td>
<td>Display and default values</td>
<td>Display and default values</td>
<td>Display and default values</td>
<td>Display and default values</td>
<td>Display and default values</td>
</tr>
<tr>
<td>HS OVR TMP TRIP</td>
<td>GLOBAL AUTORESET DISABLE ALL</td>
<td>IN1 PROGRAMMING STOP</td>
<td>PROTOCOL MODBUS</td>
<td>SET TIME 00:00:00</td>
<td>TOTAL ENERGY</td>
</tr>
<tr>
<td>SHORT CIRC IGNORE</td>
<td>HS OVR TMP A.RESET DISABLE</td>
<td>IN1 STATE MAINTAIN OPEN</td>
<td>BAUD RATE 115200 BPS</td>
<td>SET DATE 01/01/2000</td>
<td>LAST STRT PERIOD</td>
</tr>
<tr>
<td>OVERLOAD TRIP</td>
<td>SHORT CIRC A.RESET DISABLE</td>
<td>IN1 MIN ACTIVE 0.1 SEC</td>
<td>STOP BIT 1.0 BITS</td>
<td>DEFAULT DATA V/I/COS PHI</td>
<td>LAST STRT MAX</td>
</tr>
<tr>
<td>UNDER CURR TRIP</td>
<td>OVERLOAD A.RESET DISABLE</td>
<td>IN1 MIN INACTIVE 0.1 SEC</td>
<td>PARITY CHECK NONE</td>
<td>LCD CONTRAST [*******]</td>
<td>TOTAL RUN TIME</td>
</tr>
<tr>
<td>UNDER VOLT TRIP</td>
<td>UNDER CURR A.RESET DISABLE</td>
<td>IN2 PROGRAMMING SOFT STOP</td>
<td>SERIAL LINK NO.</td>
<td>LCD INTENSITY [*******]</td>
<td>TOTAL # OF STRTS</td>
</tr>
<tr>
<td>OVER VOLT TRIP</td>
<td>UNDER VOLT A.RESET DISABLE</td>
<td>IN2 STATE MAINTAIN OPEN</td>
<td>COM CHANGE PARAM</td>
<td>LAST TRIP</td>
<td></td>
</tr>
<tr>
<td>PHASE LOSS TRIP</td>
<td>OVER VOLT A.RESET DISABLE</td>
<td>IN2 MIN ACTIVE 0.1 SEC</td>
<td>CMD VIA COMM ABC</td>
<td>TRIP CURRENT</td>
<td></td>
</tr>
<tr>
<td>PHASE SEQ TRIP</td>
<td>PHASE LOSS A.RESET DISABLE</td>
<td>IN2 MIN INACTIVE 0.1 SEC</td>
<td>CMD VALID FOR 1.0 SEC</td>
<td>TOTAL # OF TRIPS</td>
<td></td>
</tr>
<tr>
<td>SHORTED SCR TRIP</td>
<td>PHASE SEQ A.RESET DISABLE</td>
<td>IN3 PROGRAMMING START</td>
<td>RESET CMD VALID NO</td>
<td>PREVIOUS TRIP -1</td>
<td></td>
</tr>
<tr>
<td>LNG STRT TM TRIP</td>
<td>SHORT SCR A.RESET DISABLE</td>
<td>IN3 STATE MAINTAIN CLOSE</td>
<td>COM TIMEOUT 10.0SEC</td>
<td>PREVIOUS TRIP -2</td>
<td></td>
</tr>
<tr>
<td>SLOW SPD TM TRIP</td>
<td>LNG STRT TM A.RESET DISABLE</td>
<td>IN3 MIN INACTIVE 0.1 SEC</td>
<td>UPD COMM STEPS 1ST ACK THEN UPD</td>
<td>PREVIOUS TRIP -3</td>
<td></td>
</tr>
<tr>
<td>COMM T/O TRIP</td>
<td>SLW SPD TM A.RESET DISABLE</td>
<td>IN3 MIN INACTIVE 0.1 SEC</td>
<td></td>
<td>PREVIOUS TRIP -4</td>
<td></td>
</tr>
<tr>
<td>EXT FAULT TRIP</td>
<td>COMM T/O A.RESET DISABLE</td>
<td></td>
<td>INPUT POLICY VIA PRIORITY</td>
<td>PREVIOUS TRIP -5</td>
<td></td>
</tr>
<tr>
<td>WRNG PARAMS TRIP</td>
<td>EXT FAULT A.RESET DISABLE</td>
<td></td>
<td>INPUT PRIORITY IN1,IN2,IN3,COM</td>
<td>PREVIOUS TRIP -6</td>
<td></td>
</tr>
<tr>
<td>COMM FAILED TRIP</td>
<td>WRNG PARAMS</td>
<td>RLY1 ACTION FAULT</td>
<td></td>
<td>PREVIOUS TRIP -7</td>
<td></td>
</tr>
<tr>
<td>Condition</td>
<td>Description</td>
<td>Configuration</td>
<td>Action</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------</td>
<td>----------------------------------</td>
<td>--------------------------------</td>
<td>---------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOO MANY TRIP</td>
<td>COMM FAILED</td>
<td>RLY1 ON STATE ON=NO / OFF=NC</td>
<td>PREVIOUS TRIP - 8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MTOR INSUL TRIP</td>
<td>TOO MANY A.RESET DISABLE</td>
<td>RLY1 ON DELAY 0.0 SEC</td>
<td>PREVIOUS TRIP - 9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M.OVR TMP TRIP</td>
<td>MTOR INSUL A.RESET DISABLE</td>
<td>RLY1 OFF DELAY 0.0 SEC</td>
<td>RESET STATISTICAL DATA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WRONG FREQ TRIP</td>
<td>M.OVR TMP A.RESET DISABLE</td>
<td>RLY2 ACTION END OF ACC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M.UNBALANCE TRIP</td>
<td>WRONG FREQ A.RESET DISABLE</td>
<td>RLY2 ON STATE ON=NO / OFF=NC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GND FAULT TRIP</td>
<td>NO VOLTAGE A.RESET DISABLE</td>
<td>RLY2 ON DELAY 0.0 SEC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO CURRENT TRIP</td>
<td>M.UNBALANCE A.RESET DISABLE</td>
<td>RLY2 OFF DELAY 0.0 SEC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO CTR PWR TRIP</td>
<td>GND FAULT A.RESET DISABLE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OVER CURR TRIP</td>
<td>NO CURRENT A.RESET DISABLE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHEAR PIN TRIP</td>
<td>NO CTR PWR A.RESET DISABLE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>OVER CURR A.RESET DISABLE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SHEAR PIN A.RESET DISABLE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## 5.6.1 Main Parameters – page 1

### Table 9 Parameter list (Part 1)

<table>
<thead>
<tr>
<th>MAIN PARAMETERS</th>
<th>Display and default values</th>
<th>Range</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>SET LANGUAGE: ENGLISH</td>
<td>SPANISH GERMAN FRENCH ENGLISH TURKCE RUSSIAN (Optional)</td>
<td>Sets Starter’s language</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STARTER FLC 44 AMP</td>
<td>N/A</td>
<td>Displays the FLC (Full load current)</td>
<td>This parameter is not configurable.</td>
<td></td>
</tr>
<tr>
<td>CONNECTION TYPE LINE</td>
<td>LINE, INSIDE DELTA</td>
<td>Sets Starter’s connection type.</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>RATED LINE VOLT 400 VOLT</td>
<td>208-600V 190-600V</td>
<td>Sets rated LINE VOLTAGE.</td>
<td>The maximum rated voltage depends on the rated voltage of the iStart.</td>
<td></td>
</tr>
<tr>
<td>UNDER VOLTAGE 75% RATED VOLT</td>
<td>50-90%</td>
<td>Trips the iStart when line voltage drops below the % defined.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OVER VOLTAGE 110% RATED VOLT</td>
<td>109-125%</td>
<td>Trips the iStart when line voltage increases above the % defined.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHASE SEQUENCE IGNORE</td>
<td>POSITIVE/NEGATIVE/IGNORE</td>
<td></td>
<td>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</td>
<td></td>
</tr>
</tbody>
</table>
### O/C SHEAR PIN

**400% FLA**

- **100%-400%**
  - **Note:** The range of the INITIAL VOLTAGE can be extended to 850% by using the EXTEND SETTING.
  - Sets OVER-CURRENT SHEAR PIN protection.
  - Operational during run time only.
  - **Note:** This protection is not intended to replace fast acting fusser to protect from short current!

### UNDER CURRENT

**20 % FLA**

- **0%-90%**
  - Sets minimum allowed current.
  - Operational during run time only.
  - If the current drops to this level a trip will occur.

### OVERLOAD CLASS

**IEC CLASS 10**

- IEC CLASS 5/IEC CLASS 10/IEC CLASS 20/IEC CLASS 30/NEMA CLASS 5/NEMA CLASS 10/NEMA CLASS 20/NEMA CLASS 30/
  - Sets OVERLOAD curve.
  - 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 5.5.1 on page 42ff. 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>
<thead>
<tr>
<th>Class</th>
<th>10</th>
<th>20</th>
<th>30</th>
</tr>
</thead>
<tbody>
<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>
</tbody>
</table>

### OVERLOAD PROTECT

**DISABLE/ ENABLE WHILE RUN/ ENABLE ALWAYS**

- 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.
  - **Note:**
In order to restart after OVERLOAD trip, the thermal register should be 50% or less.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOTOR UNBALANCE</td>
<td>10 - 100% of Motor FLA. Increments of 1%</td>
<td>Sets the motor unbalance protection. Current unbalance is the ratio between the highest and lowest current of the motor. ( \text{Unbalance} = \frac{i_2}{i_1} ) (Limited to: Unbalance ( \leq 100% )) Where: ( i_2 ) = highest current, ( i_1 ) = lowest current</td>
</tr>
<tr>
<td>GROUND FAULT</td>
<td>1 - 60% of FLA. Increments of 1%</td>
<td>Sets the allowed ground fault level. 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>
<tr>
<td>NUMBER OF STARTS</td>
<td>Off, 1-10</td>
<td>These three parameters work together to set the number of starts allowed during a defined time period</td>
</tr>
<tr>
<td>START PERIOD</td>
<td>1-60 minutes</td>
<td></td>
</tr>
<tr>
<td>START INHIBIT</td>
<td>15 MINUTE</td>
<td></td>
</tr>
<tr>
<td>DISPLAY MODE</td>
<td>BASIC</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>PROFESSIONAL</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EXPERT</td>
<td></td>
</tr>
<tr>
<td>PARAMETERS LOCK</td>
<td>LOCKED/NOT LOCKED</td>
<td>The software lock prevents undesired parameter modification. When locked, the LCD displays the following when you press Enter or the ▼ ▲ keys: UNAUTHORIZED ACCESS</td>
</tr>
<tr>
<td>LOCKED</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOCKED/NOT LOCKED</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Tripping Curves of the Integrated Overcurrent Protection

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

The horizontal axis represent ratio of [starter Current / pickup current parameter]:

e.g. the current of starter is now 250% of FLA, and O/C PICKUP CURR. Parameter is “100% FLA” –

so the multiple of pickup current will be: 250%FLA / 100%FLA = 2.5.

The vertical axis represent the time in seconds.

Over current example:

We will choose the settings to be:

<table>
<thead>
<tr>
<th>Setting</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>O/C CURVE TYPE</td>
<td>IEC CURVE: U1</td>
</tr>
<tr>
<td>O/C IEC TD</td>
<td>Not relevant to U.S. curves.</td>
</tr>
<tr>
<td>O/C US TD</td>
<td>8.00</td>
</tr>
<tr>
<td>O/C PICKUP CURR.</td>
<td>150 % FLA</td>
</tr>
<tr>
<td>O/C PROTECT</td>
<td>ENABLE ALWAYS</td>
</tr>
</tbody>
</table>

Then if the starter’s current is 450% of FLA, then the multiple of pickup current will be:

450%FLA / 150%FLA = 3.

According to the “U1 Curves” chart below – with Time Dial of 8.00 and multiple of pickup of 3 – the O/C trip will occur after 4 seconds.

U.S. Class OVERCURRENT curves:
Figure 16  U.S. Class OVERCURRENT curves – U1 curves

Figure 17  U.S. Class OVERCURRENT curves – U2 curves
Figure 18  U.S. Class OVERCURRENT curves – U3 curves

Figure 19  U.S. Class OVERCURRENT curves – U4 curves
IEC Class OVERCURRENT curves:

Figure 20  U.S. Class OVERCURRENT curves – U5 curves

Figure 21  IEC Class OVERCURRENT curves – C1 curves
Figure 22  IEC Class OVERCURRENT curves – C2 curves

Figure 23  IEC Class OVERCURRENT curves – C3 curves
Figure 24  IEC Class OVERCURRENT curves – C4 curves

Figure 25  IEC Class OVERCURRENT curves – C5 curves
Tripping Curves of the Integrated Overload Protection

NEMA Class OVERLOAD curves
### 5.6.2 Start/Stop Motor – page 2 of Basic (pages 2-3 of Professional, pages 2-5 of Expert)

**Table 10 Parameter list (Part 2)**

<table>
<thead>
<tr>
<th>START/STOP MOTOR</th>
<th>Display and default values</th>
<th>Range</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MOTOR FLA</strong></td>
<td></td>
<td>50%-100% of STARTER FLC</td>
<td>Sets iStart's FLA (Full Load Ampere)</td>
<td>Should be programmed as shown on the motor's name plate. <strong>Note:</strong> When the iStart is installed Inside Delta, set MOTOR FLA = (&lt;\text{rated motor current}&gt;/1.73).</td>
</tr>
<tr>
<td><strong>SOFT START CURVE 1(STANDARD)</strong></td>
<td>9 !! - DOL - !! 5 !! TORQUE !! 4 !! PUMP 3 !! 3 !! PUMP 2 !! 2 !! PUMP 1 !! 1 – STANDARD - 0 !! GENERATOR !!</td>
<td>Sets starter's SOFT START CURVE.</td>
<td>When iStart is connected „Inside-Delta“, only CURVE 1 is applied.</td>
<td></td>
</tr>
<tr>
<td><strong>PULSE TYPE</strong></td>
<td>CURRENT PULSE E. VOLTAGE PULSE E. VOLTAGE</td>
<td></td>
<td>Expert only.</td>
<td></td>
</tr>
<tr>
<td><strong>PULSE DISABLE</strong></td>
<td>DISABLE</td>
<td></td>
<td>Expert only.</td>
<td></td>
</tr>
<tr>
<td><strong>PULSE VOLT 0% RATED VOLT</strong></td>
<td>50-99% RATED VOLT</td>
<td></td>
<td>Expert only.</td>
<td></td>
</tr>
<tr>
<td><strong>PULSE CURRENT 0% FLA</strong></td>
<td>0-700% FLA</td>
<td></td>
<td>Expert only.</td>
<td></td>
</tr>
<tr>
<td><strong>PULSE RISE TIME 0.1 SEC</strong></td>
<td>0 – 5.0 SEC.</td>
<td></td>
<td>Expert only.</td>
<td></td>
</tr>
<tr>
<td><strong>PULSE CONST TIME 0.0 SEC</strong></td>
<td>0 – 10.0 SEC.</td>
<td>Sets starter's PULSE START TIME. PULSE START level is 80% Un.</td>
<td>Expert only. Intended to start high friction loads, requiring high starting torque for a short time. <strong>Note:</strong> When iStart is connected „Inside-Delta“, PULSE START can not be activated.</td>
<td></td>
</tr>
<tr>
<td><strong>PULSE FALL TIME 0.1 SEC</strong></td>
<td>0 – 5.0 SEC.</td>
<td></td>
<td>Expert only.</td>
<td></td>
</tr>
</tbody>
</table>
### INITIAL VOLTAGE

<table>
<thead>
<tr>
<th>10 % RATED VOLT</th>
<th>28-45%</th>
<th>Sets the starting voltage of the motor. The motor's torque is directly proportional to the square of the voltage.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Note:</strong> The range of the INITIAL VOLTAGE can be extended to 25-60% by using the EXTEND SETTING.</td>
<td></td>
<td>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.</td>
</tr>
</tbody>
</table>

### INITIAL CURRENT

<table>
<thead>
<tr>
<th>0 % FLA</th>
<th>0-400%</th>
<th>Sets the starting current of the motor.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Professional and Expert only.</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### CURRENT LIMIT

<table>
<thead>
<tr>
<th>400 % FLA</th>
<th>100-400%</th>
<th>Sets motor's highest current during starting.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Note:</strong> 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 5.6.3 on page 65.</td>
<td></td>
<td>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. <strong>Note:</strong> CURRENT LIMIT does not operate during Run and Soft stop.</td>
</tr>
<tr>
<td><strong>ACCELERATION TIME</strong> 10 SEC</td>
<td><strong>MAX START TIME</strong> 30 SEC</td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>----------------------</td>
<td></td>
</tr>
<tr>
<td>1-30sec. <strong>Note:</strong> Range can be extended to 1-90sec. by using the EXTEND SETTING.</td>
<td>1-30sec. <strong>Note:</strong> Range can be extended to 1-250sec. by using the EXTEND SETTING.</td>
<td></td>
</tr>
<tr>
<td>Sets ACCELERATION TIME of the motor.</td>
<td>Sets MAXIMUM START TIME</td>
<td></td>
</tr>
</tbody>
</table>

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 ACCELERATION TIME, when CURRENT LIMIT is set low, starting time will be longer than the preset ACCELERATION TIME.
When motor reaches full speed before voltage reaches nominal, ACCELERATION TIME setting is overridden, causing voltage to quickly ramp-up to nominal.
Using starting curves 2, 3, 4 prevents quick ramp up.

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.
### Settings – Control Keypad

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SOFT STOP CURVE</strong></td>
<td>Sets starter's SOFT STOP CURVE.</td>
<td></td>
</tr>
<tr>
<td>1(STANDARD)</td>
<td>9 !! - DOL - !! 5 !! TORQUE !! 4 !! PUMP 3 !! 3 !! PUMP 2 !! 2 !! PUMP 1 !! 1 – STANDARD - 0 !! GENERATOR !!</td>
<td></td>
</tr>
<tr>
<td><strong>DECELERATE TIME</strong></td>
<td>Sets DECELERATION TIME of the motor. Used for controlled deceleration of high friction loads. Determines motor’s voltage ramp down time.</td>
<td></td>
</tr>
<tr>
<td>30 SEC</td>
<td>0 – 30sec. <strong>Note:</strong> Range can be extended to 90sec. by using the EXTEND SETTING.</td>
<td></td>
</tr>
<tr>
<td><strong>STOP FINAL TORQUE</strong></td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>0 (MIN)</td>
<td>0(MIN) - 10(MAX)</td>
<td></td>
</tr>
</tbody>
</table>
**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.

**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.

⚠️ When operating in SOFT START CURVE 1 motor must be loaded, otherwise, vibration may occur towards the end of the soft start process.
## 5.6.3 Special Features – page 6 of Professional and Expert Only

### Table 11 Parameter list (Part 3)

<table>
<thead>
<tr>
<th>SPECIAL FEATURES PARAMETERS</th>
<th>Range</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLOW SPEED TORQ 0 MIN</td>
<td>1(MIN) – 10(MAX)</td>
<td>Sets SLOW SPEED TORQUE.</td>
<td></td>
</tr>
<tr>
<td>MAX SLOW TIME 30 SEC</td>
<td>1–30sec. <strong>Note:</strong> Range can be extended to 250sec. by using the EXTEND SETTING.</td>
<td>Sets maximum time for SLOW SPEED TORQUE operation.</td>
<td><strong>Note:</strong> When iStart is connected „Inside-Delta” SLOW SPEED TORQUE is not available.</td>
</tr>
<tr>
<td>SAVING ADJUST NO</td>
<td>YES/NO</td>
<td>Enables wider range of parameter settings.</td>
<td>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.</td>
</tr>
<tr>
<td>EXTEND SETTING DISABLE</td>
<td>DISABLE/ENABLE</td>
<td>Enables wider range of parameter settings.</td>
<td></td>
</tr>
<tr>
<td>3 OR 2 PHASE 3 PHASE START</td>
<td>3 PHASE START IGNOR PHASE 1 IGNOR PHASE 2 IGNOR PHASE 3</td>
<td>Defines which phases to use.</td>
<td>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).</td>
</tr>
</tbody>
</table>
## Extend Setting

*Table 12*  
Further settings

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

**Notes:**

1. See PHASE LOSS protection and refer to the warning below.

2. 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.
2.8.

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.

---

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:

<table>
<thead>
<tr>
<th>Phase to</th>
<th>Connection on the ISA- SL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>1L1 to 2T1</td>
</tr>
<tr>
<td>Phase 2</td>
<td>3L2 to 4T2</td>
</tr>
<tr>
<td>Phase 3</td>
<td>5L3 to 6T3</td>
</tr>
</tbody>
</table>

- 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.
### 5.6.4 Fault Parameters – Page 3 of Basic (page 5 of Professional and page 7 of Expert)

**Table 14  \ Error table**

<table>
<thead>
<tr>
<th>FAULT PARAMETERS</th>
<th>Display and Default Values</th>
<th>Range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HS OVR TMP FLT TRIP</td>
<td></td>
<td>This parameter determines what to do if the temperature of the heat sink in the iStart exceeds the maximum allowed.</td>
</tr>
<tr>
<td></td>
<td>HS OVR TMP DLY 0.1 SEC</td>
<td>0.1 – 60.0 SEC</td>
<td>The time needed to enter the fault state.</td>
</tr>
<tr>
<td></td>
<td>HS OVR TMP AFTR 0.1 SEC</td>
<td>0.1 – 60.0 SEC</td>
<td>The time needed to exit the fault state.</td>
</tr>
<tr>
<td></td>
<td>SHORT CIRC FLT IGNORE</td>
<td></td>
<td>This parameter determines what to do if there is a short circuit.</td>
</tr>
<tr>
<td></td>
<td>SHORT CIRC DLY 0.1 SEC</td>
<td>0.1 – 60.0 SEC</td>
<td>The time needed to enter the fault state.</td>
</tr>
<tr>
<td></td>
<td>SHORT CIRC AFTR 0.1 SEC</td>
<td>0.1 – 60.0 SEC</td>
<td>The time needed to exit the fault state.</td>
</tr>
<tr>
<td></td>
<td>OVERLOAD FLT TRIP</td>
<td></td>
<td>This parameter determines what to do if there is an overload.</td>
</tr>
<tr>
<td></td>
<td>OVERLOAD DLY 0.1 SEC</td>
<td>0.1 – 60.0 SEC</td>
<td>The time needed to enter the fault state.</td>
</tr>
<tr>
<td></td>
<td>OVERLOAD AFTR 0.1 SEC</td>
<td>0.1 – 60.0 SEC</td>
<td>The time needed to exit the fault state.</td>
</tr>
<tr>
<td></td>
<td>UNDER CURR FLT TRIP</td>
<td></td>
<td>This parameter determines what to do if there is an under current state.</td>
</tr>
<tr>
<td></td>
<td>UNDER CURR DLY 5.0 SEC</td>
<td>0.1 – 60.0 SEC</td>
<td>The time needed to enter the fault state.</td>
</tr>
<tr>
<td></td>
<td>UNDER CURR AFTR 0.1 SEC</td>
<td>0.1 – 60.0 SEC</td>
<td>The time needed to exit the fault state.</td>
</tr>
</tbody>
</table>
### UNDER VOLT FLT

**TRIP**

This parameter determines what to do if there is an under volt state.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TRIP</strong></td>
<td>- 0.1 – 60.0 SEC</td>
</tr>
<tr>
<td><strong>WARNING</strong></td>
<td>- 0.1 – 60.0 SEC</td>
</tr>
<tr>
<td><strong>TRIP + WARNING</strong></td>
<td>- 0.1 – 60.0 SEC</td>
</tr>
</tbody>
</table>

### UNDER VOLT DLY

**5.0 SEC**

The time needed to enter the fault state.

### UNDER VOLT AFTR

**0.1 SEC**

The time needed to exit the fault state.

### OVER VOLT FLT

**TRIP**

This parameter determines what to do if there is an over volt state.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TRIP</strong></td>
<td>- 0.1 – 60.0 SEC</td>
</tr>
<tr>
<td><strong>WARNING</strong></td>
<td>- 0.1 – 60.0 SEC</td>
</tr>
<tr>
<td><strong>TRIP + WARNING</strong></td>
<td>- 0.1 – 60.0 SEC</td>
</tr>
</tbody>
</table>

### OVER VOLT DLY

**0.1 SEC**

The time needed to enter the fault state.

### OVER VOLT AFTR

**0.1 SEC**

The time needed to exit the fault state.

### PHASE LOSS FLT

**TRIP**

This parameter determines what to do if 1 or 2 phases are missing.

**Notes:**

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.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TRIP</strong></td>
<td>- 0.1 – 60.0 SEC</td>
</tr>
<tr>
<td><strong>WARNING</strong></td>
<td>- 0.1 – 60.0 SEC</td>
</tr>
<tr>
<td><strong>TRIP + WARNING</strong></td>
<td>- 0.1 – 60.0 SEC</td>
</tr>
</tbody>
</table>

### PHASE LOSS DLY

**0.1 SEC**

The time needed to enter the fault state.

### PHASE LOSS AFTR

**0.1 SEC**

The time needed to exit the fault state.

### PHASE SEQ FLT

**TRIP**

This parameter determines what to do if there is a fault with the sequence of the phases.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TRIP</strong></td>
<td>- 0.1 – 60.0 SEC</td>
</tr>
<tr>
<td><strong>WARNING</strong></td>
<td>- 0.1 – 60.0 SEC</td>
</tr>
<tr>
<td><strong>TRIP + WARNING</strong></td>
<td>- 0.1 – 60.0 SEC</td>
</tr>
</tbody>
</table>

### PHASE SEQ DLY

**0.1 SEC**

The time needed to enter the fault state.

### PHASE SEQ AFTR

**0.1 SEC**

The time needed to exit the fault state.
**Settings – Control Keypad**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
</table>
| **SHORTED SCR FLT TRIP** |         | 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 FLT TRIP** |         | 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. |
| **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** |         | 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** |         | 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** |         | 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. |
### Settings – Control Keypad

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Default Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EXT FAULT AFTR</strong></td>
<td>0.1 SEC</td>
<td>The time needed to exit the fault state.</td>
</tr>
<tr>
<td><strong>WRNG PARAMS FLT</strong></td>
<td>0.1 – 60.0 SEC</td>
<td>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.</td>
</tr>
<tr>
<td><strong>WRNG PARAMS DLY</strong></td>
<td>0.1 SEC</td>
<td>The time needed to enter the fault state.</td>
</tr>
<tr>
<td><strong>COMM FAILED FLT</strong></td>
<td>0.1 – 60.0 SEC</td>
<td>This parameter determines what to do if there is a communication failure.</td>
</tr>
<tr>
<td><strong>COMM FAILED DLY</strong></td>
<td>0.1 SEC</td>
<td>The time needed to enter the fault state.</td>
</tr>
<tr>
<td><strong>TOO MANY FLT</strong></td>
<td>0.1 – 60.0 SEC</td>
<td>This parameter determines what to do if there are too many starts within the defined time period.</td>
</tr>
<tr>
<td><strong>TOO MANY DLY</strong></td>
<td>0.1 SEC</td>
<td>The time needed to enter the fault state.</td>
</tr>
<tr>
<td><strong>TOO MANY AFTR</strong></td>
<td>0.1 SEC</td>
<td>The time needed to exit the fault state.</td>
</tr>
<tr>
<td><strong>MTOR INSUL FLT</strong></td>
<td>0.1 – 60.0 SEC</td>
<td>This parameter determines what to do if the wiring insulation causes a fault.</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value Range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOTOR_INSUL_DLY</td>
<td>0.1 – 60.0 SEC</td>
<td>The time needed to enter the fault state.</td>
</tr>
<tr>
<td>MOTOR_INSUL_AFTR</td>
<td>0.1 – 60.0 SEC</td>
<td>The time needed to exit the fault state.</td>
</tr>
<tr>
<td>M_OVR_TMP_FLT</td>
<td></td>
<td>This parameter determines what to do if the external temperature sensor generates a fault.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trip, Warning, Trip + Warning.</td>
</tr>
<tr>
<td>M_OVR_TMP_DLY</td>
<td>0.1 – 60.0 SEC</td>
<td>The time needed to enter the fault state.</td>
</tr>
<tr>
<td>M_OVR_TMP_AFTR</td>
<td>0.1 – 60.0 SEC</td>
<td>The time needed to exit the fault state.</td>
</tr>
<tr>
<td>WRONG_FREQ_FLT</td>
<td></td>
<td>This parameter determines what to do if the current is the wrong frequency.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trip, Warning, Trip + Warning.</td>
</tr>
<tr>
<td>WRONG_FREQ_DLY</td>
<td>0.1 – 60.0 SEC</td>
<td>The time needed to enter the fault state.</td>
</tr>
<tr>
<td>WRONG_FREQ_AFTR</td>
<td>0.1 – 60.0 SEC</td>
<td>The time needed to exit the fault state.</td>
</tr>
<tr>
<td>M_UNBALANCE_FLT</td>
<td></td>
<td>This parameter determines what to do if the phases at the motor are unbalanced.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trip, Warning, Trip + Warning.</td>
</tr>
<tr>
<td>Setting</td>
<td>Action</td>
<td>Parameter</td>
</tr>
<tr>
<td>------------------------------</td>
<td>------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>TRIP</td>
<td>WARNING</td>
<td>TRIP + WARNING</td>
</tr>
<tr>
<td>M. UNBALANCE DLY</td>
<td>1.0 – 60.0 SEC</td>
<td>1.0 – 60.0 SEC</td>
</tr>
<tr>
<td>M. UNBALANCE AFTR</td>
<td>0.1 – 60.0 SEC</td>
<td>0.1 – 60.0 SEC</td>
</tr>
<tr>
<td>GND FAULT FLT TRIP</td>
<td>IGNORE</td>
<td>TRIP + WARNING</td>
</tr>
<tr>
<td>GND FAULT DLY AFTR</td>
<td>0.1 – 60.0 SEC</td>
<td>0.1 – 60.0 SEC</td>
</tr>
<tr>
<td>NO CURRENT FLT TRIP</td>
<td>IGNORE</td>
<td>TRIP + WARNING</td>
</tr>
<tr>
<td>NO CURRENT DLY AFTR</td>
<td>0.1 – 60.0 SEC</td>
<td>0.1 – 60.0 SEC</td>
</tr>
<tr>
<td>NO CTR PWR FLT TRIP</td>
<td>IGNORE</td>
<td>TRIP + WARNING</td>
</tr>
<tr>
<td>NO CTR PWR DLY AFTR</td>
<td>0.1 – 60.0 SEC</td>
<td>0.1 – 60.0 SEC</td>
</tr>
<tr>
<td>OVER CURR FLT TRIP</td>
<td>IGNORE</td>
<td>TRIP + WARNING</td>
</tr>
<tr>
<td>OVER CURR DLY AFTR</td>
<td>0.1 – 60.0 SEC</td>
<td>0.1 – 60.0 SEC</td>
</tr>
<tr>
<td>SHEAR PIN FLT TRIP</td>
<td>IGNORE</td>
<td>TRIP WARNING</td>
</tr>
<tr>
<td>Parameter</td>
<td>Setting</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------</td>
<td>------------------</td>
<td>------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>SHEAR PIN DLY</td>
<td>0.1 – 60.0 SEC</td>
<td>The time needed to enter the fault state.</td>
</tr>
<tr>
<td>SHEAR PIN AFTR</td>
<td>0.1 – 60.0 SEC</td>
<td>The time needed to exit the fault state.</td>
</tr>
<tr>
<td>WELDED CON. FLT</td>
<td>IGNORE</td>
<td>This parameter determines what to do if there is current when the iStart is in the stop state.</td>
</tr>
<tr>
<td>WELDED CON. TRIP</td>
<td>TRIP</td>
<td></td>
</tr>
<tr>
<td>WELDED CON.</td>
<td>WARNING</td>
<td></td>
</tr>
<tr>
<td>WELDED CON. DLY</td>
<td>0.1 – 60.0 SEC</td>
<td>The time needed to enter the fault state.</td>
</tr>
<tr>
<td>WELDED CON. AFTR</td>
<td>0.1 – 60.0 SEC</td>
<td>The time needed to exit the fault state.</td>
</tr>
</tbody>
</table>
### Table 15  AUTORESET Parameter

<table>
<thead>
<tr>
<th>AUTORESET PARAMS</th>
<th>Display and Default Values</th>
<th>Range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLOBAL AUTORESET</td>
<td>DISABLE ALL</td>
<td>DISABLE ALL</td>
<td>The Autoreset feature is disabled for all faults, regardless of what is defined for the fault.</td>
</tr>
<tr>
<td></td>
<td>ENABLE ALL</td>
<td>ENABLE ALL</td>
<td>ENABLE ALL = The Autoreset feature is enabled. It is defined for each fault separately.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AUTORESET PARAMS</th>
<th>Display and Default Values</th>
<th>Range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>{FaultName} MODE</td>
<td>A.RESET DISABLE</td>
<td>A.RESET DISABLE</td>
<td>iStart will not automatically reset after the fault occurs.</td>
</tr>
<tr>
<td>AUTO_RESET OFF</td>
<td>WAIT UNTIL SOLVD</td>
<td>WAIT UNTIL SOLVD</td>
<td>iStart automatically resets after the fault condition ends.</td>
</tr>
<tr>
<td></td>
<td>WAIT # SECOND</td>
<td>WAIT # SECOND</td>
<td>iStart waits # seconds, then checks if the fault condition ended. If yes, iStart automatically resets. If the fault condition still exists, it re-checks every # seconds.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>X can be 10, 20, 30, 40 or 50.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>WAIT # MINUTE</td>
<td>WAIT # MINUTE</td>
<td>iStart waits # minutes, then checks if the fault condition ended. If yes, iStart automatically resets. If the fault condition still exists, it re-checks every # minutes.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>X can be 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 30 or 45.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>WAIT 1 HOUR</td>
<td>WAIT 1 HOUR</td>
<td>iStart waits 1 hour, then checks if the fault condition ended. If yes, iStart automatically resets. If the fault condition still exists, it re-checks every hour.</td>
</tr>
<tr>
<td>{FaultName} TRY</td>
<td>ALWAYS DO A. RST</td>
<td>ALWAYS DO A. RST</td>
<td>iStart automatically resets indefinitely.</td>
</tr>
</tbody>
</table>
### 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.

<table>
<thead>
<tr>
<th>FaultName</th>
<th>1ST</th>
<th>0.0 – 900.0 SEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLVD</td>
<td>1.0 SEC</td>
<td>After the fault is solved, iStart waits the time defined before attempting to reset.</td>
</tr>
<tr>
<td>DLY</td>
<td>10.0 SEC</td>
<td>After the 1st attempt to reset, iStart waits the amount of time defined before trying to reset again.</td>
</tr>
</tbody>
</table>

### TRY0

YES

YES initializes the counter for the number of tries when a reset is successful.

NO

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.**

<table>
<thead>
<tr>
<th>RNEN</th>
<th>ENABLE DUR</th>
<th>DISABLE DUR START</th>
</tr>
</thead>
<tbody>
<tr>
<td>START</td>
<td>DUR</td>
<td>STRT</td>
</tr>
<tr>
<td>DUR</td>
<td>START</td>
<td>DUR</td>
</tr>
</tbody>
</table>

DISABLE 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).
### Table 16  I/O Parameter

<table>
<thead>
<tr>
<th>I/O PROGRAMMING PARAMETERS</th>
<th>Display and Default Values</th>
<th>Range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN1 PROGRAMMING STOP</td>
<td>INACTIVE</td>
<td></td>
<td>This input is ignored.</td>
</tr>
<tr>
<td></td>
<td>START</td>
<td></td>
<td>Start the motor.</td>
</tr>
<tr>
<td></td>
<td>STOP</td>
<td></td>
<td>Stop the motor.</td>
</tr>
<tr>
<td></td>
<td>SOFT STOP</td>
<td></td>
<td>Soft Stop the motor. <strong>Note</strong>: In multiISA-SL mode the WHICH MOTOR parameters define which motor to start.</td>
</tr>
<tr>
<td></td>
<td>EXTERNAL TRIP</td>
<td></td>
<td>Receive a trip command from an external source.</td>
</tr>
<tr>
<td></td>
<td>RESET</td>
<td></td>
<td>Reset the iStart when it is tripped. <strong>Note</strong>: The reset does not take place while the start command is being given.</td>
</tr>
<tr>
<td></td>
<td>START=1,STOP=0</td>
<td></td>
<td>• Start when a command is received. • Stop when no command is received.</td>
</tr>
<tr>
<td></td>
<td>START=1,S.STOP=0</td>
<td></td>
<td>• Start when a command is received. • Soft Stop when no command is received. <strong>Note</strong>: In multiISA-SL mode the WHICH MOTOR parameters define which motor to start.</td>
</tr>
<tr>
<td></td>
<td>START 1ST ADJUST</td>
<td></td>
<td>Start 1st motor.</td>
</tr>
<tr>
<td></td>
<td>START 2ND ADJUST</td>
<td></td>
<td>Start 2nd motor.</td>
</tr>
<tr>
<td></td>
<td>START 3RD ADJUST</td>
<td></td>
<td>Start 3rd motor.</td>
</tr>
<tr>
<td></td>
<td>START 4TH ADJUST</td>
<td></td>
<td>Start 4th motor.</td>
</tr>
<tr>
<td></td>
<td>S.STOP 1ST ADJ.</td>
<td></td>
<td>Soft Stop 1st motor.</td>
</tr>
<tr>
<td></td>
<td>S.STOP 2ND ADJ.</td>
<td></td>
<td>Soft Stop 2nd motor.</td>
</tr>
<tr>
<td></td>
<td>S.STOP 3RD ADJ.</td>
<td></td>
<td>Soft Stop 3rd motor.</td>
</tr>
<tr>
<td></td>
<td>S. STOP 4TH ADJ.</td>
<td></td>
<td>Soft Stop 4th motor.</td>
</tr>
<tr>
<td></td>
<td>WHICH MOTOR BIT0</td>
<td></td>
<td>The two parameters work together to define which motor the following commands are for: • START</td>
</tr>
<tr>
<td>WHICH MOTOR</td>
<td>BIT1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td>------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STOP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOFT STOP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>START=1,STOP=0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>START=1,S.STOP=0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIT1, BIT0 → Motor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0, 0 → 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0, 1 → 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1, 0 → 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1, 1 → 4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SLOW FORWARD</th>
<th>iStart will start the motor at slow speed in the forward direction.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLOW REVERSE</td>
<td>iStart will start the motor at slow speed in reverse.</td>
</tr>
<tr>
<td>ENERGY SAVER</td>
<td>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.</td>
</tr>
<tr>
<td>NO ENERGY SAVER</td>
<td>Cancels the Energy Saver.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IN1 STATE</th>
<th>MAINTAIN OPEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN1 MIN ACTIVE</td>
<td>0.1 SEC (increments of 0.1 SEC)</td>
</tr>
<tr>
<td>IN1 MIN INACTIVE</td>
<td>0.1 SEC (increments of 0.1 SEC)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IN1 PROGRAMMING</th>
<th>SOFT STOP</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN2 STATE</td>
<td>MAINTAIN OPEN</td>
</tr>
<tr>
<td>IN2 MIN ACTIVE</td>
<td>0.1 SEC (increments of 0.1 SEC)</td>
</tr>
<tr>
<td>IN2 MIN INACTIVE</td>
<td>0.1 SEC (increments of 0.1 SEC)</td>
</tr>
</tbody>
</table>

Note: Range can be extended to 1.0 SEC by using the EXTEND SETTING.
### IN3 PROGRAMMING

**START**
- Same as IN1 PROGRAMMING

**ST**
- MAINTAIN CLOSE
- MAINTAIN OPEN
- MOMENTARY CLOSE
- MOMENTARY OPEN

**MIN ACTIVE**
- 0.1 – 0.5 SEC (increments of 0.1 SEC)

**MIN INACTIVE**
- 0.1 – 0.5 SEC (increments of 0.1 SEC)

### 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.

**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).

### 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**
<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOFT STOP</td>
<td>Active during ramp down.</td>
</tr>
<tr>
<td>STOP IMMEDIATE</td>
<td>Active from ramp down and continues to be active while stopped.</td>
</tr>
<tr>
<td>NOT 1ST MOTOR</td>
<td>Active when motors 2, 3, or 4 are to be acted upon.</td>
</tr>
<tr>
<td>FAULT</td>
<td>Active while in a fault state.</td>
</tr>
<tr>
<td>WARNING</td>
<td>Active while in a warning state.</td>
</tr>
<tr>
<td>RLY1 ON STATE</td>
<td>Defines the ON state of the Relay 1. If it is Normally Open (NO) or Normally Closed (NC).</td>
</tr>
<tr>
<td>RLY1 ON DELAY</td>
<td>Sets the delay until for the ON command to take effect.</td>
</tr>
<tr>
<td>RLY1 OFF DELAY</td>
<td>Sets the delay time for the OFF command to take effect.</td>
</tr>
<tr>
<td>RLY2 ACTION</td>
<td>Same as RLY1 ACTION for Relay 2.</td>
</tr>
</tbody>
</table>

### Relay 1 State

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
</table>
| RLY1 ON STATE | ON=NO / OFF=NC  
ON=NC / OFF=NO |

### Delay Settings

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RLY1 ON DELAY</td>
<td>0.0 – 60.0 SEC</td>
</tr>
<tr>
<td>RLY1 OFF DELAY</td>
<td>0.0 – 60.0 SEC</td>
</tr>
</tbody>
</table>

### Relay 2 State

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
</table>
| RLY2 ON STATE | ON=NO / OFF=NC  
ON=NC / OFF=NO |

### Delay Settings

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RLY2 ON DELAY</td>
<td>0.0 – 60.0 SEC</td>
</tr>
<tr>
<td>RLY2 OFF DELAY</td>
<td>0.0 – 60.0 SEC</td>
</tr>
</tbody>
</table>
## 5.6.7 Global Parameter

<table>
<thead>
<tr>
<th>GLOBAL PARAMETER</th>
<th>Range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display and default values</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SET TIME</strong> 00:00:00</td>
<td>Time in 24 hour hh:mm:ss format.</td>
<td></td>
</tr>
<tr>
<td><strong>SET DATE</strong> 01/01/2014</td>
<td>Date in DD/MM/YYYY format.</td>
<td></td>
</tr>
<tr>
<td>DEFAULT DATA V/I/POWER FACTOR</td>
<td>ACTUAL TRIP ACTUAL WARNING RTD TEMPERATURE</td>
<td>Sets the default actual data display.</td>
</tr>
<tr>
<td></td>
<td>PTC TEMPERATURE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NTC TEMPERATURE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>INTERNAL TEMP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3PH VOLTAGE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3PH CURRENT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>V/I/POWER FACTOR</td>
<td></td>
</tr>
<tr>
<td>LCD CONTRAST [***** ]</td>
<td>1-8</td>
<td>Sets the contrast of the LCD display.</td>
</tr>
<tr>
<td>LCD INTENSITY [**********]</td>
<td>1-8</td>
<td>Sets the intensity of LCD display.</td>
</tr>
</tbody>
</table>
### Statistical Data

**Table 17: Statistical Data**

<table>
<thead>
<tr>
<th>Display and default values</th>
<th>Range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL ENERGY 0 KWH</td>
<td></td>
<td>Displays total energy drawn by the motor in KWH.</td>
</tr>
<tr>
<td>LAST STRT PERIOD 0SEC</td>
<td></td>
<td>Displays last starting time in seconds. Starting time is the duration until motor’s current reaches nominal.</td>
</tr>
<tr>
<td>LAST STRT MAX I 0 % FLA</td>
<td></td>
<td>Displays last starting maximum starting current.</td>
</tr>
<tr>
<td>TOTAL RUN TIME 0 HOURS</td>
<td></td>
<td>Displays Motor’s total run time.</td>
</tr>
<tr>
<td>TOTAL # OF STRTS 0</td>
<td></td>
<td>Displays total number of starts.</td>
</tr>
<tr>
<td>LAST TRIP NO FAULT</td>
<td></td>
<td>Displays motor’s last trip cause.</td>
</tr>
<tr>
<td>TRIP CURRENT 0 % FLA</td>
<td></td>
<td>Displays motor’s current when motor was tripped by the iStart.</td>
</tr>
<tr>
<td>TOTAL # OF TRIPS 0</td>
<td></td>
<td>Displays total number of trips.</td>
</tr>
<tr>
<td>PREVIOUS TRIP -1 NO FAULT 9</td>
<td></td>
<td>Displays the motor’s trip history.</td>
</tr>
<tr>
<td>PREVIOUS TRIP -9 NO FAULT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PREVIOUS TRIP -9 NO FAULT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PREVIOUS TRIP -9 NO FAULT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PREVIOUS TRIP -9 NO FAULT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PREVIOUS TRIP -9 NO FAULT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PREVIOUS TRIP -9 NO FAULT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PREVIOUS TRIP -9 NO FAULT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PREVIOUS TRIP -9 NO FAULT</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.7 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.

5.7.1 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.
Table 18  Fault memory

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

To see details, press the Enter key.
5.7.2 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.

![Event Details Example]

<table>
<thead>
<tr>
<th>Order</th>
<th>Details Code</th>
<th>Description</th>
<th>Range</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OPER:</td>
<td>Operation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>FAULT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>CURR P1</td>
<td>Phase 1 current</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>VOLT P1</td>
<td>Phase 1 voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MAX CURR P1</td>
<td>Phase 1 voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>CURR P2</td>
<td>Phase 2 current</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>VOLT P2</td>
<td>Phase 2 voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MAX CURR P2</td>
<td>Phase 2 voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>CURR P3</td>
<td>Phase 3 current</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>VOLT P3</td>
<td>Phase 3 voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MAX CURR P3</td>
<td>Phase 3 current</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.8 **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.

**Table 20**  
Currently data

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
<th>Syntax Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; - TRIP - &gt;</td>
<td>When there is a trip, the - TRIP - view displays as the default data view.</td>
<td></td>
</tr>
<tr>
<td>&lt; - NO FAULT - &gt;</td>
<td>Displays line voltage and frequency. Frequency is displayed after start command only.</td>
<td></td>
</tr>
<tr>
<td>&lt;WARNING 02/03&gt;</td>
<td>Displays line voltage and frequency. Frequency is displayed after start command only.</td>
<td></td>
</tr>
<tr>
<td>&lt; OVERLOAD &gt;</td>
<td>Syntax:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 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.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• YY refers to the total number of warnings that are active at that moment.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• ZZZZZZ represents the name of the fault. Refer to for details on each warning.</td>
<td></td>
</tr>
<tr>
<td>&lt; V1: V2: V3:&gt;</td>
<td>Displays the line voltage and frequency. Frequency is displayed after start command only.</td>
<td></td>
</tr>
<tr>
<td>&lt; 0% 0% 0%&gt;</td>
<td>Displays the operating current in each of the three phases as a percentage of motor FLA (Full Load Ampere).</td>
<td></td>
</tr>
<tr>
<td>&lt;I1: I2: I3:&gt;</td>
<td>&lt;0% 0% 0%&gt;</td>
<td></td>
</tr>
<tr>
<td><a href="">Vrms:Irms:PwrF:</a></td>
<td>&lt;0% 0% 0.00&gt;</td>
<td></td>
</tr>
</tbody>
</table>

5.8.1 **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.
6. 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.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>2</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>3</strong></td>
<td>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!</td>
</tr>
<tr>
<td><strong>4</strong></td>
<td>Do not interchange line and load connections</td>
</tr>
<tr>
<td><strong>5</strong></td>
<td>Before starting the motor verify its rotation direction. If needed, disconnect the rotor from the mechanical load and verify the right rotation direction.</td>
</tr>
<tr>
<td><strong>6</strong></td>
<td>Prior to Start up procedure make sure that line voltage and control voltage match the ones shown on the starter's name plate.</td>
</tr>
<tr>
<td><strong>7</strong></td>
<td>When start signal is initiated and a motor is not connected to load terminals, the SHORT SCR or WRONG CONNECTION protection will be activated.</td>
</tr>
</tbody>
</table>
6.1 Standard Starting Procedure

Connect Control Supply. On LED will light.
Review all parameters with Mode and Select keys Set parameters as required.
If necessary, return to Default Parameters (see “Service Mode”).

Motor starts to turn shortly after

Initial inrush current or mechanical shock

Speed accelerates smoothly to

Current during acceleration is too high?

Motor speed accelerate to nominal?

Apply Stop command and wait until motor stops.

Slightly increase Initial Voltage and Current Limit settings to allow for load changes.
Starting Procedure

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.
6.2 Examples of Starting Curves

6.2.1 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.

6.2.2 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.

### 6.2.3 Choosing a Suitable Pump Curve (Centrifugal Pumps)

#### 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).
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.
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.
7. Communication

7.1 Modbus Communication

7.1.1 Features

- RS485 Hardware.
- Asynchronous serial link.
- Half duplex.
- Format: Modbus RTU Mode (Remote Terminal Unit Mode).
  - Binary.
  - Each character includes from 9.5 to 12 bits:
    - 1 start bit.
    - 8 data bits, LSB sent first.
    - 1 Parity bit, Even/Odd/No can be selected.
    - 0.5, 1, 1.5 or 2 Stop bits can be selected.
  - Cyclical Redundancy Check (CRC) for the entire frame, 16 bits.
- Baud Rates: 1200 up to 115200 bits per second can be selected.
- Response time of the iStart:
  - Normally, 1ms <= time response <= 40mS.
  - For a long response, time response <= 100mS.
- Setting Parameters cannot be set during Start, Soft Stop operations and when the motor is running.

Notes:
You must connect the control panel earth to the iStart earth screw before connecting serial link wires. Ignoring this instruction may result in permanent damage to the serial link hardware.
• It is recommended to connect a 120 OHM resistor to the “+” and “-” pins of the serial link for proper RS485 Communication.

• Turn off (and on again) control power after changing the Baud Rate, Parity Check or Serial Link No. (slave address). These parameters can be modified only manually and not through the serial link.

### 7.1.2 Basic Structure of the Serial Link Frame

Modbus RTU frames have the same structure for both the "Query" transmissions from the Master to the Slave (iStart) and the response transmissions from the Slave to the Master:

| Byte 1 | Serial Link No. (= Slave Address) | (1 - 248) |
| Byte 2 | Function | (3, 4, 6, 8 &16 are supported) |
| Byte 3 | Data Bytes | (0xXX) |
| . | . | (0xXX) |
| . | . | (0xXX) |
| Byte n-1 | CRC Low | (0xXX) |
| Byte n | CRC High | (0xXX) |

#### Sync (Silent Interval)

In RTU mode, a "Silent Interval" of blank 3.5 characters separates the transmission frames and synchronizes transmission.

The entire frame must be transmitted as a continuous stream.

A silent time of more than 3.5 character times during frame transmission will cause the receiving device to ignore the incomplete frame. The next byte will be assumed to be the Serial Link No. of the next frame.

If a second message is transmitted before 3.5 character times from the end of the previous one, the receiving device will consider it as a continuation of the first frame, thereby resulting in a CRC error and causing the receiving device to ignore the second frame.
Serial Link No. (Slave Address)

Contains iStart Slave Number (1 - 248) on the serial link. The iStart default value is 1. Serial Link No. is used as the first byte in both the "Query" transmission from Master to Slave and in response transmission from Slave to Master.

Note:
Address 0 that is normally used for broadcast is not supported by the iStart.

Function
The function code informs the iStart of the requested action to take. The function is used as the second byte in both the "Query" transmission from Master to Slave and in the “Response” transmission from Slave to Master.

The function code informs the iStart of the requested action to take. The function is used as the second byte in both the "Query" transmission from Master to Slave and in the “Response” transmission from Slave to Master.

7.1.3 List of Functions Supported by the iStart

<table>
<thead>
<tr>
<th>Function</th>
<th>Modbus Name</th>
<th>Use in iStart</th>
</tr>
</thead>
<tbody>
<tr>
<td>03</td>
<td>Read Holding Registers</td>
<td>Read Setting Parameters</td>
</tr>
<tr>
<td>04</td>
<td>Read Input Registers</td>
<td>Read Actual Data</td>
</tr>
<tr>
<td>06</td>
<td>Write Single Register</td>
<td>Write a Single Settings Parameter</td>
</tr>
<tr>
<td>08</td>
<td>Diagnostic</td>
<td>Check Communication</td>
</tr>
<tr>
<td>16</td>
<td>Force Multiple Registers</td>
<td>Write Settings Parameters Control Commands</td>
</tr>
</tbody>
</table>
Data
The Data field includes information that is transferred to and from the iStart. The specific data format changes according to the function. When Word data parameters are transmitted, the high byte is transmitted first, followed by the low byte.

CRC
The CRC (Cyclic Redundancy Check) has two bytes (16 bit) that are used to check the entire frame bytes. It is generated in the master device and transmitted as the last two bytes of the frame. The low byte is appended first, followed by the high byte.

The slave device regenerates the CRC bytes and compares them to the CRC bytes received. If the CRC bytes are not identical, the frame is flushed and no response is transmitted to the master.

iStart Memory Organization
The iStart memory is organized according to the common Modbus addresses as follows:

<table>
<thead>
<tr>
<th>iStart Use</th>
<th>Memory Type</th>
<th>Max Query/Response Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual Data</td>
<td>Read Word Registers,</td>
<td># 1...160, addressed 1...160</td>
</tr>
<tr>
<td>Setting Parameters</td>
<td>Read/Write Word Registers,</td>
<td># 1...1900, addressed 1...1900</td>
</tr>
<tr>
<td>Control Commands</td>
<td>Write Word Register,</td>
<td># 1 addressed 5001</td>
</tr>
</tbody>
</table>

7.2 Actual Data (Read Word Registers)
Actual data includes measured values such as voltage, current and insulation resistance. It includes also logic information as well as statistic information. All parameters are word (two bytes) parameters. The protocol supports only Reading of these parameters.

The parameter addresses for all actual data have an offset of – 1.
<table>
<thead>
<tr>
<th>Parameter</th>
<th># (4x)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logic Status</td>
<td>1</td>
<td>Logic status of iStart. 1 indicates: Bit 15: iStart Tripped  Bit 14: Motor Stopped  Bit 13: Motor in Soft Stop Process  Bit 12: Motor in Start Process  Bit 11: Motor is Running  Bit 10: Dual Adjust bit  Bit 9: Triple Adjust bit  Bit 8: Motor is running at Slow Speed forward  Bit 7: Motor is running at Slow Speed reverse  Bit 6: Insulation Alarm (Optional)  Bit 5 - Bit 0: Reserved</td>
</tr>
<tr>
<td>Current</td>
<td>2</td>
<td>Current, % FLA</td>
</tr>
<tr>
<td>Voltage</td>
<td>3</td>
<td>Line voltage, % Rated Line voltage</td>
</tr>
<tr>
<td>Phase sequence Correct</td>
<td>4</td>
<td>1: Correct Phase Sequence  0: Wrong Phase Sequence</td>
</tr>
<tr>
<td>Hardwired inputs</td>
<td>5</td>
<td>Discrete Hardwired control Logic inputs Programmable to: Inactive Input, Start, Stop, Soft Stop, External trip, Reset, Start/Stop, Start/Soft Stop  Bit 15 - Bit 3: Reserved.  Bit 2: Logic input # 3 Status – 1: Active, 0: Inactive  Bit 1: Logic input # 2 Status – 1: Active, 0: Inactive  Bit 0: Logic input # 1 Status – 1: Active, 0: Inactive</td>
</tr>
<tr>
<td>Relays</td>
<td>6</td>
<td>Relay statuses  Bit 15 – Bit 2: Reserved  Bit 1: Relay # 2 Status – 1: Active, 0: Inactive  Bit 0: Relay # 1 Status – 1: Active, 0: Inactive</td>
</tr>
<tr>
<td>Insulation Resistance</td>
<td>7</td>
<td>Motor Insulation, Kohm. (Optional)</td>
</tr>
<tr>
<td>I Zero Current</td>
<td>8</td>
<td>Ground leakage current, % FLA</td>
</tr>
<tr>
<td>I Motor Unbalanced Current</td>
<td>9</td>
<td>Max current deviation between phases, %</td>
</tr>
<tr>
<td>Parameter</td>
<td># (4x)</td>
<td>Comment</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>--------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Frequency</td>
<td>10</td>
<td>Mains Frequency [0.1 Hz]</td>
</tr>
<tr>
<td>Thermistor Resistance</td>
<td>11</td>
<td>Thermistor resistance, tenth Kohm (Optional)</td>
</tr>
<tr>
<td>Power [Watt] – Low word</td>
<td>12</td>
<td>Power modulo 64K (65536)</td>
</tr>
<tr>
<td>Power [Watt] – High word</td>
<td>13</td>
<td>Power divided by 64K (65536) without the remainder</td>
</tr>
<tr>
<td>Power Factor</td>
<td>14</td>
<td>Power Factor * 100</td>
</tr>
<tr>
<td>Total run time [Sec] – Low word</td>
<td>15</td>
<td>Total Motor runtime modulo 64K (65536)</td>
</tr>
<tr>
<td>Total run time [Sec] – High word</td>
<td>16</td>
<td>Total Motor runtime divided by 64K (65536) without the remainder</td>
</tr>
<tr>
<td>Logic Status at Power Fail</td>
<td>17</td>
<td>Logic Status at Control Power Supply turned off</td>
</tr>
<tr>
<td>Total Run Time [Hour]</td>
<td>18</td>
<td>Total Hours of Motor runtime</td>
</tr>
<tr>
<td>Total Starts</td>
<td>19</td>
<td>Total Number of Starts</td>
</tr>
<tr>
<td>Last Start Period [Sec]</td>
<td>20</td>
<td>Duration of Last Start, Seconds</td>
</tr>
<tr>
<td>Last Start Peak I</td>
<td>21</td>
<td>Peak Current during Last Starting process, % FLA</td>
</tr>
<tr>
<td>Time to Re - Enable Start [Sec]</td>
<td>22</td>
<td>Wait time until next start command will be allowed</td>
</tr>
<tr>
<td>Total Trips</td>
<td>23</td>
<td>Total Number of Trips</td>
</tr>
<tr>
<td>Parameter</td>
<td># (4x)</td>
<td>Comment</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>--------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Last Trip Number</td>
<td>24</td>
<td>Number of the fault that caused trip</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01  Over Temperature</td>
</tr>
<tr>
<td></td>
<td></td>
<td>02  Short Circuit Current</td>
</tr>
<tr>
<td></td>
<td></td>
<td>03  Overload</td>
</tr>
<tr>
<td></td>
<td></td>
<td>04  Under Current</td>
</tr>
<tr>
<td></td>
<td></td>
<td>05  Under Voltage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>06  Over Voltage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>07  Phase Loss</td>
</tr>
<tr>
<td></td>
<td></td>
<td>08  Phase Sequence</td>
</tr>
<tr>
<td></td>
<td></td>
<td>09  Shorted SCR or Wrong Connection.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10  Long Start Time</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11  Slow Speed Time</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12  MODBUS Timeout</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13  External Fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14  Wrong Parameters</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15  COM Port Failed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>16  Too Many Starts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>17  Motor Insulation (Optional)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18  Thermistor (Optional)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>19  Wrong Frequency</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20  No Voltage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>21  Over 7.5 * FLA current</td>
</tr>
<tr>
<td></td>
<td></td>
<td>22  Over 7.5 * FLC current</td>
</tr>
<tr>
<td></td>
<td></td>
<td>23  Motor Unbalance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24  Ground Fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25  No Current</td>
</tr>
<tr>
<td></td>
<td></td>
<td>26  No Control power</td>
</tr>
<tr>
<td></td>
<td></td>
<td>27  Over Current (Inverse)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>28  Shear Pin Current</td>
</tr>
<tr>
<td></td>
<td></td>
<td>29  Wrong VZC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30  Welded Contactor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>31  No Calibration</td>
</tr>
<tr>
<td>Pre Trip I</td>
<td>25</td>
<td>Current at trip time, %FLA</td>
</tr>
<tr>
<td>Logic Input Status</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>Version CRC16</td>
<td>27</td>
<td>The unique CRC16 Calculation of each SW Version</td>
</tr>
<tr>
<td>Phase Sequence</td>
<td>28</td>
<td>1: Positive, 0: Negative</td>
</tr>
<tr>
<td>Time To Over Current Trip</td>
<td>29</td>
<td>Time left until “Over Current” Trip occurs in seconds</td>
</tr>
<tr>
<td>Parameter</td>
<td># (4x)</td>
<td>Comment</td>
</tr>
<tr>
<td>----------------------------</td>
<td>--------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>COS Phi</td>
<td>30</td>
<td>Cos Phi * 100</td>
</tr>
<tr>
<td>Phase 1 Voltage</td>
<td>31</td>
<td>Phase 1 voltage, 0.1% Rated Line Voltage</td>
</tr>
<tr>
<td>Phase 2 Voltage</td>
<td>32</td>
<td>Phase 2 voltage, 0.1% Rated Line Voltage</td>
</tr>
<tr>
<td>Phase 3 Voltage</td>
<td>33</td>
<td>Phase 3 voltage, 0.1% Rated Line Voltage</td>
</tr>
<tr>
<td>Phase 1 Current</td>
<td>34</td>
<td>Phase 1 Current, 0.1% FLA</td>
</tr>
<tr>
<td>Phase 2 Current</td>
<td>35</td>
<td>Phase 2 Current, 0.1% FLA</td>
</tr>
<tr>
<td>Phase 3 Current</td>
<td>36</td>
<td>Phase 3 Current, 0.1% FLA</td>
</tr>
<tr>
<td>Energy [KWH] - Low word</td>
<td>37</td>
<td>Total Energy modulo 64K (65536)</td>
</tr>
<tr>
<td>Energy [KWH] - High word</td>
<td>38</td>
<td>Total Energy divided by 64K (65536) without the remainder</td>
</tr>
<tr>
<td>Energy per cycle - first word - MSB</td>
<td>39</td>
<td>Energy per cycle in Watts</td>
</tr>
<tr>
<td>Energy per cycle - second word</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy per cycle - third word</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy per cycle - forth word - LSB</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>Reserved</td>
<td>43 - 47</td>
<td></td>
</tr>
<tr>
<td>Analog option card - temper-</td>
<td>48</td>
<td>Thermistor or phase 1 RTD Temperature (Analog option cards), 0.1°C</td>
</tr>
<tr>
<td>ature 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analog Option Card - Tem-</td>
<td>49</td>
<td>Phase 2 RTD Temperature (Analog Option Card), 0.1°C</td>
</tr>
<tr>
<td>perature 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analog Option Card - Tem-</td>
<td>50</td>
<td>Phase 3 RTD Temperature (Analog Option Card), 0.1°C</td>
</tr>
<tr>
<td>perature 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reserved</td>
<td>51 - 52</td>
<td></td>
</tr>
<tr>
<td>Phase 1 Temperature</td>
<td>53</td>
<td>Phase 1 internal temperature, Kelvin</td>
</tr>
<tr>
<td>Phase 2 Temperature</td>
<td>54</td>
<td>Phase 2 internal temperature, Kelvin</td>
</tr>
<tr>
<td>Phase 3 Temperature</td>
<td>55</td>
<td>Phase 3 internal temperature, Kelvin</td>
</tr>
<tr>
<td>Reserved</td>
<td>56 - 110</td>
<td></td>
</tr>
<tr>
<td>Previous Trips</td>
<td>111 - 120</td>
<td>Trip numbers of 10 last trips - from latest to earliest.</td>
</tr>
</tbody>
</table>
7.2.1 Example 1: Read Actual Data

To read actual parameters 2 and 3 (Current and Voltage Actual Parameters, Addressed as 1 and 2) of iStart serial link # 18, the host computer should send following frame:

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Serial Link No.</td>
<td>(0x12)</td>
</tr>
<tr>
<td>2</td>
<td>Function</td>
<td>(0x04)</td>
</tr>
<tr>
<td>3</td>
<td>Starting Address High</td>
<td>(0x00)</td>
</tr>
<tr>
<td>4</td>
<td>Starting Address Low</td>
<td>(0x01)</td>
</tr>
<tr>
<td>5</td>
<td>No. of Points High</td>
<td>(0x00)</td>
</tr>
<tr>
<td>6</td>
<td>No. of Points Low</td>
<td>(0x02)</td>
</tr>
<tr>
<td>7</td>
<td>CRC_Low</td>
<td>(0xXX)</td>
</tr>
<tr>
<td>8</td>
<td>CRC_High</td>
<td>(0xXX)</td>
</tr>
</tbody>
</table>

The iStart response, when Current = 400 % of FLA, and Voltage = 420V, is:

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
<th>Value</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Serial Link No.</td>
<td>(0x12)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Function</td>
<td>(0x04)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Byte Count</td>
<td>(0x04)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Data High, parameter 2</td>
<td>(0x01)</td>
<td>(400% FLA)</td>
</tr>
<tr>
<td>5</td>
<td>Data Low, parameter 2</td>
<td>(0x90)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Data High, parameter 3</td>
<td>(0x01)</td>
<td>(420V)</td>
</tr>
<tr>
<td>7</td>
<td>Data Low, parameter 3</td>
<td>(0xA4)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>CRC_Low</td>
<td>(0xXX)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>CRC_High</td>
<td>(0xYY)</td>
<td></td>
</tr>
</tbody>
</table>

The parameter addresses for all actual data have an offset of −1. For example: In order to read parameter # 5, the user should call address 304.
7.3 Setting Parameters (Read\Write Word Registers)

Setting parameters includes all parameters that can be set manually. These parameters determine the modes of operation of the iStart. They also set the protection level. All parameters are word (two bytes) parameters. The protocol supports both reading and modifying of (most of) these parameters.

The parameter addresses for all setting parameters have an offset of –1.

For example: In order to read parameter # 10, the user should call address 9.

Notes:
1. Use function 3 to read the setting parameters.
2. Use functions 6 and 16 to write the setting parameters.
3. Each of these parameters must set with care. Incorrect settings of some parameters can damage both the motor and the ISA-SL.

7.3.1 Main Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>#</th>
<th>Range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Line Voltage</td>
<td>1</td>
<td>190 - 600 V</td>
<td>400 (Volt)</td>
</tr>
<tr>
<td>Phase Sequence</td>
<td>2</td>
<td>0 - Ignore</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 - Positive</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 - Negative</td>
<td></td>
</tr>
<tr>
<td>iStart FLC</td>
<td>3</td>
<td>17 - 1100</td>
<td>44 (Amp)</td>
</tr>
<tr>
<td>Motor Rated Power</td>
<td>4</td>
<td>1 - 3000</td>
<td>35 (KW)</td>
</tr>
<tr>
<td>Reserved</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reserved</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>O/C Shear Pin</td>
<td>7</td>
<td>100 - 850 (% of FLA)</td>
<td>400 (% of FLA)</td>
</tr>
<tr>
<td>Reserved</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overload Class</td>
<td>9</td>
<td>IEC5 - NEMA60</td>
<td>IEC10</td>
</tr>
<tr>
<td>Parameter</td>
<td>#</td>
<td>Range</td>
<td>Default</td>
</tr>
<tr>
<td>------------------------</td>
<td>----</td>
<td>--------------------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Overload Protect</td>
<td>10</td>
<td>0 - Disable 1 - Enable While Run 2 - Enable Always</td>
<td>0</td>
</tr>
<tr>
<td>Under Current Level</td>
<td>11</td>
<td>0 - 90 (% of FLA)</td>
<td>20 (% of FLA)</td>
</tr>
<tr>
<td>M.Unbalance Current Level</td>
<td>12</td>
<td>10 - 100 (% of FLA)</td>
<td>20 (% of FLA)</td>
</tr>
<tr>
<td>Ground Fault Current Level</td>
<td>13</td>
<td>1 - 60 (% of FLA)</td>
<td>20 (% of FLA)</td>
</tr>
<tr>
<td>Under Voltage Level</td>
<td>14</td>
<td>50 - 90 (% of Rated V)</td>
<td>75 (% of Rated V)</td>
</tr>
<tr>
<td>Over Voltage Level</td>
<td>15</td>
<td>109 - 125 (% of Rated V)</td>
<td>110 (% of Rated V)</td>
</tr>
<tr>
<td>Reserved</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Starts</td>
<td>17</td>
<td>0 (OFF) 1 - 10</td>
<td>10</td>
</tr>
<tr>
<td>Start Period</td>
<td>18</td>
<td>1 - 60[Sec]</td>
<td>30[Sec]</td>
</tr>
<tr>
<td>Start Inhibit</td>
<td>19</td>
<td>1 - 60[Sec]</td>
<td>15[Sec]</td>
</tr>
<tr>
<td>Extended Settings</td>
<td>20</td>
<td>0 - Disable 1 - Enable</td>
<td>0 - Disable</td>
</tr>
<tr>
<td>Reserved</td>
<td>21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over Current Protect</td>
<td>22</td>
<td>0 - Disable 1 - Enable While Run 2 - Enable Always</td>
<td>0 - Disable</td>
</tr>
<tr>
<td>Parameter</td>
<td>#</td>
<td>Range</td>
<td>Default</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----</td>
<td>------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Over Current Curve Type</td>
<td>23</td>
<td>0 - IEC Curve C1</td>
<td>0 – IEC CURVE C1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 - IEC Curve C2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 - IEC Curve C3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 - IEC Curve C4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 - IEC Curve C5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 - US Curve U1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 - US Curve U2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>7 - US Curve U3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>8 - US Curve U4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>9 - US Curve U5</td>
<td></td>
</tr>
<tr>
<td>Over Current IEC Time Dial</td>
<td>24</td>
<td>5 - TD 0.05</td>
<td>5 – TD 0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 - TD 0.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>20 - TD 0.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>30 - TD 0.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>40 - TD 0.4</td>
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<td>50 - TD 0.5</td>
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<td>60 - TD 0.6</td>
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<td>70 - TD 0.7</td>
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<td>80 - TD 0.8</td>
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<td>90 - TD 0.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>100 - TD 1.0</td>
<td></td>
</tr>
<tr>
<td>Parameter</td>
<td>#</td>
<td>Range</td>
<td>Default</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----</td>
<td>---------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Over Current US Time Dial</td>
<td>25</td>
<td>50 - TD 0.5</td>
<td>50 – TD 0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100 - TD 1</td>
<td></td>
</tr>
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<td></td>
<td></td>
<td>200 - TD 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>300 - TD 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>400 - TD 4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>500 - TD 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>600 - TD 6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>800 - TD 8</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1000 - TD 10</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1200 - TD 12</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1500 - TD 15</td>
<td></td>
</tr>
<tr>
<td>Over Current Pick Up Current [% FLA]</td>
<td>26</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
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<td></td>
<td>150</td>
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<td>200</td>
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<td>350</td>
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<td>400</td>
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<tr>
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<td>500</td>
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<tr>
<td></td>
<td></td>
<td>550</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>600</td>
<td></td>
</tr>
</tbody>
</table>
### 7.3.2 Start Parameters (First Adjust)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>#</th>
<th>Range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor FLA</td>
<td>51</td>
<td>17 - 1100</td>
<td>44 (Amp)</td>
</tr>
<tr>
<td>Soft Start Curve</td>
<td>52</td>
<td>0 - Generator 1 - Standard 2 - Pump Curve 1 3 - Pump Curve 2 4 - Pump Curve 3 5 - Internal (Do Not Set) 6 - Internal (Do Not Set) 7 - Internal (Do Not Set) 8 - Internal (Do Not Set) 9 - DOL</td>
<td>1 - Standard</td>
</tr>
<tr>
<td>Initial Voltage</td>
<td>53</td>
<td>25 - 60</td>
<td>28 (% of full voltage)</td>
</tr>
<tr>
<td>Initial Current</td>
<td>54</td>
<td>0 - 400</td>
<td>0 (% of FLA)</td>
</tr>
<tr>
<td>Current Limit</td>
<td>55</td>
<td>70 - 400</td>
<td>400 (% of FLA)</td>
</tr>
<tr>
<td>Acceleration Time</td>
<td>56</td>
<td>1 - 90</td>
<td>10 (Seconds)</td>
</tr>
<tr>
<td>Max Start Time</td>
<td>57</td>
<td>1 - 250</td>
<td>30 (Seconds)</td>
</tr>
<tr>
<td>Pulse Type</td>
<td>58</td>
<td>0 - Pulse Disable 1 - Voltage Pulse 2 - Current Pulse</td>
<td>0 – Pulse Disable</td>
</tr>
<tr>
<td>Voltage Pulse Level</td>
<td>59</td>
<td>50 – 99</td>
<td>50 (% of full voltage)</td>
</tr>
<tr>
<td>Current Pulse Level</td>
<td>60</td>
<td>0 – 700</td>
<td>0 (% of FLA)</td>
</tr>
<tr>
<td>Pulse Rise Time</td>
<td>61</td>
<td>1 - 5</td>
<td>1 (0.1 seconds)</td>
</tr>
<tr>
<td>Reserved</td>
<td>62</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse Constant Time</td>
<td>63</td>
<td>0 - 10</td>
<td>0 (0.1 seconds)</td>
</tr>
<tr>
<td>Pulse Fall Time</td>
<td>64</td>
<td>1 - 5</td>
<td>1 (0.1 seconds)</td>
</tr>
<tr>
<td>Reserved</td>
<td>65</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Note:
Start Parameters (second, third and fourth Adjust) have the same parameters. Their addresses are shifted from first adjust by: \(((\text{Adjust Number} - 1) \times 40)\).

For example: the “Pulse Rise Time” for third adjusts has the address: 
\((# \text{ Pulse Rise Time First Adjust}) + ((\text{Adjust} - 1) \times 40) + \text{offset of} - 1 = 61 + 2 \times 40 = 140\).

### 7.3.3 Stop Parameters (First Adjust)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>#</th>
<th>Range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft Stop Curve(^{vi})</td>
<td>211</td>
<td>0 - Generator</td>
<td>1 – Standard</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 - Standard</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 - Pump Curve</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 - Pump Curve</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 - Pump Curve</td>
<td></td>
</tr>
<tr>
<td>Reserved</td>
<td>212</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deceleration Time</td>
<td>213</td>
<td>0 - 30</td>
<td>30 (Seconds)</td>
</tr>
<tr>
<td>Reserved</td>
<td>214</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note:
Stop Parameters (second, third and fourth Adjust) have the same parameters. Their addresses are shifted from first adjust by: \(((\text{Adjust Number} - 1) \times 20)\).

For example: the “Deceleration Time” for forth adjusts has the address: 
\((#\text{Deceleration Time First Adjust}) + ((\text{Adjust} - 1) \times 20) + \text{offset of} -1 = 213 + 3 \times 20 = 272\).
7.3.4 Special Features Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>#</th>
<th>Range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reserved</td>
<td>291</td>
<td>293</td>
<td></td>
</tr>
<tr>
<td>Two Phase Mode&lt;sup&gt;vii&lt;/sup&gt;</td>
<td>294</td>
<td>0 - Three Phase Mode (Standard)</td>
<td>0 - Three Phase Mode (Standard)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 - Ignore Phase 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 - Ignore Phase 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 - Ignore Phase 3</td>
<td></td>
</tr>
<tr>
<td>Light Duty Enable</td>
<td>295</td>
<td>0 - Disable</td>
<td>0 - Disable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 - Enable</td>
<td></td>
</tr>
</tbody>
</table>

7.3.5 Fault Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>#</th>
<th>Range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over Temperature Trip</td>
<td>311</td>
<td>0 - Disable Trip &amp; Warning</td>
<td>1 - Enable Trip Only</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 - Enable Trip Only</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 - Enable Warning Only</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 - Enable Trip &amp; Warning</td>
<td></td>
</tr>
<tr>
<td>Over Temperature Active Time</td>
<td>312</td>
<td>1 - 600 (0.1 sec)</td>
<td>1</td>
</tr>
<tr>
<td>Over Temperature Inactive Time</td>
<td>313</td>
<td>1 - 600 (0.1 sec)</td>
<td>1</td>
</tr>
<tr>
<td>No Calibration Trip</td>
<td>404</td>
<td>0 - Disable Trip &amp; Warning</td>
<td>1 - Enable Trip Only</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 - Enable Trip Only</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 - Enable Warning Only</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 - Enable Trip &amp; Warning</td>
<td></td>
</tr>
<tr>
<td>Parameter</td>
<td>#</td>
<td>Range</td>
<td>Default</td>
</tr>
<tr>
<td>----------------------------</td>
<td>----</td>
<td>---------------------</td>
<td>---------</td>
</tr>
<tr>
<td>No Calibration Active Time</td>
<td>405</td>
<td>1 - 600 (0.1 sec)</td>
<td>1</td>
</tr>
<tr>
<td>No Calibration Inactive Time</td>
<td>406</td>
<td>1 - 600 (0.1 sec)</td>
<td>1</td>
</tr>
</tbody>
</table>

**Notes:**

The next fault parameters are the same as the ones above except for a few exceptionsviii. Their addresses are shifted from first set (Trip, Active & Inactive time) by: (Fault Number –1) * 3). For example: the “Too Many Starts Inactive Time” has the address: (# Over Temperature Inactive Time) + ((Fault Number – 1) * 3) + offset of –1 = 313 + 15*3 = 4357.

**Faults List**

<table>
<thead>
<tr>
<th>#</th>
<th>Fault</th>
<th>#</th>
<th>Fault</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Over Temperature</td>
<td>17</td>
<td>Motor Insulation (Optional)</td>
</tr>
<tr>
<td>02</td>
<td>Short Circuit Current</td>
<td>18</td>
<td>Thermistor (Optional)</td>
</tr>
<tr>
<td>03</td>
<td>Overload</td>
<td>19</td>
<td>Wrong Frequency</td>
</tr>
<tr>
<td>04</td>
<td>Under Current</td>
<td>20</td>
<td>No Voltage</td>
</tr>
<tr>
<td>05</td>
<td>Under Voltage</td>
<td>21</td>
<td>Over 7p5 FLA current</td>
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### 7.3.6 Auto Reset Parameters

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Notes:

1. The next Auto-Reset parameters are the same as the ones above. Their addresses are shifted from first set (When Active, Number of Tries… after Start Enable) by: \((\text{Fault Number} - 1) \times 7\).

   For example: the “No Control Power Wait for solved” has the address:
   \(^{(\text{Over Temperature Wait for solved}) + ((\text{Fault Number} - 1) \times 3)} + \text{offset of} -1 = 506 + 25 \times 7 = 680\).

2. The complete list of fault parameters is listed on page 110.

3. The last fault (No Calibration) does not have an autoreset parameters group.
### 7.3.7 I/O Programming Parameters

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<td>3 - input#1, input#3, input#2, comm.</td>
<td>3 - input#1, input#3, input#2, comm.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 - input#3, input#1, input#2, comm.</td>
<td>4 - input#3, input#1, input#2, comm.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 - input#3, input#2, input#1, comm.</td>
<td>5 - input#3, input#2, input#1, comm.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 - input#1, input#2, comm., input#3</td>
<td>6 - input#1, input#2, comm., input#3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7 - input#2, input#1, comm., input#3</td>
<td>7 - input#2, input#1, comm., input#3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8 - input#2, input#3, comm., input#1</td>
<td>8 - input#2, input#3, comm., input#1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9 - input#1, input#3, comm., input#2</td>
<td>9 - input#1, input#3, comm., input#2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 - input#3, input#1, comm., input#2</td>
<td>10 - input#3, input#1, comm., input#2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11 - input#3, input#2, comm., input#1</td>
<td>11 - input#3, input#2, comm., input#1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 - input#1, comm., input#2, input#3</td>
<td>12 - input#1, comm., input#2, input#3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13 - input#2, comm., input#1, input#3</td>
<td>13 - input#2, comm., input#1, input#3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14 - input#2, comm., input#3, input#1</td>
<td>14 - input#2, comm., input#3, input#1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15 - input#1, comm., input#3, input#2</td>
<td>15 - input#1, comm., input#3, input#2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>16 - input#3, comm., input#1, input#2</td>
<td>16 - input#3, comm., input#1, input#2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>17 - input#3, comm., input#2, input#1</td>
<td>17 - input#3, comm., input#2, input#1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18 - comm., input#1, input#2, input#3</td>
<td>18 - comm., input#1, input#2, input#3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>19 - comm., input#2, input#1, input#3</td>
<td>19 - comm., input#2, input#1, input#3</td>
</tr>
<tr>
<td>Parameter</td>
<td>#</td>
<td>Range</td>
<td>Default</td>
</tr>
<tr>
<td>-----------</td>
<td>----</td>
<td>----------------------------------------------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Inputs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Policy</td>
<td>918</td>
<td>0 – Last Command Active 1 – First Command Active 2 – Via Priority</td>
<td>2 – Via Priority</td>
</tr>
<tr>
<td>Relay #1</td>
<td>919</td>
<td>0 - Active at Never 1 - Active at Run Immediate 2 - Active at Starting 3 - Active at End of Acceleration 4 - Active at Stop 5 - Active at Soft Stop 6 - Active at Stop Immediate 7 - Active at Alternative Adjust 8 - Active at Fault 9 - Active at Warning</td>
<td>8 - Active at fault</td>
</tr>
<tr>
<td>Relay #1</td>
<td></td>
<td>0 – 600 (0.1 sec)</td>
<td>0</td>
</tr>
<tr>
<td>Active</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delay</td>
<td>920</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relay #1</td>
<td></td>
<td>0 – 600 (0.1 sec)</td>
<td>0</td>
</tr>
<tr>
<td>Inactive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delay</td>
<td>921</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relay #1</td>
<td></td>
<td>0 - Normally Open 1 - Normally Close</td>
<td>0 – Normally Open</td>
</tr>
<tr>
<td>Active</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polarity</td>
<td>922</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relay #2</td>
<td></td>
<td>0 – Never Active 9 - Active at Warning</td>
<td>3 - Active at end of acceleration</td>
</tr>
<tr>
<td>Program</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity</td>
<td>923</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relay #2</td>
<td></td>
<td>0 - 600 (0.1 sec)</td>
<td>0</td>
</tr>
<tr>
<td>Active</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delay</td>
<td>924</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 7.3.8 Global Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>#</th>
<th>Range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language selected</td>
<td>1001</td>
<td>1 – English</td>
<td>1 – English</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The languages list is not uniform - Ask a esco sales representative for the list of languages for your iStart!</td>
</tr>
<tr>
<td>Seconds</td>
<td>1002</td>
<td>0 - 60</td>
<td>0</td>
</tr>
<tr>
<td>Minutes</td>
<td>1003</td>
<td>0 - 60</td>
<td>0</td>
</tr>
<tr>
<td>Hours</td>
<td>1004</td>
<td>0 - 23</td>
<td>0</td>
</tr>
<tr>
<td>Days</td>
<td>1005</td>
<td>1 - 31</td>
<td>1</td>
</tr>
<tr>
<td>Months</td>
<td>1006</td>
<td>1 - 12</td>
<td>1</td>
</tr>
<tr>
<td>Years</td>
<td>1007</td>
<td>2014 - 2050</td>
<td>2014</td>
</tr>
<tr>
<td>LCD Contrast</td>
<td>1008</td>
<td>1 - 8</td>
<td>6</td>
</tr>
<tr>
<td>LCD Intensity</td>
<td>1009</td>
<td>1 - 8</td>
<td>8</td>
</tr>
<tr>
<td>Reserved</td>
<td>1010</td>
<td>0 - 10</td>
<td>0</td>
</tr>
</tbody>
</table>
### 7.3.9 Communication Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>#</th>
<th>Range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default Actual Data Screen</td>
<td>1011</td>
<td>0 - Actual Trip 1 - Actual Warning 2 - RTD Temperature(\text{vi}) 3 - PTC Temperature 4 - NTC Temperature 5 - Internal Temperature 6 - Frequency(\text{vii}) 7 - Control Voltage 8 - 3 Phase Voltage 9 - 3 Phase Current %FLA 10 - 3 Phase Current Amps 11 - V/I/Power Factor</td>
<td>11 - V/I/Power Factor</td>
</tr>
<tr>
<td>Display Mode</td>
<td>1012</td>
<td>0 - Basic 1 - Professional 2 - Expert</td>
<td>0 – Basic</td>
</tr>
<tr>
<td>Parameters Lock</td>
<td>1013</td>
<td>0 - Locked 1 - Not Locked</td>
<td>1 – Not Locked</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>#</th>
<th>Range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>No longer in use</td>
<td>1101</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parameter</td>
<td>#</td>
<td>Range</td>
<td>Default</td>
</tr>
<tr>
<td>-------------------</td>
<td>-----</td>
<td>--------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Baud Rate</td>
<td>1102</td>
<td>12 - 1200 (bps)</td>
<td>1152 - 115200 (bps)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24 - 2400 (bps)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>48 - 4800 (bps)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>96 - 9600 (bps)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>192 - 19200 (bps)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>384 - 38400 (bps)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>768 - 76800 (bps)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1152 - 115200 (bps)</td>
<td></td>
</tr>
<tr>
<td>Stop bit Length</td>
<td>1103</td>
<td>0 - 0.5 bit</td>
<td>1 – 1.0 bit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 - 1.0 bit</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 - 1.5 bit</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 - 2.5 bit</td>
<td></td>
</tr>
<tr>
<td>Parity Check</td>
<td>1104</td>
<td>0 - None</td>
<td>0 – None</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 - Even</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 - Odd</td>
<td></td>
</tr>
<tr>
<td>Slave Address</td>
<td>1105</td>
<td>1 - 247</td>
<td>1</td>
</tr>
<tr>
<td>Comm. Program</td>
<td>1106</td>
<td>0 - No, 1 - Yes</td>
<td>0 - No</td>
</tr>
<tr>
<td>save</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comm. Control</td>
<td>1107</td>
<td>0 - No, 1 - Yes</td>
<td>0 – No</td>
</tr>
<tr>
<td>Comm. CMD Hold</td>
<td>1108</td>
<td>0 - 100 (0.1 sec)</td>
<td>10</td>
</tr>
<tr>
<td>Time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comm. CMD Reset</td>
<td>1109</td>
<td>0 - No, 1 - Yes</td>
<td>0 – No</td>
</tr>
<tr>
<td>Comm. Timeout</td>
<td>1110</td>
<td>0 - 9000 (0.1 sec)</td>
<td>100</td>
</tr>
<tr>
<td>UPD Comm. Steps</td>
<td>1111</td>
<td>0 – Comm check before write</td>
<td>0 – Comm check before write</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 – Comm writes before check</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

29. Parameter # is "1 based". The address is 1 lower than the parameter #. For example address of parameter #1 is 0.

30. When the Write Multiple Register function (16) is used to adjust one or more setting parameters, then if one or more setting parameters are out of range, or if it is beyond the
allowed limit an Illegal_Data_Address (exception code 0x02) error response will be returned.

31. It is possible to preset setting parameters only when motor is stopped.

32. When the motor is Soft Started, Soft Stopped, runs at a slow speed, the iStart ignores the Preset Multiple Register function. An Illegal_Function exception response (exception code 0x01) is returned by the iStart whenever its logic condition does not enable presetting.

33. Always wait more than 0.5 sec after using Function16 to preset parameters before transmitting again to the same iStart.

34. After changing one or more of Communication parameters – iStart Control Power needs to be shut-down in order that the changes will take effect.

35. After setting iStart parameters, the user is responsible for reading and testing all changed setting parameters.

### 7.3.10 Example 2: Read Setting Parameters

To read the Adjust Soft Start Setting parameters #173 – 175 (addressed at 172 – 174) (Init Volt, Init Current and Current Limit) for motor number 4 attached to the iStart # 1, the host computer should send following frame:

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
<th>Value</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Serial Link No.</td>
<td>(0x01)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Function</td>
<td>(0x03)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Starting Address High</td>
<td>(0x00)</td>
<td>Address = 172 (173 - 1)</td>
</tr>
<tr>
<td>4</td>
<td>Starting Address Low</td>
<td>(0xAC)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>No. of Registers High</td>
<td>(0x00)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>No. of Registers Low</td>
<td>(0x03)</td>
<td></td>
</tr>
</tbody>
</table>
The iStart normal response:

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
<th>Value</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Serial Link No.</td>
<td>(0x01)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Function</td>
<td>(0x03)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Byte Count</td>
<td>(0x06)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Data High</td>
<td>(0x00)</td>
<td>Init Volt = 0</td>
</tr>
<tr>
<td>5</td>
<td>Data High</td>
<td>(0x1C)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Data High</td>
<td>(0x00)</td>
<td>Init Current = 0%</td>
</tr>
<tr>
<td>7</td>
<td>Data Low</td>
<td>(0x00)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Data High</td>
<td>(0x01)</td>
<td>Current Limit = 400%</td>
</tr>
<tr>
<td>9</td>
<td>Data Low</td>
<td>(0x90)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>CRC Low</td>
<td>(0xXX)</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>CRC High</td>
<td>(0xYY)</td>
<td></td>
</tr>
</tbody>
</table>

### 7.3.11 Example 3: Write a Single Setting Parameter

To write a single setting parameter (Under Voltage Level = 80%) to Setting Parameter # 14 (addressed as 13) of iStart Serial Link # 7, the host computer should send following frame:

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
<th>Value</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Serial Link No.</td>
<td>(0x07)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Function</td>
<td>(0x06)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Starting Address High</td>
<td>(0x00)</td>
<td>Address =13 (14-1)</td>
</tr>
<tr>
<td>4</td>
<td>Starting Address Low</td>
<td>(0x0D)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Data High</td>
<td>(0x00)</td>
<td>80% of rated line voltage</td>
</tr>
<tr>
<td>6</td>
<td>Data Low</td>
<td>(0x50)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>CRC Low</td>
<td>(0xXX)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>CRC High</td>
<td>(0xYY)</td>
<td></td>
</tr>
</tbody>
</table>
The iStart normal response is an echo of the query:

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
<th>Value</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Serial Link No.</td>
<td>0x07</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Function</td>
<td>0x06</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Starting Address High</td>
<td>0x00</td>
<td>Address =13 (14-1)</td>
</tr>
<tr>
<td>4</td>
<td>Starting Address Low</td>
<td>0x0D</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Register Value High</td>
<td>0x00</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Register Value Low</td>
<td>0x50</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>CRC Low</td>
<td>0xXX</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>CRC High</td>
<td>0xYY</td>
<td></td>
</tr>
</tbody>
</table>
7.3.12 Example 4: Write Multiple Setting Parameters

To write multiple setting parameters (Ground Fault Current Level = 75%, Under Voltage Level = 40%, Over Voltage Level = 120%) to Setting Parameters # 13-15 (addressed as 12 - 14) of iStart # 128, the host computer should send following frame:

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
<th>Value</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Serial Link No.</td>
<td>(0x80)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Function</td>
<td>(0x10)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Starting Address High</td>
<td>(0x00)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Starting Address Low</td>
<td>(0x0C)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>No. of Registers High</td>
<td>(0x00)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>No. of Registers Low</td>
<td>(0x03)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Byte Count</td>
<td>(0x06)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Data High</td>
<td>(0x00)</td>
<td>Address = 75</td>
</tr>
<tr>
<td>9</td>
<td>Data Low</td>
<td>(0x4B)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Data High</td>
<td>(0x00)</td>
<td>Address = 40</td>
</tr>
<tr>
<td>11</td>
<td>Data Low</td>
<td>(0x28)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Data High</td>
<td>(0x00)</td>
<td>Address = 120</td>
</tr>
<tr>
<td>13</td>
<td>Data Low</td>
<td>(0x78)</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>CRC Low</td>
<td>(0xXX)</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>CRC High</td>
<td>(0xYY)</td>
<td></td>
</tr>
</tbody>
</table>

The iStart normal response:

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Serial Link No.</td>
<td>(0x80)</td>
</tr>
<tr>
<td>2</td>
<td>Function</td>
<td>(0x10)</td>
</tr>
<tr>
<td>3</td>
<td>Starting Address High</td>
<td>(0x00)</td>
</tr>
<tr>
<td>4</td>
<td>Starting Address Low</td>
<td>(0x0C)</td>
</tr>
<tr>
<td>5</td>
<td>No. of Registers High</td>
<td>(0x00)</td>
</tr>
<tr>
<td>6</td>
<td>No. of Registers Low</td>
<td>(0x03)</td>
</tr>
<tr>
<td>7</td>
<td>CRC Low</td>
<td>(0xXX)</td>
</tr>
<tr>
<td>8</td>
<td>CRC High</td>
<td>(0xYY)</td>
</tr>
</tbody>
</table>
Note:

After setting iStart parameters, the user is responsible for reading and testing all setting parameters. When Preset Multiple Register Function (16) is used to adjust one or more setting parameters, an Illegal_Data_Address (exception code 0x02) error response will be returned if one of the following conditions exist:

- One or more setting parameters are out of range
- Preset Multiple Register Function (16) is outside the allowed range.

7.4 Control Register Write (Write Word Register)

The iStart incorporates one Control Register for controlling the ISA-SL.

The Control Register is register #1, addressed at 5001.

In order to control the iStart using the Control register:

- Use Function 16 only.
- Use Address High = 0x13
- Use Address Low = 0x88.
- Write to one register only.
- Use data high (MS-Byte of data) = 0x5A.
- Data low Bits resolution of the control register (LS-Byte of data):

<table>
<thead>
<tr>
<th>Bit</th>
<th>Function</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Stop</td>
<td>Write &quot;1&quot; (ON) to stop.</td>
</tr>
<tr>
<td>1</td>
<td>Soft Stop</td>
<td>Write &quot;1&quot; (ON) to Soft Stop</td>
</tr>
<tr>
<td>2</td>
<td>Start</td>
<td>Write &quot;1&quot; (ON) to start</td>
</tr>
<tr>
<td>3</td>
<td>Triple Adjust</td>
<td>Write &quot;1&quot; (ON) to turn On; Write &quot;0&quot; (OFF) to turn Off</td>
</tr>
<tr>
<td>4</td>
<td>Dual Adjust</td>
<td>Write &quot;1&quot; (ON) to turn On</td>
</tr>
</tbody>
</table>
Communication

<table>
<thead>
<tr>
<th>Bit</th>
<th>Function</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Slow Speed</td>
<td>Write &quot;1&quot; for Slow Speed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Write &quot;0&quot; for normal Start</td>
</tr>
<tr>
<td>5</td>
<td>Slow Spd Reverse</td>
<td>Write &quot;1&quot; for Reverse Direction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Write &quot;0&quot; for Forward Direction</td>
</tr>
<tr>
<td>6</td>
<td>Reset</td>
<td>Write &quot;1&quot; (ON) to Reset.</td>
</tr>
</tbody>
</table>

Notes:

1. It is not possible to read the function of the control register. To read the iStart status, read the Logic Status (actual parameter #1 = address 0).

2. Bytes 2 - 8 of the control frame must be exactly as in Example 5 - Control Register Write on page 127e. Otherwise, an error message will be returned.

3. Warning: Before applying Start Command via Comm. -- make sure you have at least one I/O Logic Input that is set to stop and have higher priority than Comm.

7.4.1 Example 5 - Control Register Write

To start iStart # 1, the host computer should send the following query frame:

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
<th>Value</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Serial Link No.</td>
<td>(0x01)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Function</td>
<td>(0x10)</td>
<td>Bytes 2 - 8 must be as in this example!!!</td>
</tr>
</tbody>
</table>
### Communication

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Serial Link No.</td>
<td>(0x01)</td>
</tr>
<tr>
<td>2</td>
<td>Function</td>
<td>(0x10)</td>
</tr>
<tr>
<td>3</td>
<td>Starting Address High</td>
<td>(0x13)</td>
</tr>
<tr>
<td>4</td>
<td>Starting Address Low</td>
<td>(0x88)</td>
</tr>
<tr>
<td>5</td>
<td>No. of Registers High</td>
<td>(0x00)</td>
</tr>
<tr>
<td>6</td>
<td>No. of Registers Low</td>
<td>(0x01)</td>
</tr>
<tr>
<td>7</td>
<td>Byte Count</td>
<td>(0x02)</td>
</tr>
<tr>
<td>8</td>
<td>Data High</td>
<td>(0x5A)</td>
</tr>
<tr>
<td>9</td>
<td>Data Low</td>
<td>(0x04)</td>
</tr>
<tr>
<td>10</td>
<td>CRC Low</td>
<td>(0xXX)</td>
</tr>
<tr>
<td>11</td>
<td>CRC High</td>
<td>(0xYY)</td>
</tr>
</tbody>
</table>

The `iStart` normal response:

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Serial Link No.</td>
<td>(0x01)</td>
</tr>
<tr>
<td>2</td>
<td>Function</td>
<td>(0x10)</td>
</tr>
<tr>
<td>3</td>
<td>Starting Address High</td>
<td>(0x13)</td>
</tr>
<tr>
<td>4</td>
<td>Starting Address Low</td>
<td>(0x88)</td>
</tr>
<tr>
<td>5</td>
<td>No. of Registers High</td>
<td>(0x00)</td>
</tr>
<tr>
<td>6</td>
<td>No. of Registers Low</td>
<td>(0x01)</td>
</tr>
<tr>
<td>7</td>
<td>CRC Low</td>
<td>(0xXX)</td>
</tr>
<tr>
<td>8</td>
<td>CRC High</td>
<td>(0xYY)</td>
</tr>
</tbody>
</table>
7.5 Diagnostics

Modbus function 08, as implemented in the iStart, tests the communication serial link between the master and the iStart only supports return query data (subfunction 0x00).

To request iStart with serial link # 1 to return query data, the master should send the following query frame:

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Serial Link No.</td>
<td>(0x01)</td>
</tr>
<tr>
<td>2</td>
<td>Function</td>
<td>(0x08)</td>
</tr>
<tr>
<td>3</td>
<td>Subfunction High</td>
<td>(0x00)</td>
</tr>
<tr>
<td>4</td>
<td>Subfunction Low</td>
<td>(0x00)</td>
</tr>
<tr>
<td>5</td>
<td>Data High</td>
<td>(0x37)</td>
</tr>
<tr>
<td>6</td>
<td>Data Low</td>
<td>(0xA5)</td>
</tr>
<tr>
<td>7</td>
<td>CRC_Low</td>
<td>(0xXX)</td>
</tr>
<tr>
<td>8</td>
<td>CRC_High</td>
<td>(0xYY)</td>
</tr>
</tbody>
</table>

The normal (if no exception) response is the echo of the Query:

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Serial Link No.</td>
<td>(0x01)</td>
</tr>
<tr>
<td>2</td>
<td>Function</td>
<td>(0x08)</td>
</tr>
<tr>
<td>3</td>
<td>Subfunction High</td>
<td>(0x00)</td>
</tr>
<tr>
<td>4</td>
<td>Subfunction Low</td>
<td>(0x00)</td>
</tr>
<tr>
<td>5</td>
<td>Force Data High</td>
<td>(0x37)</td>
</tr>
<tr>
<td>6</td>
<td>Force Data Low</td>
<td>(0xA5)</td>
</tr>
<tr>
<td>7</td>
<td>CRC_Low</td>
<td>(0xXX)</td>
</tr>
<tr>
<td>8</td>
<td>CRC_High</td>
<td>(0xYY)</td>
</tr>
</tbody>
</table>
7.6 Exception Responses

When the master sends a query frame to an iStart, one of the following four responses from the iStart is possible:

1. When no communication error is detected in the query, and no mistake is found by the communication program module in the iStart, a normal response is returned.

2. If the iStart does not receive the query frame (for example because of disconnected serial link cable) then no response is returned by the iStart. After the comm timeout is reached, the master will timeout.

3. If the iStart receives the query, but faulty CRC bytes and/or Parity bits are detected, then no response is returned by the iStart. After the comm timeout is reached, the master will timeout.

4. If no communication error is detected in the query, but the iStart communication program module finds an error such as illegal Function, data address or data value, or if the iStart is busy, then an Exception response is returned. The Exception response includes an Exception Code to inform the master about the type of the error.

7.6.1 Exception Code Response Frame

Exception response frame holds fix number of 5 Bytes. The first one, the Slave Address field is the Serial link number (transmitted in query and identical to iStart Serial Link No.). The second byte, the Function field returns the echo of the transmitted query function, but with the MSB set to 1 (adding 0x80 to the transmitted function code). The third Byte is the Exception Code informing about the type of error. Last two bytes are the CRC bytes.

7.6.2 Exception Codes Supported by the iStart

<table>
<thead>
<tr>
<th>Code</th>
<th>Type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Illegal Function</td>
<td>Requested function is not supported.</td>
</tr>
</tbody>
</table>
Functions 3, 4, 6, 8 and 16 are supported.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Value</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>Illegal Data Address</td>
<td>Data address is outside the allowed range.</td>
<td></td>
</tr>
<tr>
<td>03</td>
<td>Illegal Data Value</td>
<td>Data value is not a legal value.</td>
<td></td>
</tr>
<tr>
<td>04</td>
<td>Slave Device Failure</td>
<td>Data value is not a legal value when reading from an external EEPROM.</td>
<td></td>
</tr>
<tr>
<td>06</td>
<td>Slave Device Busy</td>
<td>iStart is busy now. The master should transmit the message again later.</td>
<td></td>
</tr>
</tbody>
</table>

### 7.6.3 Example 6: Exception Response

When you write an illegal value to a single setting parameter (Under Voltage Level = 128%) to Setting Parameter # 14 (addressed as 13) of iStart Serial Link #10, the host computer should send following frame:

**Query:**

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
<th>Value</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Serial Link No.</td>
<td>(0x0A)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Function</td>
<td>(0x06)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Starting Address High</td>
<td>(0x00)</td>
<td>Address =13 (14-1)</td>
</tr>
<tr>
<td>4</td>
<td>Starting Address Low</td>
<td>(0x0D)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Data High</td>
<td>(0x00)</td>
<td>128% of rated line voltage</td>
</tr>
<tr>
<td>6</td>
<td>Data Low</td>
<td>(0x80)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>CRC Low</td>
<td>(0xXX)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>CRC High</td>
<td>(0xYY)</td>
<td></td>
</tr>
</tbody>
</table>

**Exception Response:**

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
<th>Value</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Serial Link No.</td>
<td>(0x0A)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Function</td>
<td>(0x86)</td>
<td>Original + 0x80</td>
</tr>
<tr>
<td>3</td>
<td>Exception Code</td>
<td>(0x03)</td>
<td>Illegal Data Value</td>
</tr>
<tr>
<td>4</td>
<td>CRC_Low</td>
<td>(0xXX)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>CRC_High</td>
<td>(0xYY)</td>
<td></td>
</tr>
</tbody>
</table>
Note:

There are cases where the iStart returns a normal response, but the requested action cannot be performed, or is modified by the table below.

<table>
<thead>
<tr>
<th>Master Action</th>
<th>iStart Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write setting parameters during start process</td>
<td>Ignored.</td>
</tr>
<tr>
<td>Write too few parameters (Function 16) or some of the</td>
<td>Limiting to allowed range.</td>
</tr>
<tr>
<td>parameters are outside of allowed range</td>
<td></td>
</tr>
<tr>
<td>Start command (Function 05) while the hardwired Stop</td>
<td>Command ignored if the specific input has a higher priority than the comm</td>
</tr>
<tr>
<td>Input is open</td>
<td>input. Refer to I/O Programming parameters Inputs Priority (917) and Inputs</td>
</tr>
<tr>
<td></td>
<td>Policy (918).</td>
</tr>
</tbody>
</table>

It is the user’s responsibility to verify that the requested action was performed, by reading the value of the modified parameters or the status of the command coils.
7.7 Profibus Communication

7.7.1 Global Parameters

Code Sample 1: Global Parameters in the GSD file

```plaintext
33: ;===============================================================================
34: ;==== General DP Keywords ==============================================================
35: ;===============================================================================
36:
37: GSD_Revision  = 5
38: Vendor_Name   = "IGEL Ltd"
39: Model_Name    = "iStart"
40: Revision      = "1.00"
41: Ident_Number  = 0
42: Protocol_Ident= 0xAFFE
43: Station_Type  = 0
44: FMS_supp      = 0
45: Hardware_Release= 0
46: Software_Release= "V1.00"
47: Redundancy    = "V1.00"
48: Repeater_Ctrl_Sig = 0
49: 24V_Pins      = 0
```

7.7.2 Operation Mode in Profibus

iStart supports both DPV0 and DPV1.

- DPV0 (Cyclic) allows:
  - Starting and shutdown.
  - Reading parameters (writing parameters is not allowed at DPV0).

- DPV1 allows:
  - Everything that DPV0 allows.
  - Changing the cyclic parameters that display in DPV0.
  - Writing to registers.
7.7.3 Description of the DPV0 (Cyclic) Frame

From the Profibus controller to the iStart, two bytes (16 bits) are transferred.

From the iStart to the controller, 40 bytes are transferred.

Figure 26  DPV0 parameters (Cyclic parameters)

Structure of the iStart Reception Frame

iStart can contain four different Start/Stop settings. In the LCD, these are displayed as Adjust settings.

- The first byte must be 0x5A (90 decimal).
- The second byte is as follows:

Table 21  iStart Receiving Frame – Byte 2

<table>
<thead>
<tr>
<th>Bit</th>
<th>Function</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Stop</td>
<td>1 = stop</td>
</tr>
<tr>
<td>1</td>
<td>Soft Stop</td>
<td>1 = soft stop</td>
</tr>
<tr>
<td>2</td>
<td>Start</td>
<td>1 = start</td>
</tr>
<tr>
<td>3</td>
<td>MSB</td>
<td>Refer to Table 22</td>
</tr>
</tbody>
</table>
### Table 22  LSB and MSB values for bits 3 and

<table>
<thead>
<tr>
<th>Adjust number</th>
<th>LSB</th>
<th>MSB</th>
</tr>
</thead>
<tbody>
<tr>
<td>first adjust (default)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>second adjust</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>third adjust</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>fourth adjust</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Example:
To send a Reset, send 0x5A followed by 0x80.

### Structure of the iStart Transmission Frame

The return frame contains 20 pairs of bytes (40 bytes total). Each pair of bytes represents one register, and is a 16 bit (Word) number. The first byte represents the MSB, which is the highest value.

### Choosing the Reception DPV0 Registers

The return frame contains 20 registers. Each register contains two bytes (one word, 16 bits).

There are two different ways to edit the order of the registers that are displayed in DPV0:

- Change the parameters in the GSD file.
- Send a data request (only by DPV1).

### Using GSD to Select the Registers to Display in DPV0

Lines 503 to 534 of the GSD file contain a list of parameters.

The parameters appear in blocks, each block contains 4 lines, and each block refers to one register (there are 20 blocks, which represent 20 registers).
The second line of each block starts with `Unsigned 16` followed by the number of the register (shown in green). Refer to 7.7.7 Actual Data Register Numbers (Decimal) on page 142 for the list of register numbers.

\textit{Code Sample 2: GSD file, the part that responsible to the registers that show at DPV0 (cyclic)}

\begin{verbatim}
190: ExtUserPrmData = 1001 "INDIREC PAR 1"
191: Unsigned16  1 1-1000
192: Prm_text_Ref   = 100
193: EndExtUserPrmData
194:
196: ExtUserPrmData = 1002 "INDIREC PAR 2"
197: Unsigned16  2 1-1000
198: Prm_text_Ref   = 100
199: EndExtUserPrmData
200:
201: ExtUserPrmData = 1003 "INDIREC PAR 3"
202: Unsigned16  3 1-1000
203: Prm_text_Ref   = 100
204: EndExtUserPrmData
205: 
206: 
207: 
208: ExtUserPrmData = 1020 "INDIREC PAR 20"
209: Unsigned16  22 1-1000
210: Prm_text_Ref   = 100
211: EndExtUserPrmData
\end{verbatim}

\textit{Using a Data Request (DPV1) to Select the Registers to Display in DPV0}

You can change the register that displays in DPV0 by editing Slot number 1 and Index 2.

Each register consists of 16 bits (two bytes/one word). The first byte represents the MSB of the register number.
To demonstrate this, we will use a simple PROFIBUS master to change parameters so that we can see the following registers in DPV0 (cyclic):

1. Logic Status.
2. Current.
3. Voltage.
4. Power.
5. Power Multiplier.
6. Power Factor.
7. Control In.
8. Control Out.
10. Insulation Resistance.

Step 1: The first thing that we need to do is to find the number of the registers in to 7.7.7 Actual Data Register Numbers (Decimal) on page 142.

**Table 23 Number of the registers for the sample parameters**

<table>
<thead>
<tr>
<th>Register name</th>
<th>Decimal number</th>
<th>Hex number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logic Status</td>
<td>1</td>
<td>00 01</td>
</tr>
<tr>
<td>Current</td>
<td>2</td>
<td>00 02</td>
</tr>
<tr>
<td>Voltage</td>
<td>3</td>
<td>00 03</td>
</tr>
<tr>
<td>Power</td>
<td>12</td>
<td>00 0C</td>
</tr>
<tr>
<td>Power Multiplier</td>
<td>13</td>
<td>00 0D</td>
</tr>
<tr>
<td>Power Factor</td>
<td>14</td>
<td>00 0E</td>
</tr>
<tr>
<td>Hardwired inputs</td>
<td>5</td>
<td>00 05</td>
</tr>
<tr>
<td>Relays</td>
<td>6</td>
<td>00 06</td>
</tr>
<tr>
<td>Thermistor Resistance</td>
<td>11</td>
<td>00 0B</td>
</tr>
<tr>
<td>Insulation Resistance</td>
<td>7</td>
<td>00 07</td>
</tr>
</tbody>
</table>

Step 2: Update the register numbers.

By writing the above numbers to Slot number 1 and Index number 2 through Data Request (by DPV1), we update the registers list that is displayed in DPV0.
Figure 27  Updating the register number that will display at DPV0 (by Data Request)

Also, it easy to read this list by reading from Slot number 1 and Index number 2 through Data Request (by DPV1).

Figure 28  Reading the register number that shown in the DPV0 (cyclic) list
7.7.4 Operations that are Available in DPV1

- Choose the registers that will display at DPV0 (cyclic). This is described in section 0 on page 136.
- Read and write from a random registers.

Read and Write from Random Registers by Data Request

Reading or writing by Data Request (DPV1) allows reading or writing a group of up to 20 registers in a single cycle. However, these registers must be listed consecutively in section 7.7.7 Actual Data Register Numbers (Decimal) on page 142.

In other words, registers 2 through 18 can be read in a single cycle, but two different cycles are required to read registers 4 and 9 without reading registers 5 through 8.

The cycle of reading or writing through Data Request (DPV1) is defined in two steps.

Step 1: Define the number of the first register to read or write.

Step 2: Edit the number of registers that follow.

For example, to read registers 2 through 18, you define register 2 as the first register to read and 16 as the number of registers that follow.

The length of the register number must always contain two bytes (1 word), therefore the register 0x80 is defined as 00 80.

Sample Data Request to Read Registers 2 Through 6

In this example, the register to read is 0x80.

Step 1: Configure the number of the first register to read. Enter 2 into the Slot Number field and the Index field. Enter 00 80 to define the starting register as 0x80.
Step 2: Configure the number of registers that follow.
Enter 3 into the Slot Number field.
Enter 2 into the Index field.
Enter 8 into the Length field.
The length is 8 because there are a total of 4 registers to be read, each of which contains 2 bytes (or 1 word). $4 \times 2 = 8$. 

Figure 30  Reading 4 following register by Data Request (DPV1)
7.7.5 Configure PROFIBUS in the iStart

All the setting parameters to establish PROFIBUS communication are under Comm option menu. There are 5 steps to configuring the PROFIBUS.

1. Press the Down key until the following message appears:
   
   | COMM OPTION          |
   | --- ** PROFIBUS **- |

2. Press the Enter key once to cause the following message to appear:
   
   | SERIAL LINK NO.     |
   | ** ENABLE **         |

   This selection allows control through PROFIBUS.

3. Press the Down key once to cause the following message to appear:
   
   | COM CHANGE PARAM    |
   | ** YES **           |

4. Select YES to enable parameters to be sent via Profibus. Select NO to prevent Profibus from sending parameters.

5. Press the Down key a second time to cause the following message to appear:
   
   | CMD VIA COMM        |
   | ** YES **           |

6. Select YES to enable commands like STOP/START to be sent via Profibus. Select NO to prevent Profibus from sending these commands.

7.7.6 Watch Dog Definition

The Watch-Dog mechanism enables and disables the PROFIBUS controller to exercise sole control over iStart.

When the Watch-Dog is enabled, the iStart will stop the motor when the communication between the controller and the device is cut.
### 7.7.7 Actual Data Register Numbers (Decimal)

<table>
<thead>
<tr>
<th>Register Number</th>
<th>Parameter Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Logic Status</td>
<td>Logic status of iStart. 1 indicates:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d15: iStart Tripped.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d14: Motor Stopped.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d11: Motor is Running.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d10: Adjust number LSB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d9: Adjust number MSB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d8: Motor is running at Slow Speed forward.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d7: Motor is running at Slow Speed reverse.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d6: Insulation Alarm (Optional)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d5..d0: Reserved</td>
</tr>
<tr>
<td>2</td>
<td>Current</td>
<td>Current, % FLA</td>
</tr>
<tr>
<td>3</td>
<td>Voltage</td>
<td>Line voltage, Volts</td>
</tr>
<tr>
<td>4</td>
<td>Phase Sequence</td>
<td>1: Correct phase seq. 0: Wrong phase seq.</td>
</tr>
<tr>
<td>5</td>
<td>Hardwired inputs</td>
<td>Discrete Hardwired control inputs:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d15..d3: Reserved</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d2: Logic input #3 status – 1: Active, 0: Inactive.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d1: Logic input #2 status – 1: Active, 0: Inactive.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d0: Logic input #1 status – 1: Active, 0: Inactive.</td>
</tr>
<tr>
<td>Register Number</td>
<td>Parameter Name</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------</td>
<td>---------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>6</td>
<td>Relays</td>
<td>Relays status</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d15..d2: Reserved.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d1: Relay #2 status – 1: Active, 0: Inactive.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d0: Relay #1 status – 1: Active, 0: Inactive.</td>
</tr>
<tr>
<td>7</td>
<td>Insulation Resistance</td>
<td>Motor insulation, Kohm (Optional).</td>
</tr>
<tr>
<td>8</td>
<td>l Zero Current</td>
<td>Ground leakage current, % FLA</td>
</tr>
<tr>
<td>9</td>
<td>l Motor Unbalanced Current</td>
<td>Max current deviation between phases, %</td>
</tr>
<tr>
<td>10</td>
<td>Frequency</td>
<td>Main frequency, Hz</td>
</tr>
<tr>
<td>11</td>
<td>Thermistor Resistance</td>
<td>Thermistor resistance, tenth Kohm (Optional).</td>
</tr>
<tr>
<td>12</td>
<td>Power [Watt] – Low word</td>
<td>Power modulo 64K (65536)</td>
</tr>
<tr>
<td>13</td>
<td>Power [Watt] – High word</td>
<td>Power divided by 64K (65536) without residue</td>
</tr>
<tr>
<td>14</td>
<td>Power Factor</td>
<td>Power Factor * 100</td>
</tr>
<tr>
<td>15</td>
<td>Total run time [Sec] – Low word</td>
<td>Total Motor runtime modulo 64K (65536)</td>
</tr>
<tr>
<td>16</td>
<td>Total run time [Sec] – High word</td>
<td>Total Motor runtime divided by 64K (65536) without residue</td>
</tr>
<tr>
<td>17</td>
<td>Logic status at power fail</td>
<td>Logic status at control power supply turns off.</td>
</tr>
<tr>
<td>18</td>
<td>Total run time</td>
<td>Total hours of running motor.</td>
</tr>
<tr>
<td>19</td>
<td>Total starts</td>
<td>Total number of starts</td>
</tr>
<tr>
<td>20</td>
<td>Last start period</td>
<td>Duration of last start, Seconds</td>
</tr>
<tr>
<td>21</td>
<td>Last start peak I</td>
<td>Peak current during last starting process</td>
</tr>
<tr>
<td>22</td>
<td>Time to Re-Enable start [Sec]</td>
<td>Wait time until next start command will be allowed</td>
</tr>
<tr>
<td>Register Number</td>
<td>Parameter Name</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------</td>
<td>----------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>23</td>
<td>Total trips</td>
<td>Total number of trips</td>
</tr>
<tr>
<td>Code number</td>
<td>Fault Description</td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td>-------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>01:</td>
<td>Over Temperature</td>
<td></td>
</tr>
<tr>
<td>02:</td>
<td>Short Circuit Current</td>
<td></td>
</tr>
<tr>
<td>03:</td>
<td>Overload</td>
<td></td>
</tr>
<tr>
<td>04:</td>
<td>Under Current</td>
<td></td>
</tr>
<tr>
<td>05:</td>
<td>Under Voltage</td>
<td></td>
</tr>
<tr>
<td>06:</td>
<td>Over Voltage</td>
<td></td>
</tr>
<tr>
<td>07:</td>
<td>Phase Loss</td>
<td></td>
</tr>
<tr>
<td>08:</td>
<td>Phase Sequence</td>
<td></td>
</tr>
<tr>
<td>09:</td>
<td>Shorted SCR or Wrong Connection.</td>
<td></td>
</tr>
<tr>
<td>10:</td>
<td>Long Start Time</td>
<td></td>
</tr>
<tr>
<td>11:</td>
<td>Slow Speed Time</td>
<td></td>
</tr>
<tr>
<td>12:</td>
<td>MODBUS Timeout</td>
<td></td>
</tr>
<tr>
<td>13:</td>
<td>External Fault</td>
<td></td>
</tr>
<tr>
<td>14:</td>
<td>Wrong Parameters</td>
<td></td>
</tr>
<tr>
<td>15:</td>
<td>COM Port Failed</td>
<td></td>
</tr>
<tr>
<td>16:</td>
<td>Too Many Starts</td>
<td></td>
</tr>
<tr>
<td>17:</td>
<td>Motor Insulation (Optional)</td>
<td></td>
</tr>
<tr>
<td>18:</td>
<td>Thermistor. (Optional)</td>
<td></td>
</tr>
<tr>
<td>19:</td>
<td>Wrong Frequency</td>
<td></td>
</tr>
<tr>
<td>20:</td>
<td>No Voltage</td>
<td></td>
</tr>
<tr>
<td>21:</td>
<td>Over 7.5 * FLA current</td>
<td></td>
</tr>
<tr>
<td>22:</td>
<td>Over 7.5 * FLC current</td>
<td></td>
</tr>
<tr>
<td>23:</td>
<td>Motor Unbalance</td>
<td></td>
</tr>
<tr>
<td>24:</td>
<td>Ground Fault</td>
<td></td>
</tr>
<tr>
<td>25:</td>
<td>No Current</td>
<td></td>
</tr>
<tr>
<td>26:</td>
<td>No Control power</td>
<td></td>
</tr>
<tr>
<td>27:</td>
<td>Over Current (Inverse)</td>
<td></td>
</tr>
<tr>
<td>28:</td>
<td>Shear pin current</td>
<td></td>
</tr>
<tr>
<td>29:</td>
<td>Wrong VZC</td>
<td></td>
</tr>
</tbody>
</table>

24 Last trip number

Code number of the fault that caused trip
<table>
<thead>
<tr>
<th>Register Number</th>
<th>Parameter Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>Pre trip I</td>
<td>Current at trip time, Amp.</td>
</tr>
<tr>
<td>26</td>
<td>Logic Input Status</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Version CRC16</td>
<td>The unique CRC16 Calculation of each SW Version</td>
</tr>
<tr>
<td>28</td>
<td>Phase Sequence</td>
<td>1: Positive, 0: Negative</td>
</tr>
<tr>
<td>29</td>
<td>Time to Over Current Trip</td>
<td>Time left until “Over Current” trip occurs in seconds</td>
</tr>
<tr>
<td>30</td>
<td>Cos Phi</td>
<td>Cos Phi * 100</td>
</tr>
<tr>
<td>31</td>
<td>Phase 1 Voltage</td>
<td>Phase 1 voltage, % Rated Line Voltage * 10</td>
</tr>
<tr>
<td>32</td>
<td>Phase 2 Voltage</td>
<td>Phase 1 voltage, % Rated Line Voltage * 10</td>
</tr>
<tr>
<td>33</td>
<td>Phase 3 Voltage</td>
<td>Phase 1 voltage, % Rated Line Voltage * 10</td>
</tr>
<tr>
<td>34</td>
<td>Phase 1 Current</td>
<td>Phase 1 current, % FLA * 10</td>
</tr>
<tr>
<td>35</td>
<td>Phase 2 Current</td>
<td>Phase 1 current, % FLA * 10</td>
</tr>
<tr>
<td>36</td>
<td>Phase 3 Current</td>
<td>Phase 1 current, % FLA * 10</td>
</tr>
<tr>
<td>37</td>
<td>Energy [KWH] – Low word</td>
<td>Total Energy modulo 64K (65536)</td>
</tr>
<tr>
<td>38</td>
<td>Energy [KWH] – High word</td>
<td>Total Energy divided by 64K (65536) without residue</td>
</tr>
<tr>
<td>39</td>
<td>Energy per cycle – first word – MSB</td>
<td>Energy per cycle in Watts</td>
</tr>
<tr>
<td>40</td>
<td>Energy per cycle – second word</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Energy per cycle – third word</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Energy per cycle – forth word – LSB</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>Reserved</td>
<td></td>
</tr>
<tr>
<td>Register Number</td>
<td>Parameter Name</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>44</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>46</td>
<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td></td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>Analog option card – Temperature 1</td>
<td>Thermistor or phase 1 RTD Temperature (Analog option cards) [Kelvin]</td>
</tr>
<tr>
<td>49</td>
<td>Analog option card – Temperature 2</td>
<td>Thermistor or phase 2 RTD Temperature (Analog option cards) [Kelvin]</td>
</tr>
<tr>
<td>50</td>
<td>Analog option card – Temperature 3</td>
<td>Thermistor or phase 3 RTD Temperature (Analog option cards) [Kelvin]</td>
</tr>
<tr>
<td>51</td>
<td>Reserved</td>
<td></td>
</tr>
<tr>
<td>52</td>
<td></td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>Phase 1 Temperature</td>
<td>Phase 1 internal temperature. [Kelvin]</td>
</tr>
<tr>
<td>54</td>
<td>Phase 2 Temperature</td>
<td>Phase 2 internal temperature. [Kelvin]</td>
</tr>
<tr>
<td>55</td>
<td>Phase 3 Temperature</td>
<td>Phase 3 internal temperature. [Kelvin]</td>
</tr>
<tr>
<td>111-120</td>
<td>Previous Trips</td>
<td>Trip number of 10 last trips – from last to earliest.</td>
</tr>
</tbody>
</table>

### 7.7.8 Default Order of Register Numbers

<table>
<thead>
<tr>
<th>Order</th>
<th>Register Number</th>
<th>Parameter Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Logic Status</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>Current</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>Voltage</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>Hardwired inputs</td>
</tr>
</tbody>
</table>
### 7.7.9 Setting Parameters for Data Request

#### Main Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>#</th>
<th>Range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Line</td>
<td>0</td>
<td>1..600 V</td>
<td>400 V</td>
</tr>
</tbody>
</table>
| Phase Sequence   | 1  | 0 – Ignore
                |    | 1 – Positive
                |    | 2 - Negative           | 0 – Ignore |
| FLC              | 2  | 17..1100 A             | 44 A      |
| Motor rated power| 3  | 1..3000 KW             | 35 KW     |
### Communication

<table>
<thead>
<tr>
<th>Parameter</th>
<th>#</th>
<th>Range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft_Start_Curve</td>
<td>24</td>
<td>0..10 (5..9 are for Tacho only)</td>
<td>0 (Standard).</td>
</tr>
<tr>
<td>Pulse_Time</td>
<td>25</td>
<td>0..10 (Tenth Seconds)</td>
<td>0 (No Pulse)</td>
</tr>
<tr>
<td>Initial_Voltage_Current</td>
<td>26</td>
<td>10..80</td>
<td>30 (% of full voltage)</td>
</tr>
<tr>
<td>Current_Limit</td>
<td>27</td>
<td>100..500</td>
<td>400 (% of FLA)</td>
</tr>
<tr>
<td>Acceleration_Time</td>
<td>28</td>
<td>1..90</td>
<td>10 (Seconds)</td>
</tr>
<tr>
<td>Max_Start_Time</td>
<td>29</td>
<td>1..250</td>
<td>30 (Seconds)</td>
</tr>
<tr>
<td>Number_Of_Starts</td>
<td>30</td>
<td>1..10 &amp; (11 = off)</td>
<td>10</td>
</tr>
<tr>
<td>Starts_Period</td>
<td>31</td>
<td>1..60</td>
<td>30 (Minutes)</td>
</tr>
<tr>
<td>Start_Prevent_Time</td>
<td>32</td>
<td>1..60</td>
<td>15 (Minutes)</td>
</tr>
<tr>
<td>Run_Condact_Delay</td>
<td>33</td>
<td>0..40</td>
<td>5 (Seconds)</td>
</tr>
<tr>
<td>Reserved</td>
<td>35..39</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Stop Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>#</th>
<th>Range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft_Stop_Curve</td>
<td>40</td>
<td>0..10 (5..9 are for Tacho only)</td>
<td>0 (Standard)</td>
</tr>
<tr>
<td>Deceleration_Time</td>
<td>41</td>
<td>1..30</td>
<td>10 (Seconds)</td>
</tr>
<tr>
<td>Final_Torque</td>
<td>42</td>
<td>0..10</td>
<td>0 (Minimum)</td>
</tr>
<tr>
<td>Reserved</td>
<td>43..47</td>
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<td></td>
</tr>
</tbody>
</table>

### Dual Adjust Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>#</th>
<th>Range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dual_Adj_Init_Voltage</td>
<td>48</td>
<td>10..80 % of full voltage</td>
<td>30</td>
</tr>
<tr>
<td>Dual_Adj_Current_Limit</td>
<td>49</td>
<td>100..500</td>
<td>400 % of FLA</td>
</tr>
<tr>
<td>Dual_Adj_Acc_Time</td>
<td>50</td>
<td>1..90</td>
<td>10 (Seconds)</td>
</tr>
<tr>
<td>Dual_Adj_Dec_Time</td>
<td>51</td>
<td>1..30</td>
<td>10 (Seconds)</td>
</tr>
<tr>
<td>Dual_Adj_Motor_FLX</td>
<td>52</td>
<td>5..1400</td>
<td>105 (Amp.)</td>
</tr>
<tr>
<td>Reserved</td>
<td>53..55</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Energy Save & Speed Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>#</th>
<th>Range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy_Save</td>
<td>56</td>
<td>1..10</td>
<td>10 (Max Save)</td>
</tr>
<tr>
<td>Slow_Speed_Torque</td>
<td>57</td>
<td>1..10</td>
<td>8</td>
</tr>
<tr>
<td>Max_Slow_Speed_Time</td>
<td>58</td>
<td>1..250</td>
<td>30 (Seconds)</td>
</tr>
<tr>
<td>Reserved</td>
<td>59..62</td>
<td></td>
<td></td>
</tr>
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</table>

### Fault Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>#</th>
<th>Range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase_Loss Y/N</td>
<td>63</td>
<td>0..1</td>
<td>0 (No)</td>
</tr>
<tr>
<td>Phase_Sequence Y/N</td>
<td>64</td>
<td>0..1</td>
<td>0 (No)</td>
</tr>
<tr>
<td>Parameter</td>
<td>#</td>
<td>Range</td>
<td>Default</td>
</tr>
<tr>
<td>-----------------------</td>
<td>----</td>
<td>------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Insulation_Alarm</td>
<td>65</td>
<td>1..50 Tenth Mohm 0.2..5 M</td>
<td>1 (Off)</td>
</tr>
<tr>
<td>Insulation_Trip</td>
<td>66</td>
<td>1..50 Tenth Mohm 0.2..5 M</td>
<td>1 (Off)</td>
</tr>
<tr>
<td>Auto_Reset</td>
<td>67</td>
<td>0 / 1 (0 - No, 1 - Yes)</td>
<td>0 (No)</td>
</tr>
<tr>
<td>Thermistor_Type</td>
<td>68</td>
<td>0 / 1 (0 - PTC, 1 - NTC)</td>
<td>0 (PTC)</td>
</tr>
<tr>
<td>Thermistor_Trip</td>
<td>69</td>
<td>0..100 Tenth Kohm 0.1..10 K</td>
<td>0 (Off)</td>
</tr>
<tr>
<td>Under_Current_Reset</td>
<td>70</td>
<td>10..120 (&amp;121=off)</td>
<td>121 (Off)</td>
</tr>
<tr>
<td>Reserved</td>
<td>71</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### I/O Programming

<table>
<thead>
<tr>
<th>Parameter</th>
<th>#</th>
<th>Range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prog. Input #7 (thermal7)</td>
<td>7</td>
<td>2 (0=En.Save, 1=S.Spd, 2=Rst)</td>
<td>2 (Energy Saver)</td>
</tr>
<tr>
<td>Prog. Input #8 (thermal8)</td>
<td>7</td>
<td>3 (0=D.Adj., 1=Rvrs, 2=Rst)</td>
<td>0 (Dual Adjust)</td>
</tr>
<tr>
<td>Fault_ Relay_Type</td>
<td>7</td>
<td>4 (0=Fault, 1=Fault-Fail Safe)</td>
<td>0 (Fault)</td>
</tr>
<tr>
<td>Immediate_Realy_Type</td>
<td>7</td>
<td>5 (0=Immediate, 1=shear pin)</td>
<td>0 (Immediate)</td>
</tr>
<tr>
<td>Parameter</td>
<td>Function</td>
<td>Value Range</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------------</td>
<td>----------------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>Imm._Realy_On_Delay</td>
<td>7 6</td>
<td>0..3600</td>
<td>0 (Seconds)</td>
</tr>
<tr>
<td>Imm._Realy_Off_Delay</td>
<td>7 7</td>
<td>0..3660</td>
<td>0 (Seconds)</td>
</tr>
<tr>
<td>Analog Output Parameter</td>
<td>7 8</td>
<td>0 - Current, 0..200% of motor_fla</td>
<td>0 (Current)</td>
</tr>
<tr>
<td>Reserved</td>
<td>7 9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
8. Installing a Fan on Size A, B and C

Step 1: Disconnect the mains and control power from the iStart.
Step 2: Remove the iStart unit from the wall.
Step 3: Mount the fan on the wall instead of the iStart unit. Use the same holes.
Step 4: Mount the iStart unit on fan using the same screws that you removed in step 2.

Figure 31  Installing a fan (sizes A, B and C)

Step 5: Connect power to the fans.

Figure 32  Fan power connection

Step 6: Reconnect mains and control power to iStart.
9. Troubleshooting


Table 24 Error table

<table>
<thead>
<tr>
<th>Fault Message</th>
<th>Cause and Troubleshooting</th>
</tr>
</thead>
</table>
| 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 5.6.2 on page 58. |
| 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 5.6.1 on page 36 (MAIN PARAMETERS).  
For more information on adjusting START PARAMETERS refer to section 5.6.2 on page 58. |
| 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). |
### Fault Message | Cause and Troubleshooting

<table>
<thead>
<tr>
<th>Fault Message</th>
<th>Cause and Troubleshooting</th>
</tr>
</thead>
<tbody>
<tr>
<td>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 &amp; O/C – SHEAR PIN refer to section 5.6.1 on page 48 (MAIN PARAMETERS).</td>
<td>CAUTION Check that „Megger“ maximum voltage is no more than 500V !!</td>
</tr>
<tr>
<td>OVERLOAD</td>
<td>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 &amp; OVERLOAD settings refer to section 5.6.1 on page 48 (MAIN PARAMETERS).</td>
</tr>
<tr>
<td>UNDER CURRENT</td>
<td>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 5.6.1 on page 48 (MAIN PARAMETERS).</td>
</tr>
<tr>
<td>UNDER VOLTAGE or NO VOLTAGE</td>
<td>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 5.6.1 on page 48 (MAIN PARAMETERS).</td>
</tr>
<tr>
<td>OVER VOLTAGE</td>
<td>Trips the starter when line voltage increases above a preset level for a preset time.</td>
</tr>
<tr>
<td>Fault Message</td>
<td>Cause and Troubleshooting</td>
</tr>
<tr>
<td>---------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td><strong>PHASE LOSS</strong></td>
<td>Trips the starter if 1 or 2 phases are missing.</td>
</tr>
<tr>
<td></td>
<td>- Check voltages are within the required range voltages and frequency is within the range of 45-65Hz.</td>
</tr>
<tr>
<td></td>
<td>- 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.</td>
</tr>
<tr>
<td></td>
<td>- 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.</td>
</tr>
<tr>
<td></td>
<td>- Phase loss might not be detected in motor operating under a light load.</td>
</tr>
<tr>
<td></td>
<td>For PHASE LOSS protection setting refer to section 5.6.3 on page 65.</td>
</tr>
<tr>
<td><strong>PHASE SEQUENCE</strong></td>
<td>Trips the starter if line phase sequence is wrong.</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
<tr>
<td><strong>SHORT CIRCUIT</strong></td>
<td>Trips the soft iStart when connected Inside Delta and Wrong connection or if over current is detected by the iStart.</td>
</tr>
<tr>
<td></td>
<td>Verify that the motor is not stalled or shorted and check cables and wiring.</td>
</tr>
<tr>
<td></td>
<td>Verify that motor and iStart are connected exactly as shown in section 0 page 25.</td>
</tr>
<tr>
<td></td>
<td>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 5.6.1 on page 48 (MAIN PARAMETERS).</td>
</tr>
</tbody>
</table>
## Fault Message | Cause and Troubleshooting

<table>
<thead>
<tr>
<th>Fault Message</th>
<th>Cause and Troubleshooting</th>
</tr>
</thead>
<tbody>
<tr>
<td>If circuitry is 100% confirmed it is possible to start when EXTEND SETTING are ENABLED. Refer to section 3.7.4 on page 24. 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.</td>
<td></td>
</tr>
</tbody>
</table>
| 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 5.6.6 on page 77 (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 5.6.6 on page 77 (I/O PROGRAMMING PARAMETERS). |
### Fault Message

<table>
<thead>
<tr>
<th>Fault Message</th>
<th>Cause and Troubleshooting</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLOW SPEED TM</td>
<td>Slow speed time is exceeded.</td>
</tr>
<tr>
<td></td>
<td><em>Check the settings of MAX SLOW TIME. For more information on programming MAX SLOW TIME refer to section 5.6.3 on page 65ff. (SPECIAL FEATURES PARAMETERS).</em></td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> Motor and iStart may be overheated when operating at slow speed for an extended period.</td>
</tr>
<tr>
<td>WRONG PARAMS</td>
<td>Parameters not transferred from RAM to EEPROM or vice versa. After replacing the EPROM with a new software version or after power up.</td>
</tr>
<tr>
<td></td>
<td><em>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.</em></td>
</tr>
<tr>
<td></td>
<td><em>(If Fault LED is on, press Reset after WRONG PARAMETERS).</em></td>
</tr>
<tr>
<td>WRONG FREQUENCY</td>
<td>Trips the soft starter when mains voltage frequency is not within the limits of 45-65Hz.</td>
</tr>
<tr>
<td></td>
<td><em>Check mains frequency.</em></td>
</tr>
</tbody>
</table>

### 9.1 Blank RMA Form

Return Material Authorization Form - „RMA“ - Fault Report – Non/Warranty Claim
After Sales Service Department
E-mail: info@esco-antriebstechnik.de
Tel. Fon + 49 2241 4807-0
Fax + 49 2241 4807-10
## Troubleshooting

| 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 esco antriebstechnik gmbh written instructions, appropriate codes, regulations and good practice, within the limits of rated capacity and normal usage.

Warranted repair/replacement

---

To be completed By esco antriebstechnik gmbh Service Dept.:

| Return Material Authorization Number |  |
| Date |  |
| Authorized by |  |
10. Dimensions

Figure 33  iStart Size A: 17A, 31A, 44A (Fan box included)
Figure 34  iStart Size A: 17A, 31A, 44A (Without fan box)
Figure 35  iStart Size B: 58A, 72A, 85A (Fan box included)
Figure 36  
iStart Size B: 58A, 72A, 85A (Without fan box)
Figure 37  iStart Size C: 105A, 145A, 170A (Fan box included)
Figure 38  iStart Size C: 105A, 145A, 170A (Without fan box)
Figure 39  iStart Size D: 230A, 310A, 350A
Figure 40  iStart Size E: 430A
Figure 41  iStart Size F: 515A
Figure 42  iStart Size G: 590A, 690A
Figure 43  iStart Size H: 720A, 850A

Figure 44  iStart Size I: 960A, 1100A
## 11. Technical Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage</td>
<td>Line to Line 208-600V (to be specified) + 10%-15% for all models</td>
</tr>
<tr>
<td>Frequency</td>
<td>45 – 65 Hz (Fixed or variable frequency source)</td>
</tr>
<tr>
<td>Control Supply</td>
<td>115V or 230V (to be specified) + 10% - 15%</td>
</tr>
<tr>
<td>Load</td>
<td>Three phases, three wires, squirrel cage induction motor.</td>
</tr>
<tr>
<td><strong>Start-Stop Parameters:</strong></td>
<td></td>
</tr>
<tr>
<td>Starter FLC</td>
<td>Starter’s Full Load Current, according to Selector Guide</td>
</tr>
<tr>
<td>Motor FLA</td>
<td>Motor Full Load Ampere 50-100% of Starter FLC (Full Load Current).</td>
</tr>
<tr>
<td>Pump and Torque Control Curves</td>
<td>Field selectable curves preventing Over-pressure during start and Water Hammer during stop.</td>
</tr>
<tr>
<td>Pulse Start Duration</td>
<td>A pulse of 80% Un, adjustable range 0.1-1 Sec, for starting high friction loads.</td>
</tr>
<tr>
<td>Initial Voltage,</td>
<td>5-80% Un</td>
</tr>
<tr>
<td>Initial Current</td>
<td>100-400% of Motor FLA</td>
</tr>
<tr>
<td>Current Limit</td>
<td>100-500% of Motor FLA</td>
</tr>
<tr>
<td>Acceleration Time</td>
<td>1-90 Sec</td>
</tr>
<tr>
<td>Deceleration Time</td>
<td>1-90 Sec</td>
</tr>
<tr>
<td><strong>Motor Protection:</strong></td>
<td></td>
</tr>
<tr>
<td>Too Many Starts</td>
<td>Maximum number of starts, range: Off or 1-10, during a time period 1-60 min.</td>
</tr>
<tr>
<td>Starts inhibit</td>
<td>Period of 1-60 min, during which starting is prevented, after Too Many Start fault.</td>
</tr>
<tr>
<td>Long Start Time (Stall protection)</td>
<td>Maximum allowable starting time 1-30 sec. (1-250sec. in EX-SETTING)</td>
</tr>
<tr>
<td>TEND SETTING</td>
<td>Two operation functions: during starting trips the starter at 850% and during running at 100-850% In, both within 1 Cycle (after internal delay).</td>
</tr>
<tr>
<td>Over Current (Shear-pin)</td>
<td>Adjustable IEC and MEMA curves.</td>
</tr>
<tr>
<td>Electronic Overload (I^2t)</td>
<td>Trips when current drops below 20-90% In, time delay 1-40</td>
</tr>
<tr>
<td>Under Current</td>
<td></td>
</tr>
<tr>
<td>sec.</td>
<td></td>
</tr>
<tr>
<td>Under Voltage*</td>
<td>Trips when main voltage drops below 50-90%, time delay 1-10</td>
</tr>
<tr>
<td>Sec</td>
<td></td>
</tr>
<tr>
<td>Over Voltage</td>
<td>Trips when main voltage increase above 110-125%, time delay</td>
</tr>
<tr>
<td>lay 1-10 sec.</td>
<td></td>
</tr>
<tr>
<td>Phase Loss, Under/Over Frequency*</td>
<td>Trips when one or two phases are missing and frequency is</td>
</tr>
<tr>
<td>45Hz. or 65Hz.</td>
<td></td>
</tr>
<tr>
<td>Phase Sequence</td>
<td></td>
</tr>
<tr>
<td>Shorted SCR or Wrong connection</td>
<td></td>
</tr>
<tr>
<td>Heat Sink Over temp</td>
<td>Trips when heat-sink temperature rises above 85°C.</td>
</tr>
</tbody>
</table>
Technical Specifications

External fault
* Trips when an External Contact closes for 2 sec.
  With optional Auto Reset.

Control:
Displays
Keypad
R1, R2
LCD in 4 – Field selectable languages and 4 LEDs.
6 keys for easy setting
2 Contacts, 8A, 250VAC, 2000VA

Temperatures:
Operating -10˚ to 50˚C. For higher ratings consult factory.
Storage -20˚ to 70˚C

Standards:
Dielectric Test
Degree of Protection
EMC Emissions
Immunity
EN 55011
CISPR 11 Class A
EN 55082-2
ESD 8KV air, IEC 801-2
Electric RF field 10 V/m, 20-1000MHz, IEC

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:

<table>
<thead>
<tr>
<th>Model</th>
<th>Elektronic</th>
<th>Fan Module Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>85</td>
<td>35VA</td>
<td>50VA</td>
</tr>
<tr>
<td>170</td>
<td>35VA</td>
<td>50VA</td>
</tr>
<tr>
<td>230</td>
<td>95VA</td>
<td>110VA</td>
</tr>
<tr>
<td>310</td>
<td>95VA</td>
<td>110VA</td>
</tr>
<tr>
<td>350</td>
<td>95VA</td>
<td>110VA</td>
</tr>
<tr>
<td>430</td>
<td>95VA</td>
<td>110VA</td>
</tr>
<tr>
<td>515</td>
<td>95VA</td>
<td>110VA</td>
</tr>
<tr>
<td>590</td>
<td>95VA</td>
<td>110VA</td>
</tr>
<tr>
<td>690</td>
<td>95VA</td>
<td>110VA</td>
</tr>
<tr>
<td>720</td>
<td>95VA</td>
<td>110VA</td>
</tr>
<tr>
<td>850</td>
<td>95VA</td>
<td>110VA</td>
</tr>
<tr>
<td>960</td>
<td>95VA</td>
<td>110VA</td>
</tr>
<tr>
<td>1100</td>
<td>95VA</td>
<td>110VA</td>
</tr>
</tbody>
</table>
12. Ordering Information

<table>
<thead>
<tr>
<th>iStart</th>
<th>31-</th>
<th>400-</th>
<th>230-</th>
<th>24-</th>
<th>0-</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Full load Current</td>
<td>Mains Voltage</td>
<td>Control Voltage</td>
<td>Control Input Voltage</td>
<td>Options</td>
<td>Front Panel</td>
</tr>
</tbody>
</table>

### Full load Current

<table>
<thead>
<tr>
<th>Specify</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Star-ter’s FLC [A]</td>
<td>17, 31, 44, 58, 72, 85, 105, 145, 170, 230, 310, 350, 430, 515, 590, 690, 720, 850, 960, 1100</td>
</tr>
</tbody>
</table>

### Mains Voltage

<table>
<thead>
<tr>
<th>Specify</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>480</td>
<td>208 – 480 VAC, 50/60Hz , +10% -15%</td>
</tr>
<tr>
<td>600</td>
<td>208 – 600 VAC, 50/60Hz , +10% -15%</td>
</tr>
<tr>
<td>690</td>
<td>208 – 690 VAC, 50/60Hz , +10% -15%. Only available with 230A and above.</td>
</tr>
</tbody>
</table>

### Control Voltage (Terminal A1, A2)

<table>
<thead>
<tr>
<th>Specify</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>230</td>
<td>95-230 VAC, 50/60Hz , +10% -15% or 95-230 VDC</td>
</tr>
</tbody>
</table>

**Note:**
- Control voltage cannot be modified on site.

### Control Input Voltage (Terminals 1-5)

<table>
<thead>
<tr>
<th>Specify</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>24 VDC/VAC +10% -15% (in this option the iStart also supplies 24VDC)</td>
</tr>
<tr>
<td>230</td>
<td>95-230 VAC, 50/60Hz , +10% -15% or 95-230 VDC</td>
</tr>
</tbody>
</table>

**Note:**
- Control input voltage cannot be modified on site.
### Options

<table>
<thead>
<tr>
<th>Specify</th>
<th>Description</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No options</td>
<td></td>
</tr>
<tr>
<td>3M</td>
<td>Communication RS-485 Board (MODBUS) (^{(1)}) (^{(3)})</td>
<td>R1</td>
</tr>
<tr>
<td>3R</td>
<td>Communication RS-232 Board (MODBUS) (^{(1)}) (^{(3)})</td>
<td>R1</td>
</tr>
<tr>
<td>3P</td>
<td>Communication Profibus (^{(1)}) (^{(3)}) (D type connector)</td>
<td>R2</td>
</tr>
<tr>
<td>3E</td>
<td>Communication ProfiNet (^{(1)}) (^{(3)}) (RJ-45 connector)</td>
<td>R?</td>
</tr>
<tr>
<td>3D</td>
<td>Communication Device Net (^{(1)}) (^{(3)}) (terminal connectors)</td>
<td>R2</td>
</tr>
<tr>
<td>2P</td>
<td>2 phase control (^{(5)})</td>
<td>R1</td>
</tr>
<tr>
<td>D</td>
<td>Remote Keypad (^{(3)})</td>
<td>R1</td>
</tr>
<tr>
<td>4</td>
<td>Insulation tester (^{(2)}) (^{(3)})</td>
<td>R2</td>
</tr>
<tr>
<td>5</td>
<td>Analog card – Thermistor in and Analog out (^{(2)}) (^{(3)})</td>
<td>R2</td>
</tr>
<tr>
<td>6</td>
<td>3XRTD Thermal sensors (^{(2)}) (^{(3)})</td>
<td>R2</td>
</tr>
<tr>
<td>8</td>
<td>Harsh environment treatment</td>
<td>R1</td>
</tr>
<tr>
<td>F115</td>
<td>Fan unit (^{(4)}) 115VAC fan unit</td>
<td>R2</td>
</tr>
<tr>
<td>F230</td>
<td>Fan unit (^{(4)}) 230VAC fan unit</td>
<td>R1</td>
</tr>
<tr>
<td>ROC</td>
<td>Chinese language LCD</td>
<td>R2</td>
</tr>
<tr>
<td>RU</td>
<td>Russian language LCD</td>
<td>R1</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>Specify</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>Standard</td>
</tr>
</tbody>
</table>
13. Attachment

13.1 Table of figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1</td>
<td>Control inputs and outputs</td>
<td>17</td>
</tr>
<tr>
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13.3 Notes
Subject to technical modifications.

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