![Emerson Industrial Automation logo]

EMERSON™
Industrial Automation

User Guide

Digistart IS

Soft starters for 3 phase induction motors

7.5 to 800kW (23A to 1600A)
200V, 400V, 575V, 690V

Part Number: 0477-0001-02
Issue: 2

CONTROL TECHNIQUES

www.controltechniques.com

General information

The manufacturer accepts no liability for any consequences resulting from inappropriate, negligent or incorrect installation or adjustment of the optional parameters of the equipment or from mismatching the starter with the motor.

The contents of this guide are believed to be correct at the time of printing. In the interests of commitment to a policy of continuous development and improvement, the manufacturer reserves the right to change the specification of the product or its performance, or the content of the guide without notice.

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Software version

This product is supplied with the latest version of user-interface and machine control software. If this product is to be used in a new or existing system with other starters, there may be some differences between their software and the software in this product. These differences may cause the product to function differently. This may also apply to starters returned from the Control Techniques Service Centre.

If there is any doubt, please contact Control Techniques or your local Distributor.

Environmental statement

Control Techniques is committed to minimising the environmental impacts of its manufacturing operations and of its products throughout their life cycle. To this end, we operate an Environmental Management System (EMS) which is certified to the International Standard ISO 14001. Further information on the EMS, our Environment Policy and other relevant information is available on request.

When the products eventually reach the end of their useful life, they can very easily be dismantled into their major component parts for efficient recycling. Many parts snap together and can be separated without the use of tools, while other parts are secured with conventional screws. Virtually all parts of the product are suitable for recycling.

Product packaging is of good quality and can be re-used. Large products are packed in wooden crates, while smaller products come in strong cardboard cartons which themselves have a high recycled fibre content. If not re-used, these containers can be recycled. Polythene, used on the protective film and bags from wrapping product, can be recycled in the same way. Control Techniques's packaging strategy favours easily recyclable materials of low environmental impact, and regular reviews identify opportunities for improvement.

When preparing to recycle or dispose of any product or packaging, please observe local legislation and best practice.

REACH legislation

EC Regulation 1907/2006 on the Registration, Evaluation, Authorisation and restriction of Chemicals (REACH) requires the supplier of an article to inform the recipient if it contains more than a specified proportion of any substance which is considered by the European Chemicals Agency (ECHA) to be a Substance of Very High Concern (SVHC) and is therefore listed by them as a candidate for compulsory authorisation.

For current information on how this requirement applies in relation to specific Control Techniques products, please approach your usual contact in the first instance. Control Techniques position statement can be viewed at:

www.controltechniques.com/REACH

Contents

1.   Safety Information

1.1   Warnings, cautions and notes

> ⚠️ **WARNING**   A Warning contains information which is essential for avoiding a safety hazard.

> ⚠️ **CAUTION**   A Caution contains information which is necessary for avoiding a risk of damage to the product or other equipment.

NOTE   A Note contains information which helps to ensure correct operation of the product.

1.2   Electrical safety - general warning

The voltages used in the starter can cause severe electrical shock and/or burns, and could be lethal. Extreme care is necessary at all times when working with or adjacent to the starter.

Specific warnings are given at the relevant places in this guide.

1.3   System design and safety of personnel

The starter is intended as a component for professional incorporation into complete equipment or a system. If installed incorrectly, the starter may present a safety hazard.

The starter uses high voltages and currents, carries stored electrical energy, and is used to control equipment which can cause injury.

Close attention is required to the electrical installation and the system design to avoid hazards either in normal operation or in the event of equipment malfunction. System design, installation, commissioning and maintenance must be carried out by personnel who have the necessary training and experience. They must read this safety information and this guide carefully.

The STOP function of the starter does not isolate dangerous voltages from the output of the starter or from any external option unit. The supply must be disconnected by an approved electrical isolation device before gaining access to the electrical connections.

None of the starter functions must be used to ensure safety of personnel, i.e. they must not be used for safety-related functions.

Careful consideration must be given to the functions of the starter which might result in a hazard, either through their intended behaviour or through incorrect operation due to a fault. In any application where a malfunction of the starter or its control system could lead to or allow damage, loss or injury, a risk analysis must be carried out, and where necessary, further measures taken to reduce the risk.

The system designer is responsible for ensuring that the complete system is safe and designed correctly according to the relevant safety standards.

1.4   Environmental limits

Instructions regarding transport, storage, installation and use of the starter must be complied with, including the specified environmental limits. Starters must not be subjected to excessive physical force.

1.5   Compliance with regulations

The installer is responsible for complying with all relevant regulations, such as national wiring regulations, accident prevention regulations and electromagnetic compatibility (EMC) regulations. Particular attention must be given to the cross-sectional areas of conductors, the selection of fuses or other protection, and protective ground connections.

Within the European Union, all machinery in which this product is used must comply with the following directives:

98/37/EC: Safety of machinery.

2004/108/EC: Electromagnetic Compatibility.

1.6   Motor

Ensure the motor is installed in accordance with the manufacturer's recommendations. Ensure the motor shaft is not exposed.

The values of the motor parameters set in the starter affect the protection of the motor. The default values in the starter should not be relied upon. It is essential that the correct value is entered in Pr **1A** *Motor Full Load Current*. This affects the thermal protection of the motor.

1.7   Adjusting parameters

Some parameters have a profound effect on the operation of the starter. They must not be altered without careful consideration of the impact on the controlled system. Measures must be taken to prevent unwanted changes due to error or tampering.

1.8   Electrical installation

1.8.1   Electrical shock risk

The voltages present in the following locations can cause severe electric shock and may be lethal:

- AC supply cables and connections
- Output cables and connections
- Many internal parts of the starter, and external option units

The AC supply must be disconnected from the starter using an approved isolation device before any cover is removed from the starter or before any servicing work is performed.

The busbar and heatsink on models IS4x0360N to IS561600N are live while the unit is operating (starting, running or stopping). If the starter is installed without a main contactor, the busbar and heatsink are live whenever mains voltage is connected (including when the starter is ready or tripped).

1.8.2   Power-up procedure

Always apply control voltage before (or with) mains voltage.

IS1x0023B to IS2x0220B: After transportation, mechanical shock or rough handling there is a possibility that the bypass contactor may have latched into the on state. To prevent the possibility of the motor starting immediately, on first commissioning or operation after transportation, always ensure that the control supply is applied before the power, so that the contactor state is initialised.

1.8.3   STOP function

The STOP function does not remove dangerous voltages from the starter, the motor or any external option units.

1.8.4   Stored charge

The starter contains capacitors that remain charged to a potentially dangerous voltage after the AC supply has been disconnected. If the starter has been energised, the AC supply must be isolated at least two minutes before work may continue.

Normally, the capacitors are discharged by an internal resistor. Under certain, unusual fault conditions, the capacitors may fail to discharge. Do not assume that the capacitors have discharged. To protect the user and the equipment, take due care when carrying out any work on the starter.

1.8.5   Equipment supplied by plug and socket

The control supply terminals of the starter are connected to the internal capacitors through rectifier diodes which are not intended to give safety isolation. If the plug terminals can be touched when the plug is disconnected from the socket, a means of automatically isolating the plug from the starter must be used (e.g. a latching relay).

1.8.6   Short circuit

Digistart IS soft starters are not short circuit proof. After severe overload or short circuit, the operation of the soft starter should be fully tested by an authorised service agent.
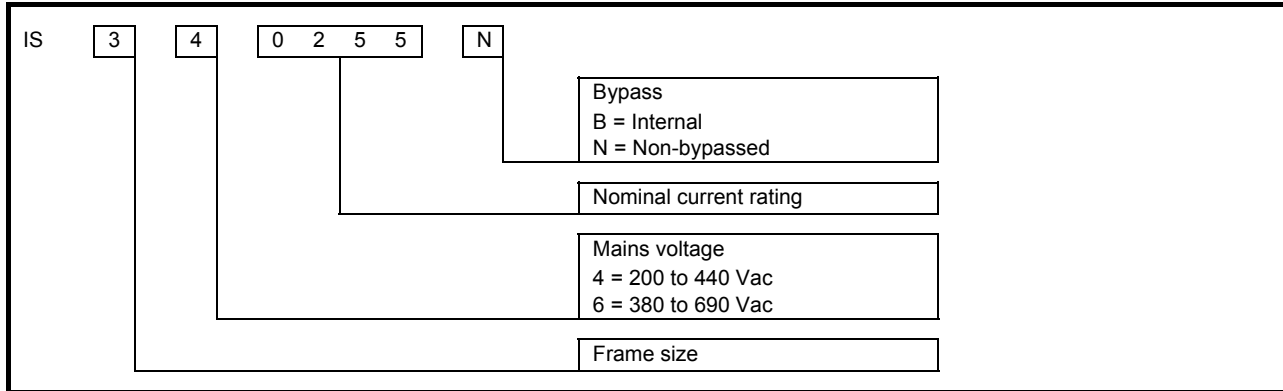
1.8.7   Auto-start

Use the auto-start feature with caution. Read all the notes related to auto-start before operation.

2. Rating Data

2.1 Model code

Figure 2-1 Model code explanation

```
IS    3    4    0  2  5  5    N
```

Bypass
B = Internal
N = Non-bypassed

Nominal current rating

Mains voltage
4 = 200 to 440 Vac
6 = 380 to 690 Vac

Frame size

2.2 Current ratings

Contact your local supplier for ratings under operating conditions not covered by these ratings charts.

2.2.1 Current ratings for bypass operation

AC53b utilisation code

The AC53b utilisation code defines the current rating and standard operating conditions for a bypassed soft starter (internally bypassed, or installed with an external bypass contactor).

The soft starter's current rating determines the maximum motor size it can be used with. The soft starter's rating depends on the number of starts per hour, the length and current level of the start, and the amount of time the soft starter will be off (not passing current) between starts.

The soft starter's current rating is only valid when used within the conditions specified in the utilisation code. The soft starter may have a higher or lower current rating in different operating conditions.

Figure 2-2 AC53b utilisation code

```
80 A   :   AC-53b   3.5 - 15   :   345
```

Off time (seconds)

Start time (seconds)

Start current (multiple of motor full load current)

Starter current rating (amperes)

Starter current rating: The full load current rating of the soft starter given the parameters detailed in the remaining sections of the utilisation code.

Start current: The maximum available start current.

Start time: The maximum allowable start time.

Off time: The minimum allowable time between the end of one start and the beginning of the next start.

Table 2-1 Current ratings - in-line connection, bypassed operation

Model	AC53b 3.0-10:350 40 ºC <1000 metres	AC53b 3.5-15:345 40 ºC <1000 metres	AC53b 4.0-20:340 40 ºC <1000 metres	AC53b 4.5-30:330 40 ºC <1000 metres
IS1x0023B	23 A	20 A	17 A	15 A
IS1x0043B	43 A	37 A	31 A	26 A
IS1x0053B	53 A	53 A	46 A	37 A
Model	**AC53b 3.0-10:590 40 ºC <1000 metres**	**AC53b 3.5-15:585 40 ºC <1000 metres**	**AC53b 4.0-20:580 40 ºC <1000 metres**	**AC53b 4.5-30:570 40 ºC <1000 metres**
IS1x0076B	76 A	64 A	55 A	47 A
IS1x0097B	97 A	82 A	69 A	58 A
IS1x0105B	105 A	105 A	95 A	78 A
IS2x0145B	145 A	123 A	106 A	90 A
IS2x0170B	170 A	145 A	121 A	97 A
IS2x0200B	200 A	189 A	160 A	134 A
IS2x0220B	220 A	210 A	178 A	148 A
IS3x0255N	255 A	231 A	201 A	176 A
IS4x0360N	360 A	360 A	310 A	263 A
IS4x0430N	430 A	430 A	368 A	309 A
IS4x0650N	650 A	650 A	561 A	455 A
IS4x0790N	790 A	790 A	714 A	579 A
IS4x0930N	930 A	930 A	829 A	661 A
IS561200N	1200 A	1200 A	1200 A	1071 A
IS561410N	1410 A	1410 A	1319 A	1114 A
IS561600N	1600 A	1600 A	1600 A	1353 A

NOTE   Models IS3x0255N to IS561600N must be externally bypassed.

Table 2-2 Current ratings - inside delta connection, bypassed operation

Model	AC53b 3.0-10:350 40 ºC <1000 metres	AC53b 3.5-15:345 40 ºC <1000 metres	AC53b 4.0-20:340 40 ºC <1000 metres	AC53b 4.5-30:330 40 ºC <1000 metres
IS1x0023B	35 A	30 A	26 A	22 A
IS1x0043B	65 A	59 A	51 A	44 A
IS1x0053B	80 A	80 A	69 A	55 A
Model	**AC53b 3.0-10:590 40 ºC <1000 metres**	**AC53b 3.5-15:585 40 ºC <1000 metres**	**AC53b 4.0-20:580 40 ºC <1000 metres**	**AC53b 4.5-30:570 40 ºC <1000 metres**
IS1x0076B	114 A	96 A	83 A	70 A
IS1x0097B	146 A	123 A	104 A	87 A
IS1x0105B	158 A	158 A	143 A	117 A
IS2x0145B	218 A	184 A	159 A	136 A
IS2x0170B	255 A	217 A	181 A	146 A
IS2x0200B	300 A	283 A	241 A	200 A
IS2x0220B	330 A	315 A	268 A	223 A
IS3x0255N	383 A	346 A	302 A	264 A
IS4x0360N	540 A	540 A	465 A	395 A
IS4x0430N	645 A	645 A	552 A	464 A
IS4x0650N	975 A	975 A	842 A	683 A
IS4x0790N	1185 A	1185 A	1071 A	868 A
IS4x0930N	1395 A	1395 A	1244 A	992 A
IS561200N	1800 A	1800 A	1800 A	1606 A
IS561410N	2115 A	2115 A	1979 A	1671 A
IS561600N	2400 A	2400 A	2400 A	2030 A

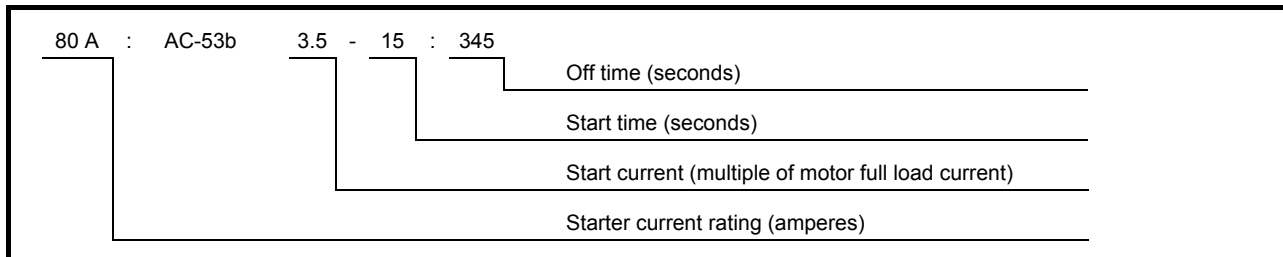## 2.2.2 Current ratings for continuous operation (not bypassed)

AC53a utilisation code

The AC53a Utilisation Code defines the current rating and standard operating conditions for a non-bypassed soft starter.

The soft starter's current rating determines the maximum motor size it can be used with. The soft starter's rating depends on the number of starts per hour, the length and current level of the start, and the percentage of the operating cycle that the soft starter will be running (passing current).

The soft starter's current rating is only valid when used within the conditions specified in the utilisation code. The soft starter may have a higher or lower current rating in different operating conditions.

Figure 2-3 AC53a utilisation code
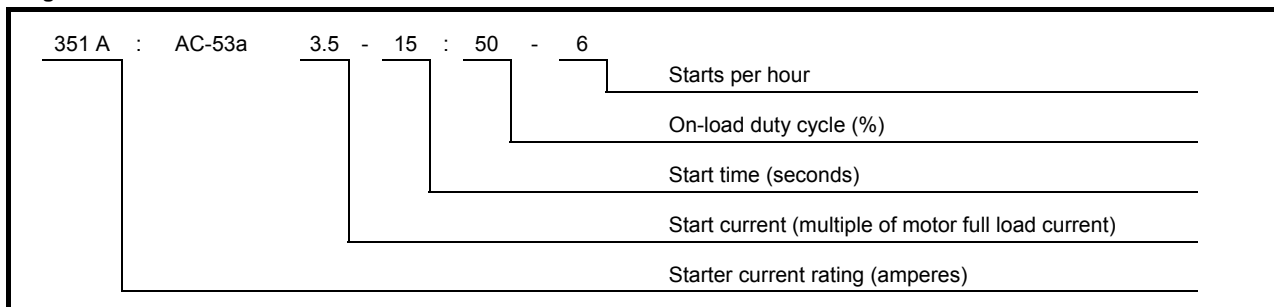
Starter current rating: The full load current rating of the soft starter given the parameters detailed in the remaining sections of the utilisation code.

Start current: The maximum available start current.

Start time: The maximum allowable start time.

On-load duty cycle: The maximum percentage of each operating cycle that the soft starter can operate.

Starts per hour: The maximum allowable number of starts per hour.

Table 2-3 Current ratings - in-line connection, non-bypassed operation

Model	AC53a 3-10:50-6 40 ºC <1000 metres	AC53a 3.5-15:50-6 40 ºC <1000 metres	AC53a 4-20:50-6 40 ºC <1000 metres	AC53a 4.5-30:50-6 40 ºC <1000 metres
IS3x0255N	255 A	222 A	195 A	171 A
IS4x0360N	360 A	351 A	303 A	259 A
IS4x0430N	430 A	413 A	355 A	301 A
IS4x0650N	650 A	629 A	532 A	437 A
IS4x0790N	790 A	790 A	694 A	567 A
IS4x0930N	930 A	930 A	800 A	644 A
IS561200N	1200 A	1200 A	1135 A	983 A
IS561410N	1410 A	1355 A	1187 A	1023 A
IS561600N	1600 A	1600 A	1433 A	1227 A

Table 2-4 Current ratings - inside delta connection, non-bypassed operation

Model	AC53a 3-10:50-6 40 ºC <1000 metres	AC53a 3.5-15:50-6 40 ºC <1000 metres	AC53a 4-20:50-6 40 ºC <1000 metres	AC53a 4.5-30:50-6 40 ºC <1000 metres
IS3x0255N	383 A	334 A	293 A	257 A
IS4x0360N	540 A	527 A	455 A	388 A
IS4x0430N	645 A	620 A	533 A	451 A
IS4x0650N	975 A	943 A	798 A	656 A
IS4x0790N	1185 A	1185 A	1041 A	850 A
IS4x0930N	1395 A	1395 A	1200 A	966 A
IS561200N	1800 A	1800 A	1702 A	1474 A
IS561410N	2115 A	2033 A	1780 A	1535 A
IS561600N	2400 A	2400 A	2149 A	1840 A

3. Mechanical Installation

⚠️ **WARNING**

Digistart IS models IS2x0145B to IS561600N weigh in excess of 15 kg (33 lb). Use appropriate safeguards when lifting these models.

⚠️ **WARNING**

Models IS2x0145B to IS561600N are intended to be mounted in an enclosure which prevents access except by trained and authorised personnel, and which prevents the ingress of contamination. The complete range is designed for use in an environment classified as Pollution Degree 3 in accordance with IEC60664-1. This means conductive pollution or dry, non-conductive pollution which becomes conductive due to condensation is acceptable.

Models IS2x0145B to IS2x0220B can be installed with optional finger guards, in which case they do not need to be mounted in an enclosure.

3.1 Dimensions and weights

**Figure 3-1 Unit dimensions**
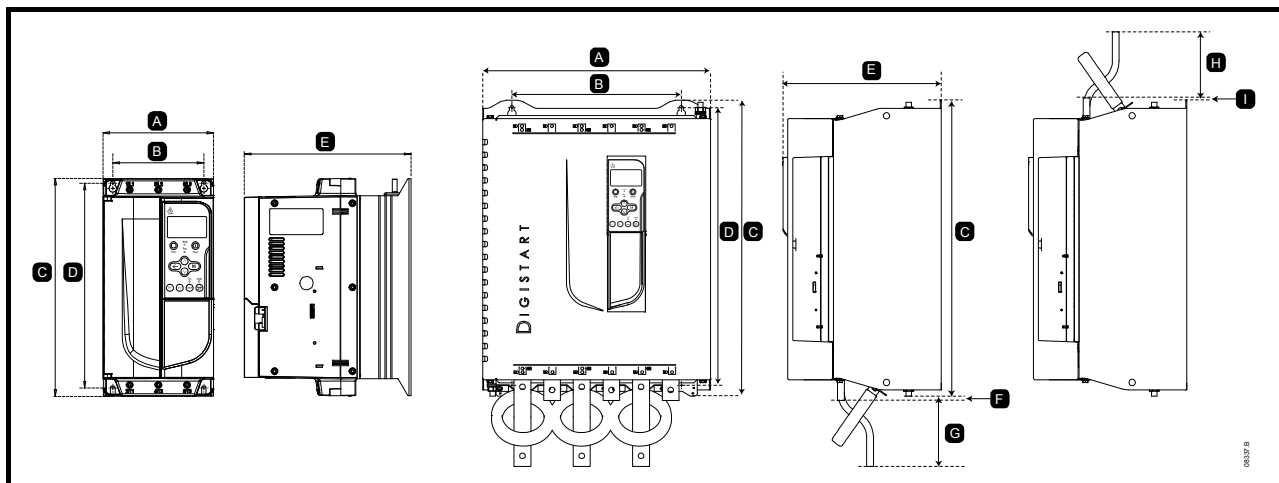
Model	A mm (in)	B mm (in)	C mm (in)	D mm (in)	E mm (in)	F mm (in)	G mm (in)	H mm (in)	I mm (in)	Weight kg (lb)
IS1x0023B IS1x0043B IS1x0053B	156.4 (6.16)	124.0 (4.88)	294.6 (11.60)	278.0 (10.94)	196.2 (7.72)	n/a	n/a	n/a	n/a	3.2 (7.05)
IS1x0076B IS1x0097B IS1x0105B	156.4 (6.16)	124.0 (4.88)	294.6 (11.60)	278.0 (10.94)	226.7 (8.92)	n/a n/a	n/a n/a	n/a n/a	n/a n/a	3.5 (7.22) 4.8 (10.58)
IS2x0145B IS2x0170B IS2x0200B IS2x0220B	282 (11.10)	250 (9.84)	438 (17.24)	380 (14.96)	254 (10.00)	n/a	n/a	n/a	n/a	16 (35.27)
IS3x0255N	394 (15.51)	320 (12.60)	460 (18.11)	400 (15.75)	284 (11.18)	n/a	n/a	n/a	n/a	25 (55.12)
IS4x0360N IS4x0430N	430 (16.93)	320 (12.60)	556 (21.89)	522 (20.55)	302 (11.89)	5.5 (0.22)	104.5 (4.11)	104.5 (4.11)	5.5 (0.22)	50.5 (111.33)
IS4x0650N IS4x0790N IS4x0930N	430 (16.93)	320 (12.60)	556 (21.89)	522 (20.55)	302 (11.89)	5.5 (0.22)	104.5 (4.11)	104.5 (4.11)	5.5 (0.22)	53.5 (117.95)
IS561200N IS561410N IS561600N	574 (22.60)	500 (19.69)	750 (29.53)	727 (28.62)	364 (14.33)	8.5 (0.33)	132.5 (5.22)	129 (5.08)	5 (0.20)	140 (308.65)

NOTE

Dimensions F, G, H and I are the additional space required for the output and input busbars, in addition to the overall chassis measurement (C).

3.2 Physical installation

Figure 3-2 Mounting clearances
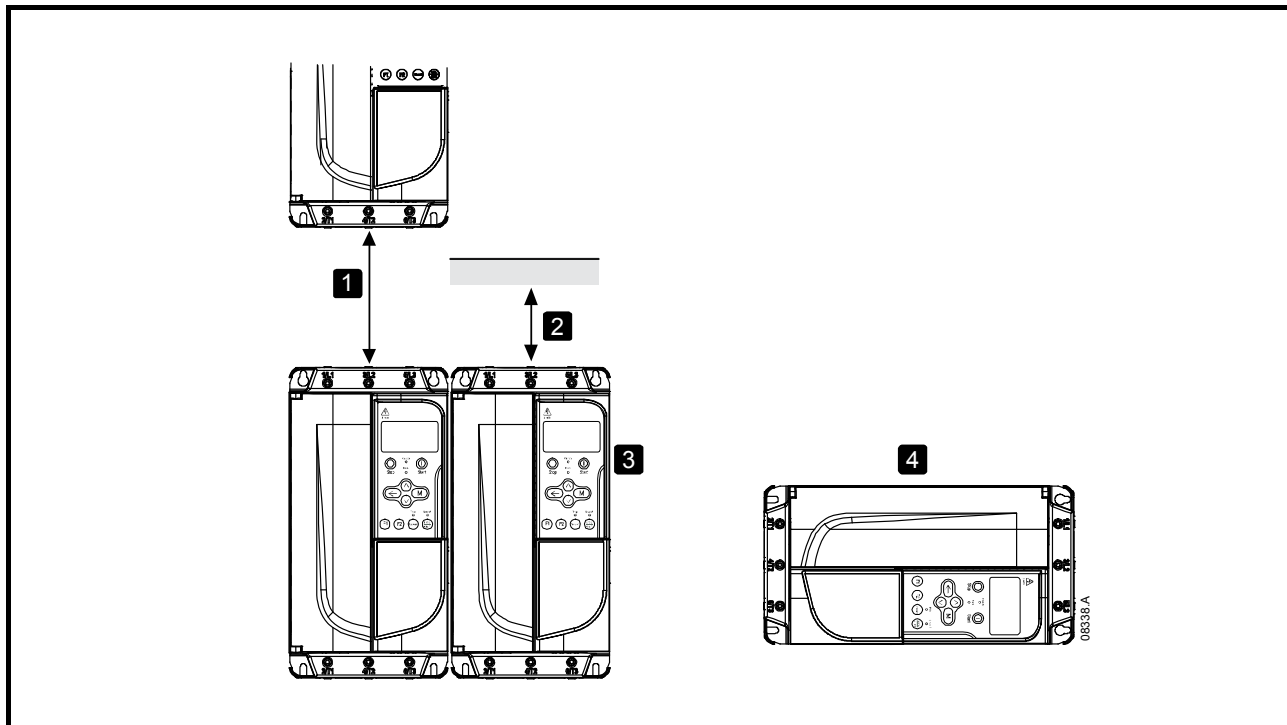
1	IS1x0023B to IS3x0255N: Allow 100 mm (3.94 in) between soft starters. IS4x0360N to IS561600N: Allow 200 mm (7.88 in) between soft starters.
2	IS1x0023B to IS2x0220B: Allow 50 mm (1.97 in) between the soft starter and solid surfaces. IS3x0255N: Allow 100 mm (3.94 in) between the soft starter and solid surfaces. IS4x0360N to IS561600N: Allow 200 mm (7.88 in) between the soft starter and solid surfaces.
3	Soft starters may be mounted side by side with no clearance.
4	The soft starter may be mounted on its side. Derate the soft starter's rated current by 15%.

3.3 Busbar adjustment procedure

The busbars on models IS4x0360N to IS561600N can be adjusted for top or bottom input and output as required.

NOTE Many electronic components are sensitive to static electricity. Voltages so low that they cannot be felt, seen or heard, can reduce the life, affect performance, or completely destroy sensitive electronic components. When performing service, proper ESD equipment should be used to prevent possible damage from occurring.

All units are manufactured with input and output busbars at the bottom of the unit as standard. The input and/or output busbars can be moved to the top of the unit if required.
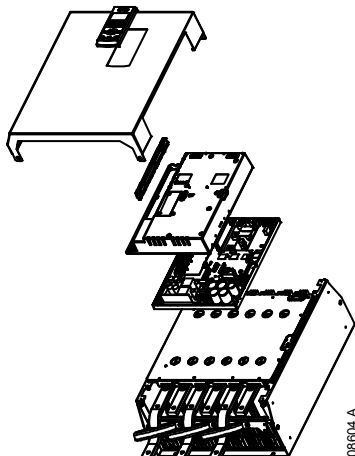
1. Remove all wiring and links from the soft starter before dismantling the unit.
2. Remove the unit cover (4 screws).
3. Remove the keypad faceplate, then gently remove the keypad (2 screws).
4. Remove the control terminal plugs.
5. Gently fold the main plastic away from the starter (12 screws).
6. Unplug the keypad loom from CON 1 (see note).
7. Label each SCR firing loom with the number of the corresponding terminal on the backplane PCB, then unplug the looms.
8. Unplug the thermistor, fan and current transformer wires from the model board.
9. Remove the plastic tray from the starter (four screws).

NOTE Remove the main plastic slowly to avoid damaging the keypad wiring loom which runs between the main plastic and the backplane PCB.

08605.A
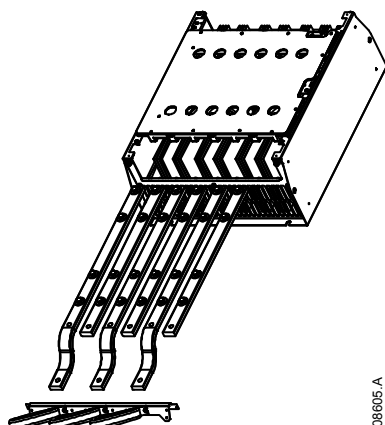
10. Unscrew and remove the magnetic bypass plates (models IS4x0430N to IS561600N only).
11. Remove the current transformer assembly (three screws).
12. Identify which busbars are to be moved. Remove the bolts holding these busbars in place then slide the busbars out through the bottom of the starter (four bolts per busbar).

08606.A
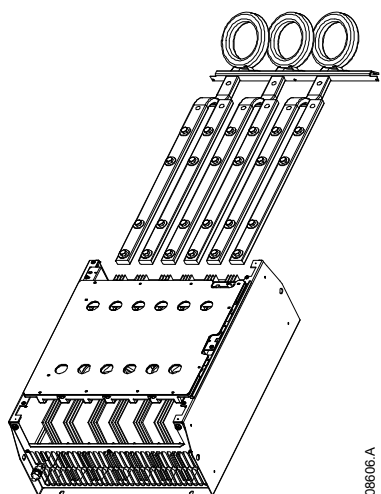
13. Slide the busbars in through the top of the starter. For input busbars, the short curved end should be outside the starter. For output busbars, the unthreaded hole should be outside the starter.
14. Replace the dome washers with the flat face towards the busbar, then tighten the bolts holding the busbars in place to 20 Nm.
15. Place the current transformer assembly over the input busbars and screw the assembly to the body of the starter (see note).
16. Run all wiring to the side of the starter and secure with cable ties.Run all wiring to the side of the starter and secure with cable ties.

NOTE If moving the input busbars, the current transformers (CTs) must also be reconfigured.

1. Label the CTs L1, L2 and L3 (L1 is leftmost when looking from the front of the starter). Remove the cable ties and unscrew the CTs from the bracket.
2. Move the CT bracket to the top of the starter. Position the CTs for the correct phases, then screw the CTs to the bracket. For models IS4x0360N to IS4x0930N, the CTs must be placed on an angle (the left hand legs of each CT will be on the top row of holes and the right hand legs will be on the bottom tabs).

⚠ CAUTION

It is the user's responsibility to follow these instructions correctly. Control Techniques cannot be held responsible for any damage to the starter or associated equipment from incorrect practice.

4.   Electrical Installation

> ⚠️ **WARNING**
>
> Always apply control voltage before (or with) mains voltage.

> ⚠️ **WARNING**
>
> Always follow the specified tightening torque for all power and ground terminal connections.

For specifications and detailed technical data, see *Technical Data* on page 74.

4.1   Terminal layout

4.1.1   Power terminations

Use only copper stranded or solid conductors, rated for 75 ºC.

Figure 4-1 Cable sizes and maximum torque settings (IS1x0023B to IS1x0105B)

NOTE   For personnel safety, the power terminals on models up to IS1x0105B are protected by snap-off tabs. When using large cables, it may be necessary to break off these tabs.

Models which are internally bypassed do not require an external bypass contactor.

Figure 4-2 Busbar dimensions and maximum torque settings (IS2x0145B to IS561600N)

The busbars on models IS4x0360N to IS561600N can be adjusted for top or bottom input and output as required. See *Busbar Adjustment Procedure* on page 11 for step-by-step instructions.

Figure 4-3 Busbar configuration options
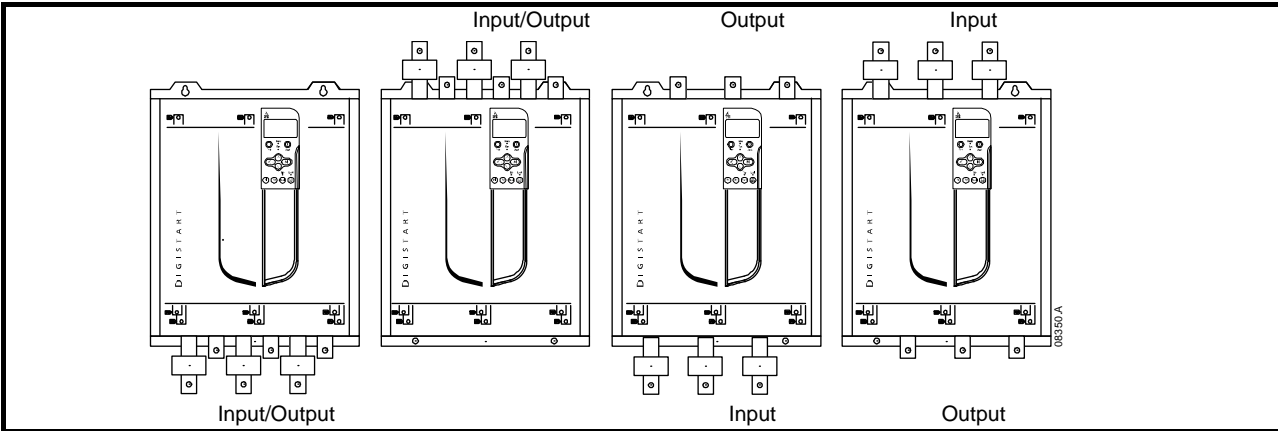
4.1.2   Ground terminals

Ground terminals are located at the back of the soft starter.

- IS1x0023B to IS1x0105B have one terminal on the input side.
- IS2x0145B to IS561600N have two terminals, one on the input side and one on the output side.

The ground terminal may also be used for a ground shield connection if necessary.

Tighten the cables as follows:

Table 4-1 Ground terminal maximum torque settings

Models	Terminal size	Torque
IS1x0023B to IS1x0105B	M6	3 Nm
IS2x0145B to IS3x0255N	M8	5 Nm
IS4x0360N to IS561600N	M10	8.5 Nm

Figure 4-4 Ground terminal locations
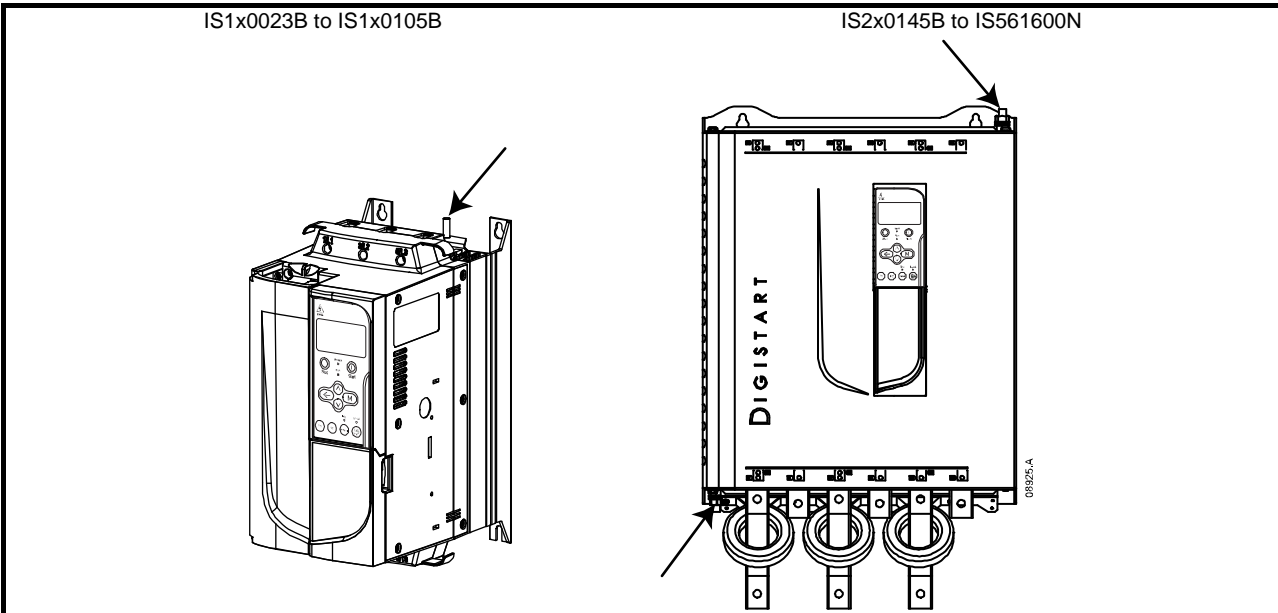
4.1.3 Control terminals

⚠ CAUTION	Always connect control voltage to the correct terminals: • 110 to 210 Vac: CSL-CSR or • 220 to 440 Vac: CSH-CSR
⚠ WARNING	The installer must ensure that the external control circuits are insulated from human contact by at least one layer of insulation (supplementary insulation) rated for use at the AC supply voltage.

Control terminations use 2.5mm^2 plug-in terminal blocks. Unplug each block, complete the wiring, then reinsert the block.

Figure 4-5 Control terminal layout
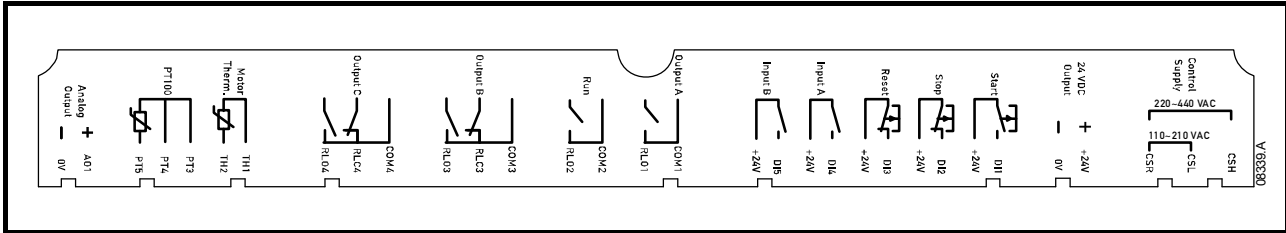
4.1.4 Control wiring

The Digistart IS has three fixed inputs for remote control. These inputs should be controlled by contacts rated for low voltage, low current operation (gold flash or similar).

Figure 4-6 Control wiring options

1	Two-wire control
2	Three-wire control
3	Four-wire control
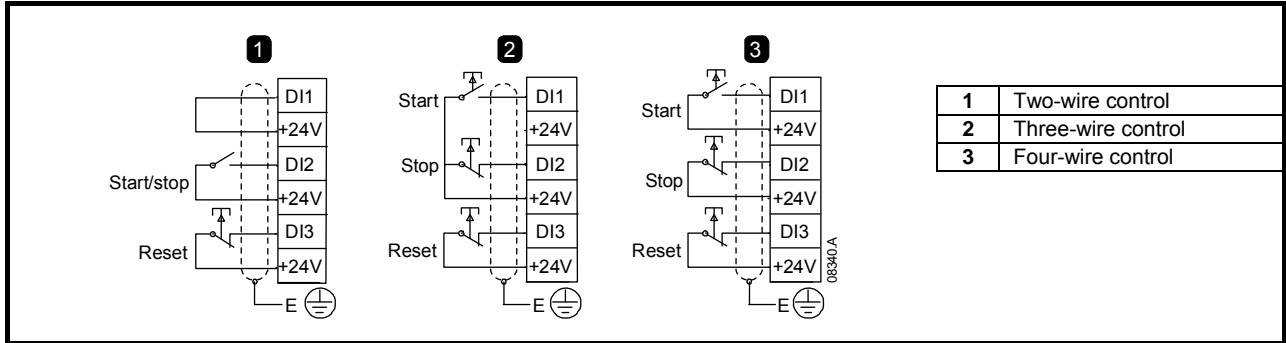
⚠ CAUTION	Do not apply voltage to the control input terminals. These are active 24 Vdc inputs and must be controlled with potential free contacts. Cables to the control inputs must be segregated from mains voltage and motor cabling.

4.1.5 Relay outputs

The Digistart IS provides four relay outputs, one fixed and three programmable.

The Run output closes when the soft start is complete (when the starting current falls below 120% of the programmed motor full load current) and remains closed until the beginning of a stop (either soft stop or coast to stop).

Operation of the programmable outputs is determined by the settings of Pr **4A** to **4I**.

• If assigned to Main Contactor, the output activates as soon as the soft starter receives a start command and remains active while the soft starter is controlling the motor (until the motor starts a coast to stop, or until the end of a soft stop).
• If assigned to a trip function, the output activates when a trip occurs.
• If assigned to a flag, the output activates when the specified flag is active (Pr **7A** to **7C**).

⚠ CAUTION	Some electronic contactor coils are not suitable for direct switching with PCB mount relays. Consult the contactor manufacturer/supplier to confirm suitability.

Three additional outputs are available on the input/output expansion card.

4.1.6   Motor thermistors

Motor thermistors can be connected directly to the Digistart IS. The soft starter will trip when the resistance of the thermistor circuit exceeds approximately 3.6 kΩ.

Figure 4-7 Motor thermistor connection
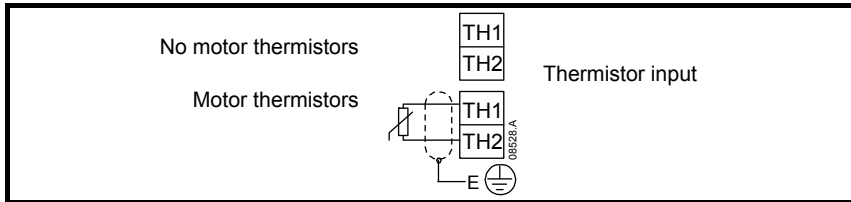
NOTE   If no motor thermistors are connected to the Digistart IS thermistor input terminals TH1, TH2 must be open. If TH1, TH2 are shorted, the Digistart IS will trip.
The thermistor circuit should be run in screened cable and must be electrically isolated from ground and all other power and control circuits.

4.2 Control connections

Figure 4-8 Digistart IS electrical schematic
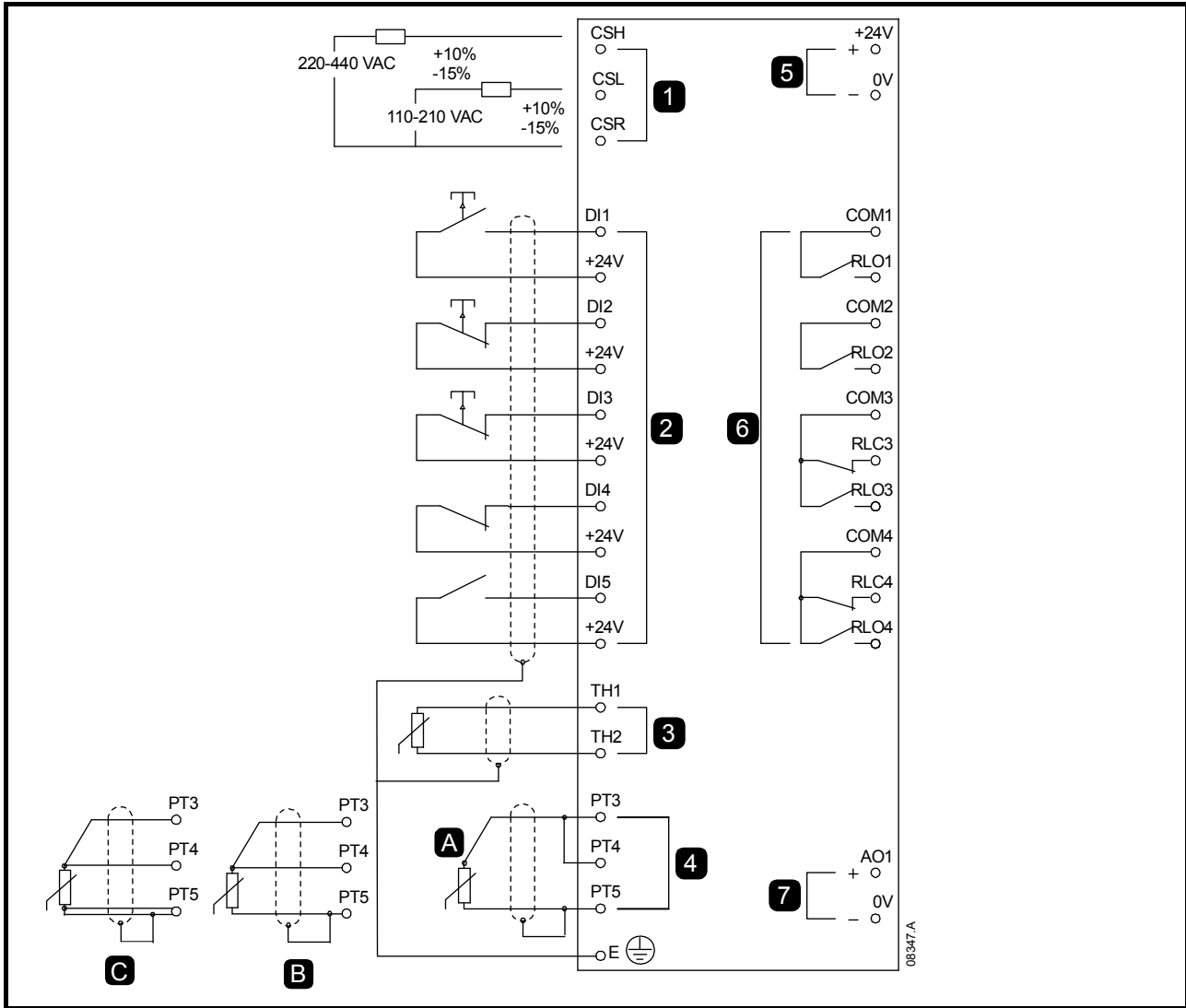
1	Control voltage		DI1, +24V	Start
2	Remote control inputs		DI2, +24V	Stop
3	Motor thermistor input		DI3, +24V	Reset
4A	RTD/PT100 input - 2-wire		DI4, +24V	Programmable input A
4B	RTD/PT100 input - 3-wire		DI5, +24V	Programmable input B
4C	RTD/PT100 input - 4-wire		COM1, RLO1	Relay output A
5	24 Vdc output		COM2, RLO2	Run relay output
6	Relay outputs		COM3, RLC3, RLO3	Relay output B
7	Analog output		COM4, RLC4, RLO4	Relay output C

The Digistart IS can be commanded to emergency stop the motor, ignoring the soft stop mode set in Pr **2H**.

When the circuit across DI4, +24V is opened, the soft starter allows the motor to coast to stop.

To use the emergency stop function, set Pr **3A** to 'Emergency Stop' (this is the default setting).

If emergency stop is not required, change the setting of Pr **3A** or connect a link across DI4, +24V.

For keypad control, the soft starter requires:

- control supply connections (terminals CSH, CSL, CSR depending on the control voltage)
- programmable input A (DI4, +24V) must be closed or Pr **3A** *Input A Function* must be changed from Emergency Stop

4.3 Power connections

4.3.1 In-line installation

• In-line installation, internally bypassed

Figure 4-9 Power connections - in-line installation, internally bypassed
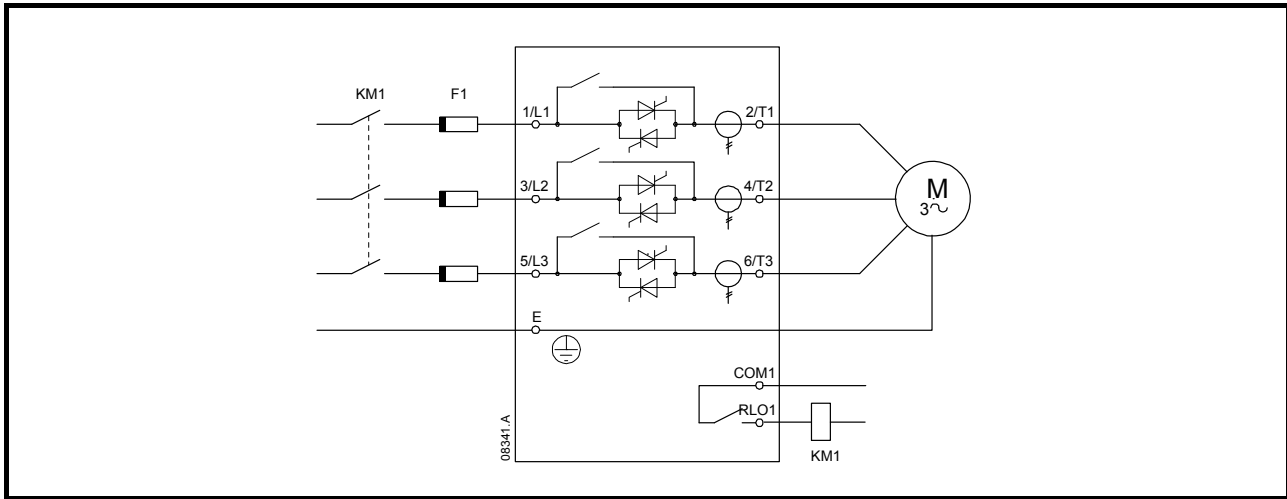
KM1	Main contactor (optional)
F1	Semiconductor fuses (optional)

NOTE   Main contactor is the default setting for Pr **4A** *Relay A Function* (COM1, RLO1).

• In-line installation, externally bypassed

Non-bypassed models have dedicated bypass terminals, which allow the Digistart IS to continue providing protection and monitoring functions even when bypassed via an external bypass contactor. The bypass contactor must be connected to the bypass terminals and controlled by the soft starter's run output (terminals COM2, RLO2).

Figure 4-10 Power connections - in-line installation, externally bypassed
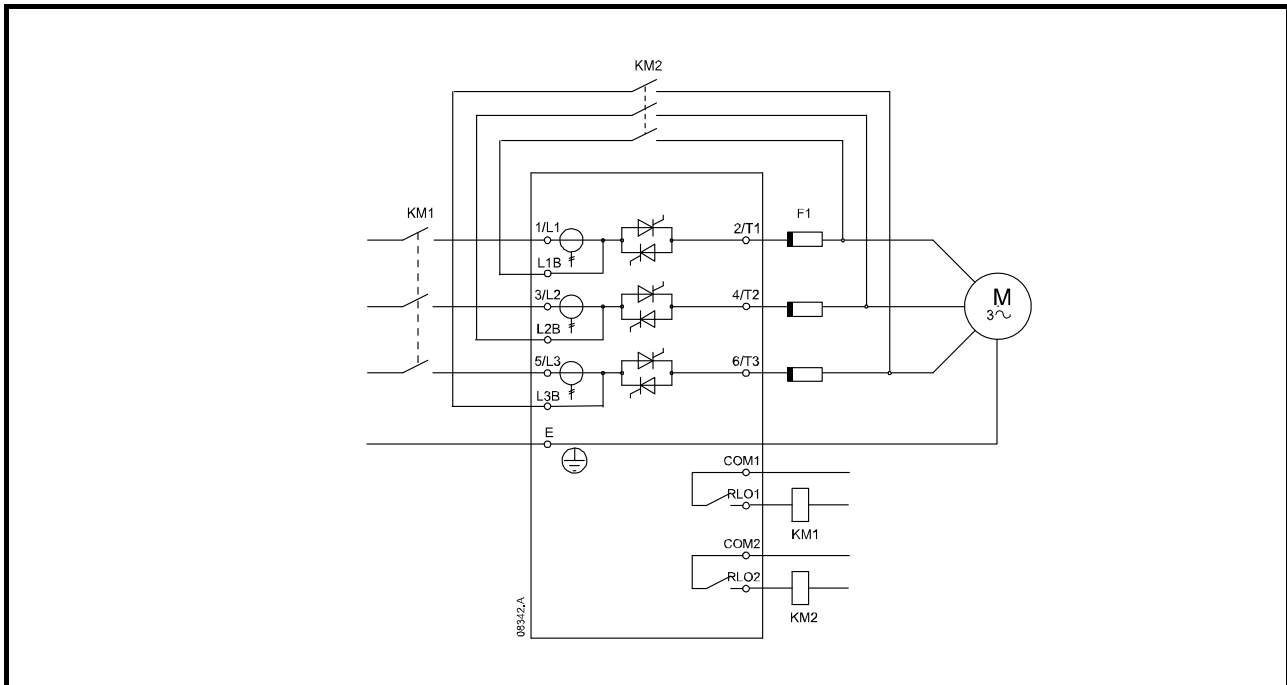
KM1	Main contactor (optional)
KM2	Bypass contactor
F1	Semiconductor fuses (optional)

> **NOTE** The bypass terminals on IS3x0255N are T1B, T2B, T3B. The bypass terminals on IS4x0360N to IS561600N are L1B, L2B, L3B.
>
> The fuses can be installed on the input side if required.

> **NOTE** Main contactor is the default setting for Pr **4A** *Relay A Function* (COM1, RLO1). Output relay COM2, RLO2 is dedicated to Run output operation and is ideal for managing an external bypass contactor.

- In-line installation, non-bypassed

Figure 4-11 Power connections - in-line installation, non-bypassed

KM1	Main contactor (optional)
F1	Semiconductor fuses (optional)

4.3.2 Inside delta installation

> ⚠ **CAUTION** When connecting the Digistart IS in inside delta configuration, always install a main contactor or shunt trip circuit breaker.

- Inside delta installation, internally bypassed

Figure 4-12 Power connections - inside delta installation, internally bypassed
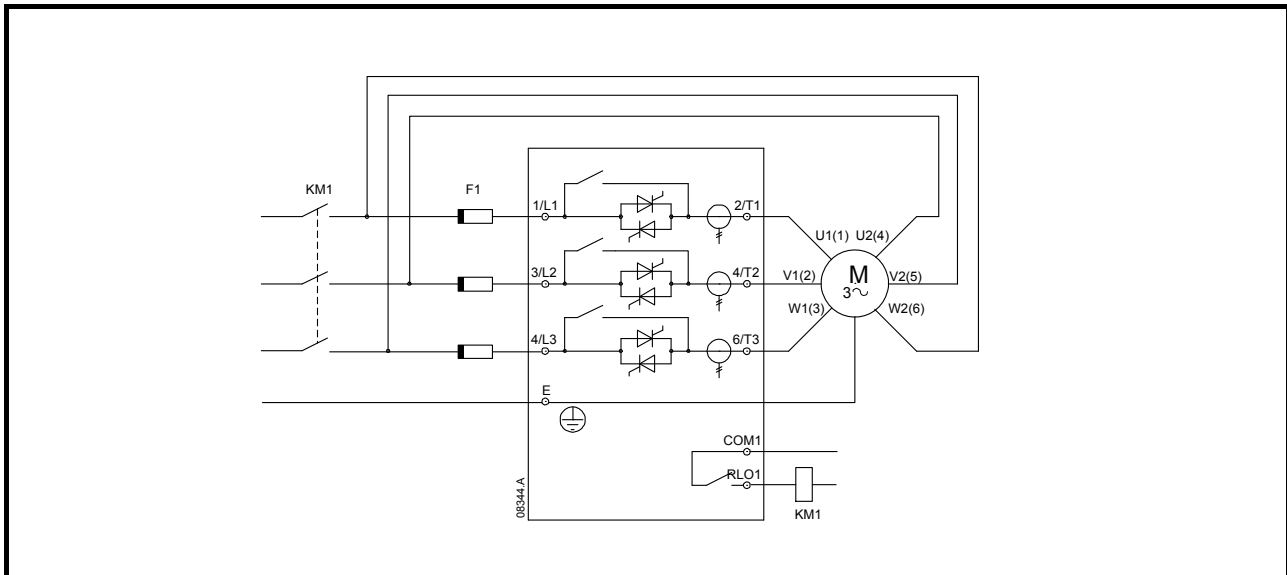
KM1	Main contactor
F1	Semiconductor fuses (optional)

• Inside delta installation, externally bypassed

Non-bypassed models have dedicated bypass terminals, which allow the Digistart IS to continue providing protection and monitoring functions even when bypassed via an external bypass contactor. The bypass contactor must be connected to the bypass terminals and controlled by the soft starter's run output (terminals COM2, RLO2).

Figure 4-13 Power connections - inside delta installation, externally bypassed
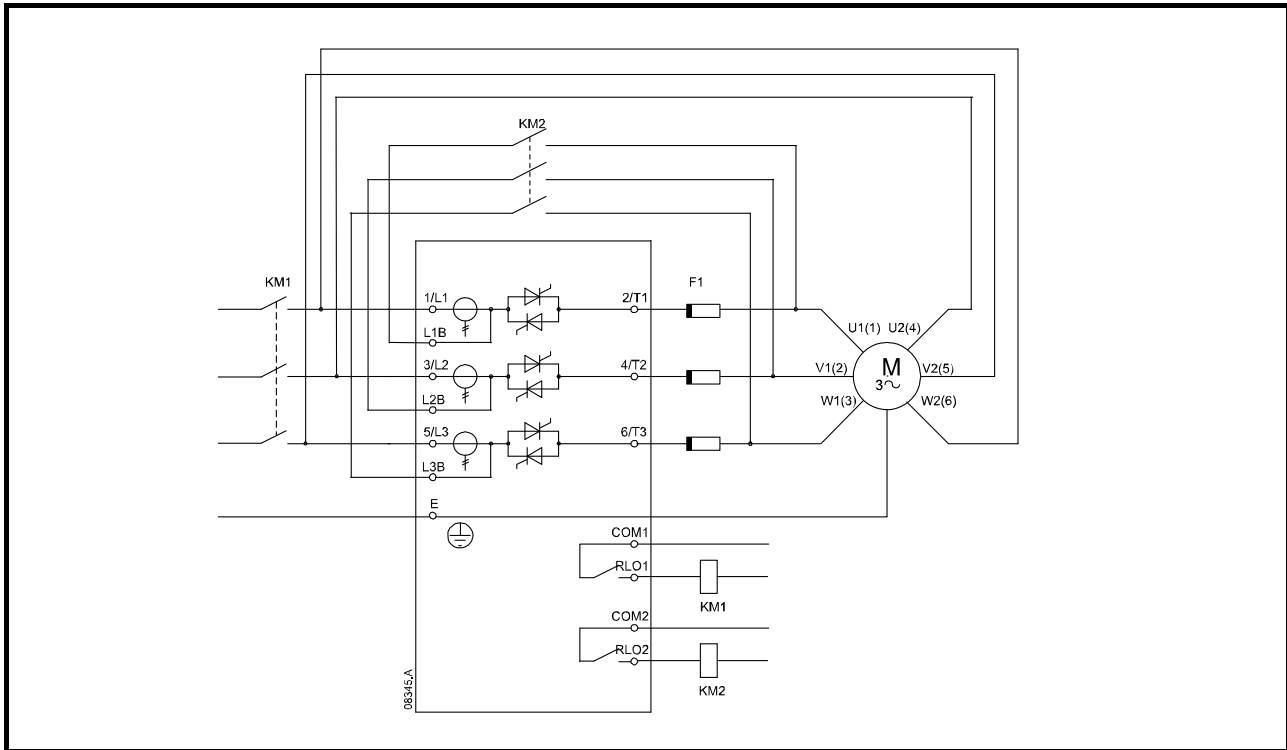
KM1	Main contactor
KM2	Bypass contactor
F1	Semiconductor fuses (optional)

NOTE	The bypass terminals on IS3x0255N are T1B, T2B, T3B. The bypass terminals on IS4x0360N to IS561600N are L1B, L2B, L3B.

The fuses can be installed on the input side if required.

• Inside delta installation, non-bypassed

Figure 4-14 Power connections - inside delta installation, non-bypassed

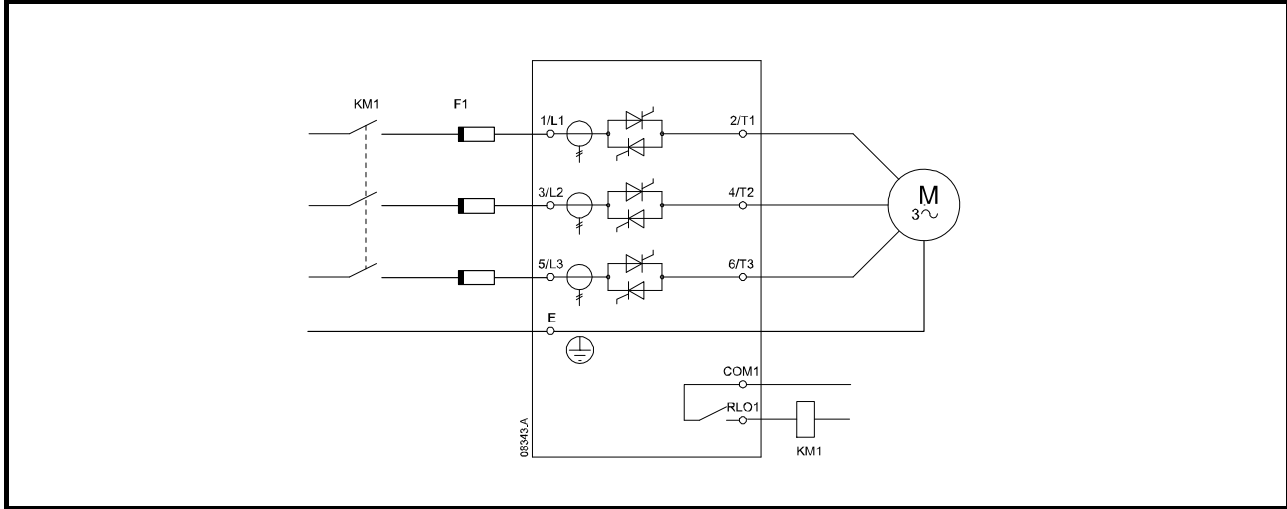| KM1	Main contactor
F1	Semiconductor fuses (optional)

4.4   Fuses

Semiconductor fuses can be used for Type 2 coordination and to reduce the risk of damage to SCRs from transient overload currents.

HRC fuses (such as Ferraz AJT fuses) can be used for Type 1 coordination.

NOTE   Adaptive Control controls the motor's speed profile, within the programmed time limit. This may result in a higher level of current than traditional control methods.

For applications using Adaptive Control to soft stop the motor with stop times greater than 30 seconds, motor branch protection should be selected as follows:

- standard HRC line fuses: minimum 150% motor full load current
- motor rated line fuses: minimum rating 100/150% motor full load current
- motor control circuit breaker minimum long time setting: 150% motor full load current,
- motor control circuit breaker minimum short time setting: 400% motor full load current for 30 seconds

NOTE   Fuse selection is based on a 400% FLC start for 20 seconds in conjunction with standard published starts per hour, duty cycle, 40°C ambient temperature and up to 1000 m altitude. For installations operating outside these conditions, consult your local supplier.

These fuse tables contain recommendations only. Always consult your local supplier to confirm the selection for your particular application.

Table 4-2 Bussman fuses - square body (170M)

Model	SCR I^2t (A^{2}s)	Supply Voltage ($\leq$ 440 Vac)	Supply Voltage ($\leq$ 575 Vac)	Supply Voltage ($\leq$ 690 Vac)
IS1x0023B	1150	170M1314	170M1314	170M1314
IS1x0043B	8000	170M1316	170M1316	170M1316
IS1x0053B	15000	170M1318	170M1318	170M1318
IS1x0076B	15000	170M1319	170M1319	170M1318
IS1x0097B	51200	170M1321	170M1321	170M1319
IS1x0105B	125000	170M1321	170M1321	170M1321
IS2x0145B	125000	170M1321	170M1321	170M1321
IS2x0170B	320000	170M2621	170M2621	170M2621
IS2x0200B	320000	170M2621	170M2621	170M2621
IS2x0220B	320000	170M2621	170M2621	170M2621
IS3x0255N	320000	170M2621	170M2621	170M2621
IS4x0360N	238000	170M6010	170M6010	170M6010
IS4x0430N	320000	170M6011	170M6011	—
IS4x0650N	1200000	170M6015	170M6015	170M6014
IS4x0790N	2530000	170M6017	170M6017	170M6016
IS4x0930N	4500000	170M6019	170M6019	170M6019
IS561200N	4500000	170M6021	—	—
IS561410N	6480000	—	—	—
IS561600N	12500000	170M6019*	—	—

* Two parallel connected fuses required per phase.

Table 4-3 Bussman fuses - British style (BS88)

Model	SCR I²t (A²s)	Supply Voltage (≤ 440 Vac)	Supply Voltage (≤ 575 Vac)	Supply Voltage (≤ 690 Vac)
IS1x0023B	1150	63FE	63FE	63FE
IS1x0043B	8000	120FEE	120FEE	120FEE
IS1x0053B	15000	200FEE	200FEE	200FEE
IS1x0076B	15000	200FEE	200FEE	200FEE
IS1x0097B	51200	200FEE	200FEE	200FEE
IS1x0105B	125000	280FM	280FM	280FM
IS2x0145B	125000	280FM	280FM	280FM
IS2x0170B	320000	450FMM	450FMM	450FMM
IS2x0200B	320000	450FMM	450FMM	450FMM
IS2x0220B	320000	450FMM	450FMM	450FMM
IS3x0255N	320000	450FMM	450FMM	450FMM
IS4x0360N	238000	—	—	—
IS4x0430N	320000	—	—	—
IS4x0650N	1200000	630FMM*	630FMM*	—
IS4x0790N	2530000	—	—	—
IS4x0930N	4500000	—	—	—
IS561200N	4500000	—	—	—
IS561410N	6480000	—	—	—
IS561600N	12500000	—	—	—

* Two parallel connected fuses required per phase.

Table 4-4 Ferraz fuses - HSJ

Model	SCR I²t (A²s)	Supply Voltage (≤ 440 Vac)	Supply Voltage (≤ 575 Vac)	Supply Voltage (≤ 690 Vac)
IS1x0023B	1150	HSJ40**	HSJ40**	Not suitable
IS1x0043B	8000	HSJ80**	HSJ80**	
IS1x0053B	15000	HSJ110**	HSJ110**	
IS1x0076B	15000	HSJ125**	HSJ125**	
IS1x0097B	51200	HSJ175	HSJ175**	
IS1x0105B	125000	HSJ225	HSJ225	
IS2x0145B	125000	HSJ250	HSJ250**	
IS2x0170B	320000	HSJ300	HSJ300	
IS2x0200B	320000	HSJ350	HSJ350	
IS2x0200B	320000	HSJ400**	HSJ400**	
IS2x0220B	320000	HSJ400**	HSJ400**	
IS3x0255N	320000	HSJ450**	HSJ450**	
IS4x0360N	238000	Not suitable	Not suitable	
IS4x0430N	320000			
IS4x0650N	1200000			
IS4x0790N	2530000			
IS4x0930N	4500000			
IS561200N	4500000			
IS561410N	6480000			
IS561600N	12500000			

** Two series connected fuses required per phase.

Table 4-5 Ferraz fuses - North American style (PSC 690)

Model	SCR I²t (A²s)	Supply Voltage (≤ 440 Vac)	Supply Voltage (≤ 575 Vac)	Supply Voltage (≤ 690 Vac)
IS1x0023B	1150	A070URD30XXX0063	A070URD30XXX0063	—
IS1x0043B	8000	A070URD30XXX0125	A070URD30XXX0125	A070URD30XXX0125
IS1x0053B	15000	A070URD30XXX0125	A070URD30XXX0125	A070URD30XXX0125
IS1x0076B	15000	A070URD30XXX0160	A070URD30XXX0160	A070URD30XXX0160
IS1x0097B	51200	A070URD30XXX0200	A070URD30XXX0200	A070URD30XXX0200
IS1x0105B	125000	A070URD30XXX0315	A070URD30XXX0315	A070URD30XXX0315
IS2x0145B	125000	A070URD30XXX0315	A070URD30XXX0315	A070URD30XXX0315
IS2x0170B	320000	A070URD30XXX0315	A070URD30XXX0315	A070URD30XXX0315
IS2x0200B	320000	A070URD30XXX0450	A070URD30XXX0450	A070URD30XXX0450
IS2x0220B	320000	A070URD30XXX0450	A070URD30XXX0450	A070URD30XXX0450
IS3x0255N	320000	A070URD30XXX0450	A070URD30XXX0450	A070URD30XXX0450
IS4x0360N	238000	A070URD33XXX0630	A070URD33XXX0630	A070URD33XXX0630
IS4x0430N	320000	A070URD33XXX0700	A070URD33XXX0700	—
IS4x0650N	1200000	A070URD33XXX1000	A070URD33XXX1000	A070URD33XXX1000
IS4x0790N	2530000	A070URD33XXX1400	A070URD33XXX1400	A070URD33XXX1250
IS4x0930N	4500000	A070URD33XXX1400	A070URD33XXX1400	A070URD33XXX1400
IS561200N	4500000	A055URD33XXX2250	—	—
IS561410N	6480000	A055URD33XXX2250	—	—
IS561600N	12500000	—	—	—

XXX = blade type. See Ferraz catalog for details.

Table 4-6 Ferraz fuses - European style (PSC 690)

Model	SCR I²t (A²s)	Supply Voltage (≤ 440 Vac)	Supply Voltage (≤ 575 Vac)	Supply Voltage (≤ 690 Vac)
IS1x0023B	1150	6.9URD30D11A0050	6.9URD30D11A0050	6.9URD30D11A0050
IS1x0043B	8000	6.9URD30D11A0125	6.9URD30D11A0125	6.9URD30D11A0125
IS1x0053B	15000	6.9URD30D11A0125	6.9URD30D11A0125	6.9URD30D11A0125
IS1x0076B	15000	6.9URD30D11A0160	6.9URD30D11A0160	6.9URD30D11A0160
IS1x0097B	51200	6.9URD30D11A0200	6.9URD30D11A0200	6.9URD30D11A0200
IS1x0105B	125000	6.9URD30D11A0315	6.9URD30D11A0315	6.9URD30D11A0315
IS2x0145B	125000	6.9URD30D11A0315	6.9URD30D11A0315	6.9URD30D11A0315
IS2x0170B	320000	6.9URD30D11A0315	6.9URD30D11A0315	6.9URD30D11A0315
IS2x0200B	320000	6.9URD31D11A0450	6.9URD31D11A0450	6.9URD31D11A0450
IS2x0220B	320000	6.9URD31D11A0450	6.9URD31D11A0450	6.9URD31D11A0450
IS3x0255N	320000	6.9URD31D11A0450	6.9URD31D11A0450	6.9URD31D11A0450
IS4x0360N	238000	6.9URD33D11A0630	6.9URD33D11A0630	6.9URD33D11A0630
IS4x0430N	320000	6.9URD33D11A0700	6.9URD33D11A0700	6.9URD33D11A0700
IS4x0650N	1200000	6.9URD33D11A1000	6.9URD33D11A1000	6.9URD33D11A1000
IS4x0790N	2530000	6.6URD33D11A1400	6.6URD33D11A1400	6.6URD33D11A1400
IS4x0930N	4500000	6.6URD33D11A1400	6.6URD33D11A1400	6.6URD33D11A1400
IS561200N	4500000	6.9URD233PLAF2200	6.9URD233PLAF2200	—
IS561410N	6480000	6.9URD233PLAF2200	6.9URD233PLAF2200	6.9URD233PLAF2200
IS561600N	12500000	6URD233PLAF2800	6URD233PLAF2800	—

Table 4-7 Ferraz fuses - AJT

Model	SCR I^2t (A^{2}s)	Supply Voltage ($\leq$ 440 Vac)	Supply Voltage ($\leq$ 575 Vac)	Supply Voltage ($\leq$ 690 Vac)
IS1x0023B	1150	AJT25	AJT25	
IS1x0043B	8000	AJT50	AJT50	
IS1x0053B	15000	AJT60	AJT60	
IS1x0076B	15000	AJT80	AJT80	
IS1x0097B	51200	AJT100	AJT100	
IS1x0105B	125000	AJT125	AJT125	
IS2x0145B	125000	AJT150	AJT150	
IS2x0170B	320000	AJT175	AJT175	Not suitable
IS2x0200B	320000	AJT200	AJT200	
IS2x0220B	320000	AJT250	AJT250	
IS3x0255N	320000	AJT300	AJT300	
IS4x0360N	238000	AJT400	AJT400	
IS4x0430N	320000	AJT450	AJT450	
IS4x0650N	1200000	A4BQ800	A4BQ800	
IS4x0790N	2530000	A4BQ1200	A4BQ1200	
IS4x0930N	4500000	A4BQ1200 / A4BT1100	A4BQ1200 / A4BT1100	
IS561200N	4500000	A4BQ1600	A4BQ1600	
IS561410N	6480000	A4BQ2000	A4BQ2000	
IS561600N	12500000	A4BQ2500 / A4BT1800	A4BQ2500 / A4BT1800	

4.5 Bypass contactor

Digistart IS soft starters with model numbers IS1x0023B to IS2x0220B are internally bypassed and do not require an external bypass contactor.

Digistart IS soft starters with model numbers IS3x0255N to IS561600N are not internally bypassed and may be installed with an external bypass contactor. Select a contactor with an AC1 rating greater than or equal to the full load current rating of the connected motor.

4.6 Main contactor

A main contactor must be installed if the Digistart IS is connected to the motor in inside delta format and is optional for in-line connection. Select a contactor with an AC3 rating greater than or equal to the full load current rating of the connected motor.

4.7 Circuit breaker

A shunt trip circuit breaker may be used instead of a main contactor to isolate the motor circuit in the event of a soft starter trip. The shunt trip mechanism must be powered from the supply side of the circuit breaker or from a separate control supply.

4.8 Power factor correction

If power factor correction is used, a dedicated contactor should be used to switch in the capacitors.

⚠ **CAUTION** Power factor correction capacitors must be connected to the input side of the soft starter. Connecting power factor correction capacitors to the output side will damage the soft starter.

4.9 EMC (electromagnetic compatibility)

4.9.1 Immunity

The Digistart IS complies with the following international immunity standards as required for IEC60947-4-2:

Table 4-8 EMC immunity

Standard	Type of Immunity	Application	Level
IEC61000-2-4	Harmonics		Class 3
IEC61000-4-2	Electrostatic Discharge	Housing of equipment	Level 3
IEC61000-4-3	Radiated radio frequency field	Housing of equipment	Level 3
IEC61000-4-4	Successive rapid transients	Control and power cables	Level 4
IEC61000-4-5	Surges	Power cables	Level 4
IEC61000-4-6	Conducted radio frequency	Control and power cables	Level 3
IEC61000-4-11	Voltage dips & short time interruptions		Class 2

4.9.2 Conducted and radiated emissions

If the Digistart IS is installed in accordance with the wiring instructions, the Digistart IS complies with the following international immunity standards:

Table 4-9 Conducted and radiated emissions

Standard	Emissions	Level
IEC60947-4-2	Conducted on power supply from 150 kHz to 30MHz	Complies
IEC60947-4-2	Radiated emissions from 30 to 1000 MHz (CISPR 11 Group 1 class B)	Complies

5.   Keypad and Status

5.1   Keypad

Figure 5-1 Keypad and display

1	Four-line display for status and programming details.
2	Status LEDs
3	Soft starter local control buttons.
4	Menu navigation buttons. **M**: Enter a menu or parameter, or save a parameter change ←: Exit the menu or parameter, or cancel a parameter change. ∧ ∨: Scroll to the next or previous status screen, menu or parameter, or change the setting of the current parameter.
5	Shortcut buttons for quick access to common tasks.

Table 5-1 Feedback LEDs

LED	On	Blinking	Off
Ready	Ready	Restart delay or motor temperature check	No control power
Run	Running	Starting/ stopping	Not running, starting or stopping
Trip	Starter tripped	Warning	Normal operation
Local	Local control mode	n/a	Remote control mode

5.2   Removing and replacing the keypad

The keypad can be removed from the soft starter and mounted remotely on a panel using the remote mounting kit.

The keypad stores a backup copy of the parameters in the soft starter, so one keypad can be used to program multiple Digistart IS starters.

NOTE The keypad can be removed or replaced while the starter is running. It is not necessary to remove mains or control voltage.

5.2.1   Removing the keypad

The keypad is attached to the body of the soft starter by a DB9 serial connector and two screws. The screws are concealed behind a snap-on faceplate.

To remove the keypad:

1. On IS1x0023B to IS2x0220B, open the Digistart IS's door.
    On IS3x0255N to IS561600N, remove the Digistart IS's front cover.
2. Insert a small screwdriver under the faceplate, at the base of the keypad, and use the screwdriver to lever the faceplate off the keypad.
3. Lift the faceplate off completely.
4. Remove the two screws holding the keypad in place.
5. Lift the keypad gently off the soft starter. Pull the keypad forwards, to avoid damaging the DB9 connector.

5.2.2 Replacing the keypad

To replace the keypad:

1. Align the connector on the back of the keypad with the socket on the soft starter and push the keypad firmly into place. The keypad will be held in place by the connector and two locating nibs in the top right and bottom left corners.
   For temporary installation (e.g. during commissioning) it is not necessary to screw the keypad in place.
2. Replace the two screws holding the keypad in place.
3. Slide the bottom edge of the faceplate over the body of the keypad, then swing the top edge of the faceplate into place and press onto the keypad. The retaining tabs on the back of the faceplate will snap into place.

5.3 Synchronising the keypad and the starter

When a keypad is connected to a Digistart IS, it synchronises its parameter settings with the settings in the soft starter.

Every time a different keypad is plugged into the starter, an acknowledgement is displayed.

```
New Display Detected
```

The default action is to copy the parameter settings from the keypad to the soft starter. To change the action, use the ∧ and ∨ buttons. Press **M** to proceed.

```
Copy Parameters
Display to Starter
Starter to Display
```

If any of the settings in the keypad are not valid for the starter, the keypad loads the default values.

NOTE If a setting in the keypad is not valid for the starter, the keypad will display the message "Par. xx Out of Range".

5.4 Displays

The keypad displays a wide range of performance information about the soft starter.

The top half of the screen shows real-time information on starter status, motor temperature and motor power.

Use the ∧ and ∨ buttons to select the information shown on the bottom half of the screen.

- Current
- Last start information
- Date and time

5.4.1 Starter status

The starter status screen shows details of the starter's operating status, motor temperature and motor power.

```
Ready
M1 000%            000.0kW
```

5.4.2 Average current

The average current screen shows real-time average current.

```
        0.0A
```

5.4.3 Programmable screen

The Digistart IS's user-programmable screen can be configured to show the most important information for the particular application. Use Pr **9B** to **9E** to select which information to display.

```
000.0A              0.0pf
00000hrs          000kWh
```

5.4.4 Current

The current screen shows real-time line current on each phase. If the RTD/PT100 and ground fault protection card is fitted, the screen will also show ground current.

```
      Phase Currents
000.0A    000.0A    000.0A
```

5.4.5 Voltage

The voltage screen shows real-time line voltage across each phase.

```
      Line Voltages
440V      441V      440V
```

NOTE Voltage monitoring is only available if the voltage measurement card is installed.

5.4.6 Last start information

The last start information screen shows details of the most recent successful start:

- start duration (seconds)
- maximum start current drawn (as a percentage of motor full load current)
- calculated rise in motor temperature

```
Last start              010 s
350 % FLC         Δ Temp 5%
```

5.4.7 Date and time

The date/time screen shows the current system date and time (24 hour format). For details on setting the date and time, see *Set Date and Time* on page 57.

```
      DD MMM YYYY
       HH:MM:SS
```

5.4.8 Performance graph

The performance graph provides a real-time display of operating performance. Use Pr **9F** to **9I** to select which information to display.

```
000.0 A            0-400%
```
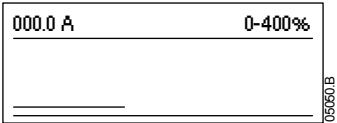
6.   Operation

6.1   Start, stop and reset commands

The soft starter can be controlled in three ways:

- using the buttons on the keypad
- via remote inputs
- via a serial communication link

The **LCL/RMT** button controls whether the Digistart IS will respond to local control (via the keypad) or remote control (via the remote inputs).

- The Local LED on the keypad is on when the soft starter is in local control mode and off when the soft starter is in remote control mode.
- The Remote LED on the Digistart IS is on when the soft starter is in Remote mode and off when in Local mode. The Remote LED is located on the main body of the starter (behind the keypad) and is only visible if the keypad is remotely mounted.

Control via the serial communication network is always enabled in local control mode, and can be enabled or disabled in remote control mode (see Pr **3O**). Control via the serial communication network requires an optional communication module.

The **STOP** button on the keypad is always enabled.

To reset a trip on the soft starter, press the **RESET** button on the keypad or activate the Reset remote input.

NOTE   Adaptive Control, Jog, Brake and PowerThrough functions are not supported with inside delta (six-wire) operation. See *Inside Delta Operation* on page 36.

6.2   Soft start methods

Soft starters offer a variety of methods to control motor starting. Each soft start method uses a different primary control parameter.

Table 6-1 Soft start methods

Soft Start Method	Parameter Controlled	Performance Parameters Influenced
Timed Voltage Ramp	Voltage	Start current, start torque, acceleration
Constant Current	Current	Start torque, acceleration
Torque Control	Torque	Start current, acceleration
Adaptive Acceleration Control	Acceleration	Start current, start torque

Best results are obtained by selecting the soft start method that directly controls the parameter of most importance for the application. Typically soft starters are used to limit motor start current or control load acceleration and/or deceleration.

The Digistart IS offers Constant Current or Adaptive Acceleration Control. Use Pr **2A** to select the soft start method.

Table 6-2 Control functions of soft start methods

To Control	Use
Motor Start Current	Constant Current
Motor/Load Acceleration	Adaptive Acceleration Control

To soft start the motor, press the **START** button on the keypad or activate the Start remote input. The motor will start using the start mode selected in Pr **2A**.

6.2.1 Constant current

Constant current is the traditional form of soft starting, which raises the current from zero to a specified level and keeps the current stable at that level until the motor has accelerated.

Constant current starting is ideal for applications where the start current must be kept below a particular level.

Figure 6-1 Constant current soft start

1: Initial current (Pr **2C**)
2: Current limit (Pr **2B**)
3: Full voltage current
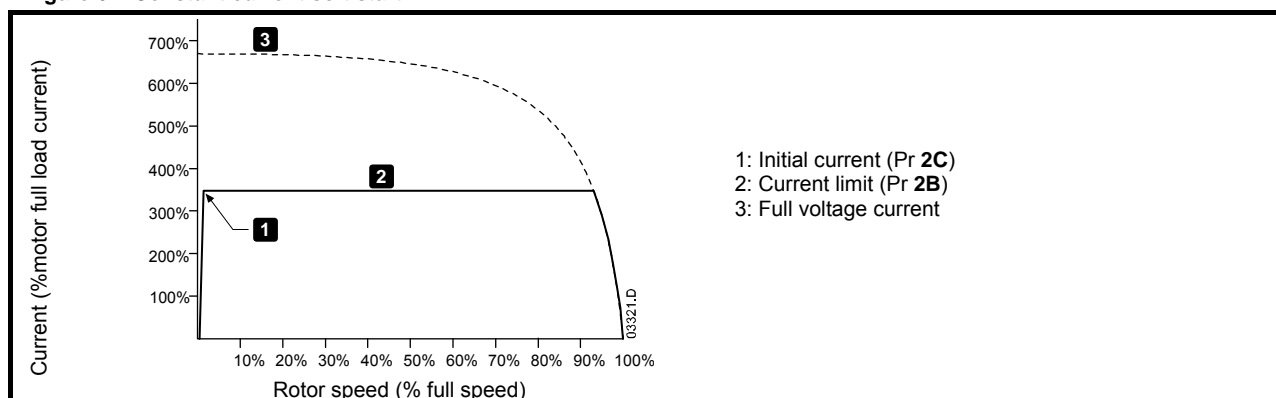
6.2.2 Current ramp

Current ramp soft starting raises the current from a specified starting level (1) to a maximum limit (3), over an extended period of time (2).

Current ramp starting can be useful for applications where:

- the load can vary between starts (for example a conveyor which may start loaded or unloaded). Set the initial current (Pr **2C**) to a level that will start the motor with a light load, and the current limit (Pr **2B**) to a level that will start the motor with a heavy load.
- the load breaks away easily, but starting time needs to be extended (for example a centrifugal pump where pipeline pressure needs to build up slowly).
- the electricity supply is limited (for example a generator set), and a slower application of load will allow greater time for the supply to respond.

Figure 6-2 Current ramp soft start

1: Initial current (Pr **2C**)
2: Start ramp time (Pr **2D**)
3: Current limit (Pr **2B**)
4: Full voltage current
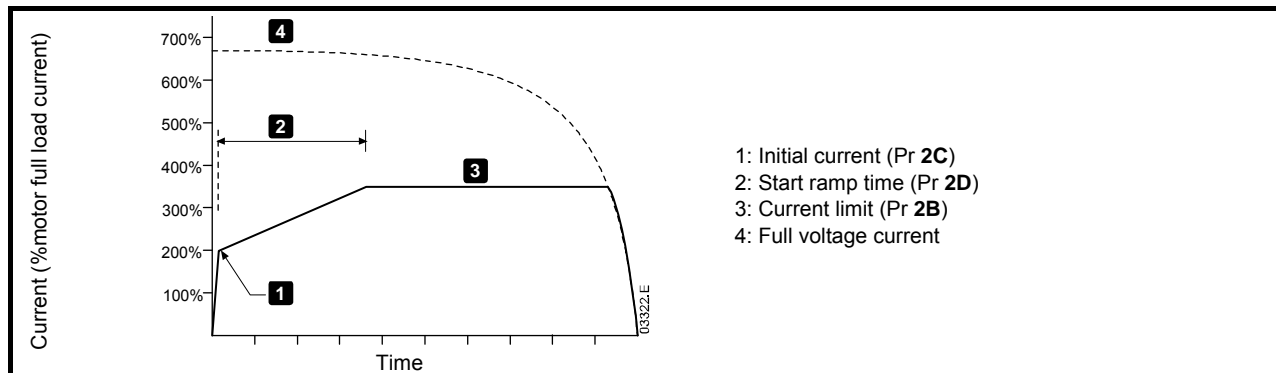
6.2.3 Adaptive control for starting

Adaptive Acceleration Control is a new intelligent motor control technique. In an adaptive control soft start, the Digistart IS adjusts the current in order to start the motor within a specified time and using a selected acceleration profile.

NOTE   Adaptive Acceleration Control cannot start the motor faster than a direct on-line (DOL) start. If the start ramp time (Pr **2D**) is shorter than the motor's DOL start time, starting current may reach DOL levels.

Every application has a particular starting profile, based on characteristics of the load and the motor. Adaptive Acceleration Control offers three different starting profiles, to suit the requirements of different applications. Selecting a profile that matches the inherent profile of the application can help smooth out acceleration across the full start time. Selecting a dramatically different Adaptive Control profile can somewhat neutralise the inherent profile.

The Digistart IS monitors the motor's performance during each start, to improve control for future soft starts.

Adaptive acceleration control

To use Adaptive Acceleration Control to control starting performance:

1. Select Adaptive Control from the Start Mode menu (Pr **2A**)
2. Set the desired Start Ramp Time (Pr **2D**)
3. Select the desired Adaptive Start Profile (Pr **2E**)
4. Set a start Current Limit (Pr **2B**) sufficiently high to allow a successful start. The first start will be a Constant Current start. This allows the Digistart IS to learn the characteristics of the connected motor. This motor data is used by the Digistart IS during subsequent Adaptive Acceleration Control starts.

Figure 6-3 Adaptive control soft start

Adaptive start profile (Pr **2E**):
1. Early acceleration
2. Constant acceleration
3. Late acceleration
4. Start ramp time (Pr **2D**)
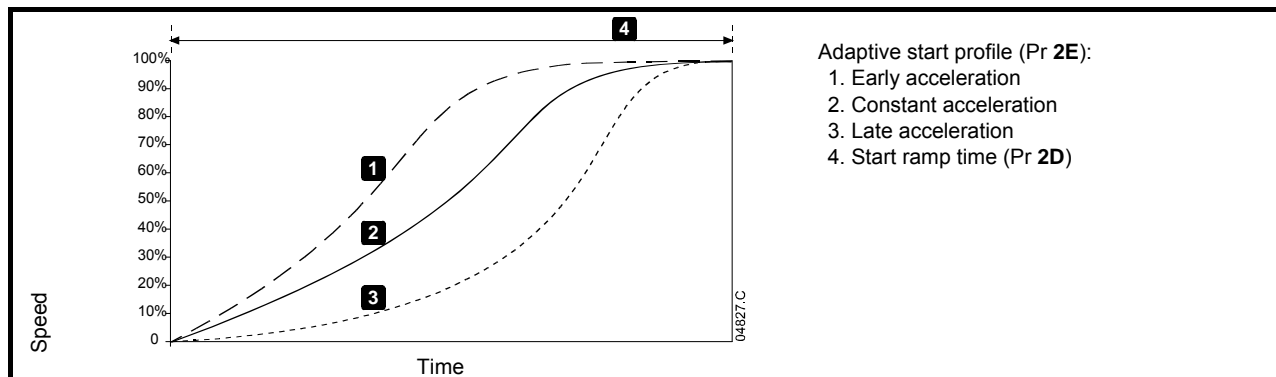
NOTE
    Adaptive Acceleration Control will control the load according to the programmed profile. Start current will vary according to the selected acceleration profile and the programmed start time.

    If replacing a motor connected to a Digistart IS programmed for Adaptive Control starting or stopping, or if the starter has been tested on a different motor prior to actual installation, the starter will need to learn the characteristics of the new motor. The Digistart IS will automatically re-learn the motor's characteristics if Pr **1A** *Motor Full Load Current* or Pr **2L** *Adaptive Control Gain* is changed.

How to select the Adaptive acceleration control start profile

The best profile will depend on the exact details of each application. If you have particular operational requirements, discuss details of your application with your local supplier.

Some loads, such as submersible pumps, should not be run at slow speeds. An early acceleration profile will raise the speed quickly, then control acceleration through the rest of the start.

NOTE
    Adaptive Control controls the motor's speed profile, within the programmed time limit. This may result in a higher level of current than traditional control methods.

Fine-tuning adaptive control

If the motor does not start or stop smoothly, adjust the adaptive control gain (Pr **2L**). The gain setting determines how much the Digistart IS will adjust future adaptive control starts and stops, based on information from the previous start. The gain setting affects both starting and stopping performance.

- If the motor accelerates or decelerates too quickly at the end of a start or stop, increase the gain setting by 5% to 10%.
- If the motor speed fluctuates during starting or stopping, decrease the gain setting slightly.

NOTE
    Changing the gain setting resets the starter's adaptive control learning. The first start after changing the gain will use constant current.

6.2.4   Kickstart

Kickstart provides a short boost of extra torque at the beginning of a start, and can be used in conjunction with current ramp or constant current starting.

Kickstart can be useful to help start loads that require high breakaway torque but then accelerate easily (for example flywheel loads such as presses).

Figure 6-4 Current ramp soft start with kickstart

1: Kickstart level (Pr **2F**)
2: Kickstart time (Pr **2G**)
3: Initial current (Pr **2C**)
4: Start ramp time (Pr **2D**)
5: Current limit (Pr **2B**)
6: Full voltage current

> **CAUTION**
> Kickstart subjects the mechanical equipment to increased torque levels. Ensure the motor, load and couplings can handle the additional torque before using this feature.

6.3   Stop methods

Soft starters offer a variety of methods for the control of motor stopping.

Table 6-3 Soft stop methods

Stop Method	Performance Result
Coast To Stop	Natural load run down
TVR Soft Stop	Extended run down time
Adaptive Deceleration Control	Extended run down time according to selected deceleration profile
STV Stop	Extended run down time
Brake	Reduced run down time

Soft starters are often used in pumping applications to eliminate the damaging effects of fluid hammer. Adaptive Control should be the preferred stop method for these applications.

To stop the motor, press the **STOP** button on the keypad or activate the Stop remote input.   The motor will stop using the stop mode selected in Pr **2H**.

6.3.1   Coast to stop

Coast to stop lets the motor slow at its natural rate, with no control from the soft starter. The time required to stop will depend on the type of load.

6.3.2 TVR soft stop

Timed voltage ramp reduces the voltage to the motor gradually over a defined time. The load may continue to run after the stop ramp is complete.

Timed voltage ramp stopping can be useful for applications where the stop time needs to be extended, or to avoid transients on generator set supplies.

Figure 6-5 TVR soft stop

1: Stop time (Pr **2I**)
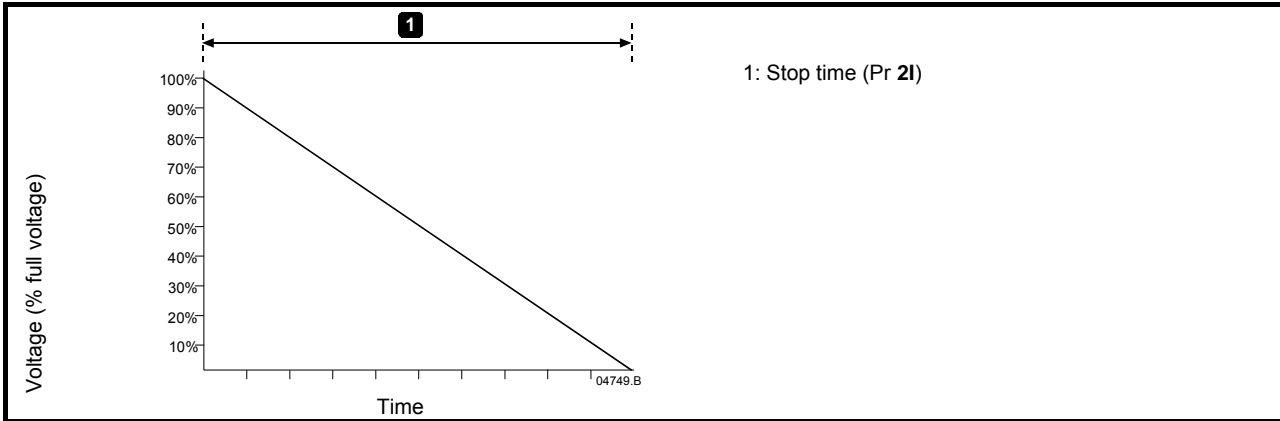
6.3.3 Adaptive control for stopping

In an adaptive control soft stop, the Digistart IS controls the current in order to stop the motor within a specified time and using a selected deceleration profile.   Adaptive Deceleration Control can be useful in extending the stopping time of low inertia loads.

NOTE   Adaptive control does not actively slow the motor down and will not stop the motor faster than a coast to stop. To shorten the stopping time of high inertia loads, use brake.

Every application has a particular stopping profile, based on characteristics of the load and the motor.   Adaptive Deceleration Control offers three different stopping profiles. Choose the adaptive control profile that best matches your application requirements.

Adaptive deceleration control

To use Adaptive Deceleration Control to control stopping performance:

1. Select Adaptive Control from the Stop Mode menu (Pr **2H**)
2. Set the desired Stop Time (Pr **2I**)
3. Select the required Adaptive Stop Profile (Pr **2K**)

Figure 6-6 Adaptive deceleration control soft stop

Adaptive Control stop profile (Pr **2K**):
1. Early deceleration
2. Constant deceleration
3. Late deceleration
4. Stop time (Pr **2I**)
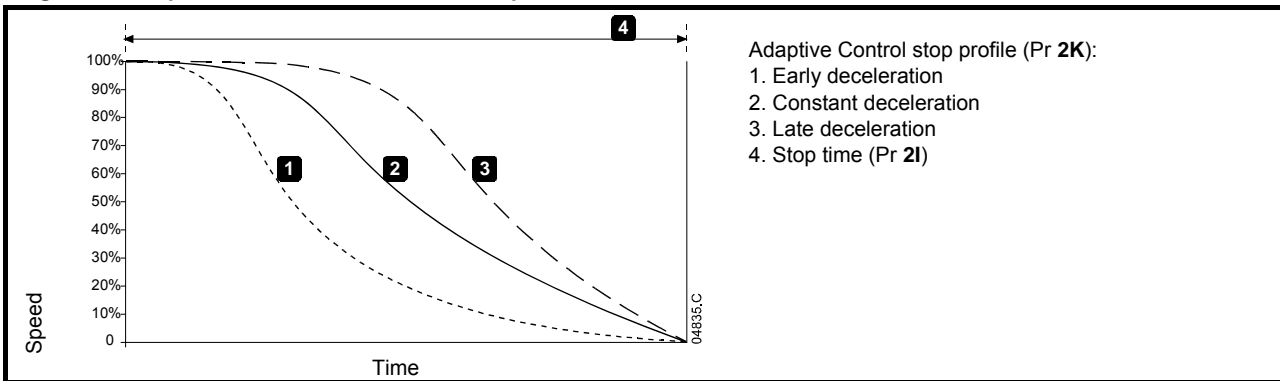
Table 6-4 Adaptive deceleration control soft stop profiles

Adaptive Stop Profile	Application
Late Deceleration	High head systems where even a small decrease in motor/pump speed results in a rapid transition between forward flow and reverse flow.
Constant Deceleration	Low to medium head, high flow applications where the fluid has high momentum.
Early Deceleration	Open pump systems where fluid must drain back through the pump without driving the pump in reverse.

NOTE Pump stopping: The hydraulic characteristics of pump systems vary considerably. This variation means the ideal deceleration profile and stop time will vary from application to application. The table provides guidelines on selecting between Adaptive Control deceleration profiles, but we recommend testing the three profiles to identify the best profile for the application.

The first Adaptive Deceleration Control stop will be a normal soft stop. This allows the Digistart IS to learn the characteristics of the connected motor. This motor data is used by the Digistart IS during subsequent Adaptive Control stops.

NOTE Adaptive Control will control the load according to the programmed profile. Stopping current will vary according to the selected deceleration profile and stop time.

If replacing a motor connected to a Digistart IS programmed for Adaptive Control starting or stopping, or if the starter has been tested on a different motor prior to actual installation, the starter will need to learn the characteristics of the new motor. The Digistart IS will automatically re-learn the motor's characteristics if Pr **1A** *Motor Full Load Current* or Pr **2L** *Adaptive Control Gain* is changed.

How to select the Adaptive deceleration control stop profile

The best profile will depend on the exact details of each application. If you have particular operational requirements, discuss details of your application with your local supplier.

NOTE Adaptive Control controls the motor's speed profile, within the programmed time limit. This may result in a higher level of current than traditional control methods.

Fine-tuning adaptive control

If the motor does not start or stop smoothly, adjust the adaptive control gain (Pr **2L**). The gain setting determines how much the Digistart IS will adjust future adaptive control starts and stops, based on information from the previous start. The gain setting affects both starting and stopping performance.

- If the motor accelerates or decelerates too quickly at the end of a start or stop, increase the gain setting by 5% to 10%.
- If the motor speed fluctuates during starting or stopping, decrease the gain setting slightly.
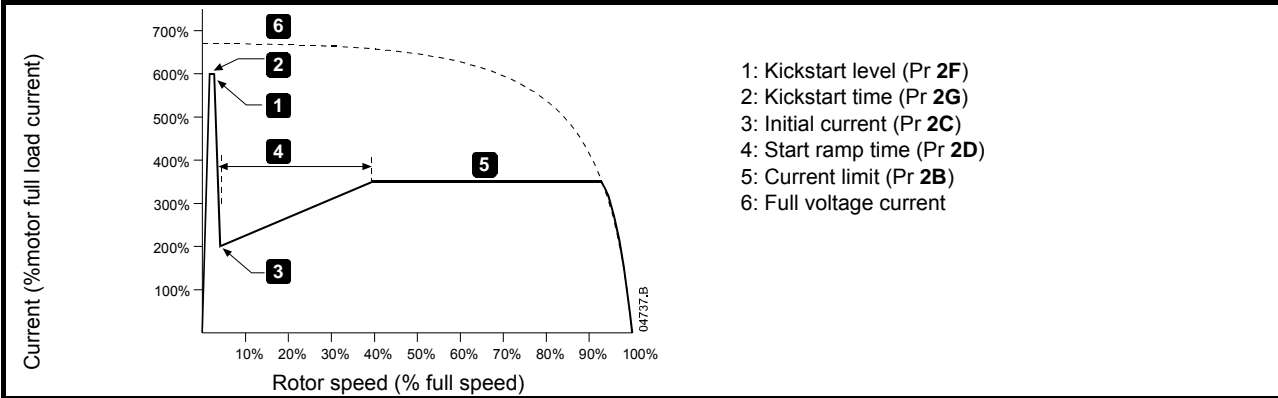
NOTE Changing the gain setting resets the starter's adaptive control learning. The first start after changing the gain will use constant current.

6.3.4 STV stop

STV soft stop is based on simple phase angle control of the SCRs.

NOTE STV soft stop does not actively slow the motor and will not stop the motor faster than a coast to stop.

Figure 6-7 STV stop
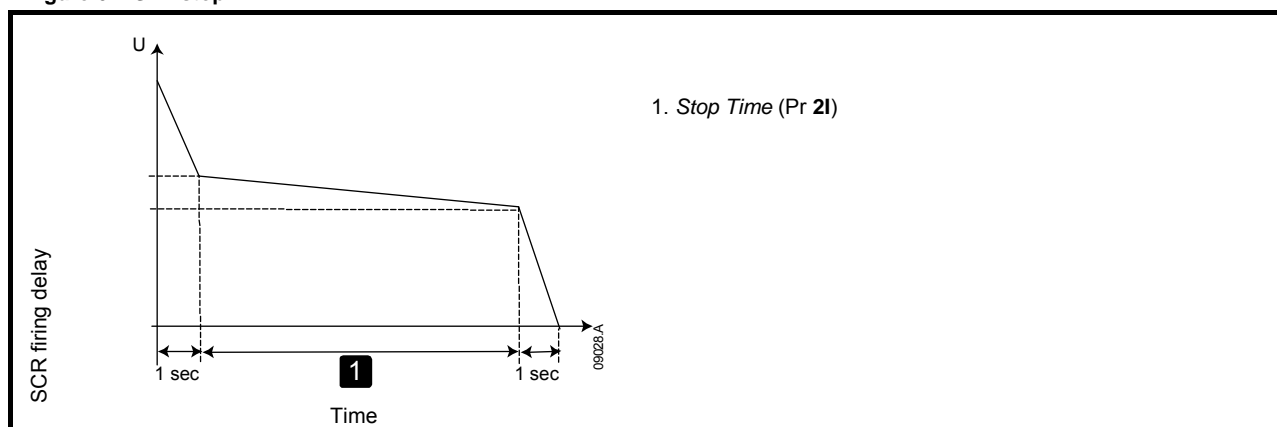
6.3.5 Brake

When brake is selected, the Digistart IS uses DC injection to slow the motor.

Digistart IS braking:

- Does not require the use of a DC brake contactor
- Controls all three phases so that the braking currents and associated heating are evenly distributed through the motor.

Braking has two stages:

1. Pre-brake: provides an intermediate level of braking to slow motor speed to a point where full brake can be operated successfully (approximately 70% speed).
2. Full brake: brake provides maximum braking torque but is ineffective at speeds greater than approximately 70%.

> ⚠️ **CAUTION**
>
> If the brake torque is set too high, the motor will stop before the end of the brake time and the motor will suffer unnecessary heating which could result in damage. Careful configuration is required to ensure safe operation of the starter and motor.

To configure the Digistart IS for brake operation:

1. Set Pr **2I** for the desired stopping time duration (1). This is the total braking time and must be set sufficiently longer than the brake time (Pr **2N**) to allow the pre-braking stage to reduce motor speed to approximately 70%. If the stop time is too short, braking will not be successful and the motor will coast to stop.
2. Set Brake Time (Pr **2N**) to approximately one quarter of the programmed Stop Time. This sets the time for the Full Brake stage (2).
3. Adjust the Brake Torque (Pr **2M**) so that the desired stopping performance is achieved. If set too low, the motor will not stop completely and will coast to stop by the end of the braking period.

For more information on using the Digistart IS with an external speed sensor (e.g. for applications with variable load during the braking cycle), see *Soft braking* on page 71.

Figure 6-8 DC brake stop

1: Stop time (Pr **2I**)
2: Brake time (Pr **2N**)
3: Coast to stop time
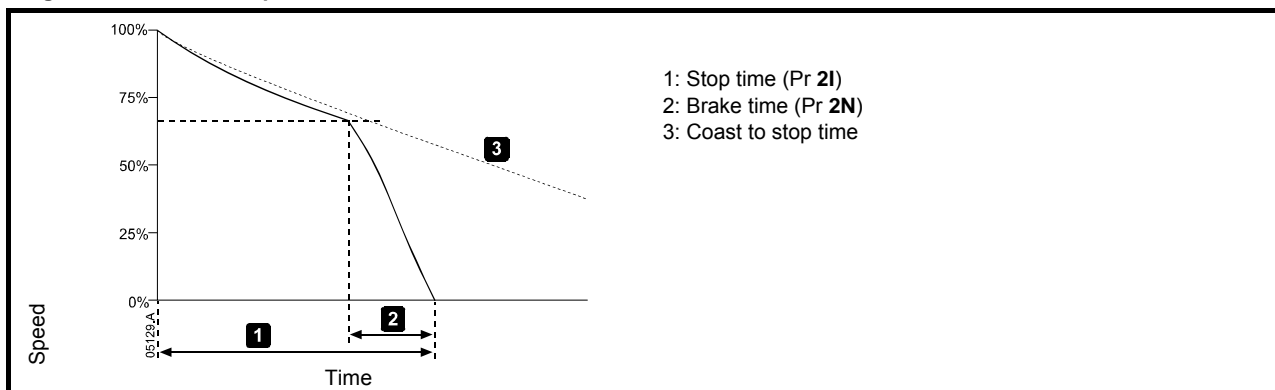
> **NOTE**
>
> Brake operation causes the motor to heat faster than the rate calculated by the motor thermal model. If you are using brake, enable the motor temperature check (Pr **5L**) or allow sufficient restart delay (Pr **6G**).
>
> During braking an increased noise level from the motor may be audible. This is a normal part of motor braking.

6.4 Jog operation

Jog runs the motor at reduced speed, to allow alignment of the load or to assist servicing. The motor can be jogged in either forward or reverse direction.

The maximum available torque for jog is approximately 50% to 75% of motor full load torque (FLT) depending on the motor. Available Jog torque in reverse is approximately 50% to 75% of the jog torque in forward direction. To set the jog torque level, use Pr **15E**.

> **NOTE**
>
> Setting Pr **15E** above 50% may cause increased shaft vibration.

Figure 6-9 Jog operation
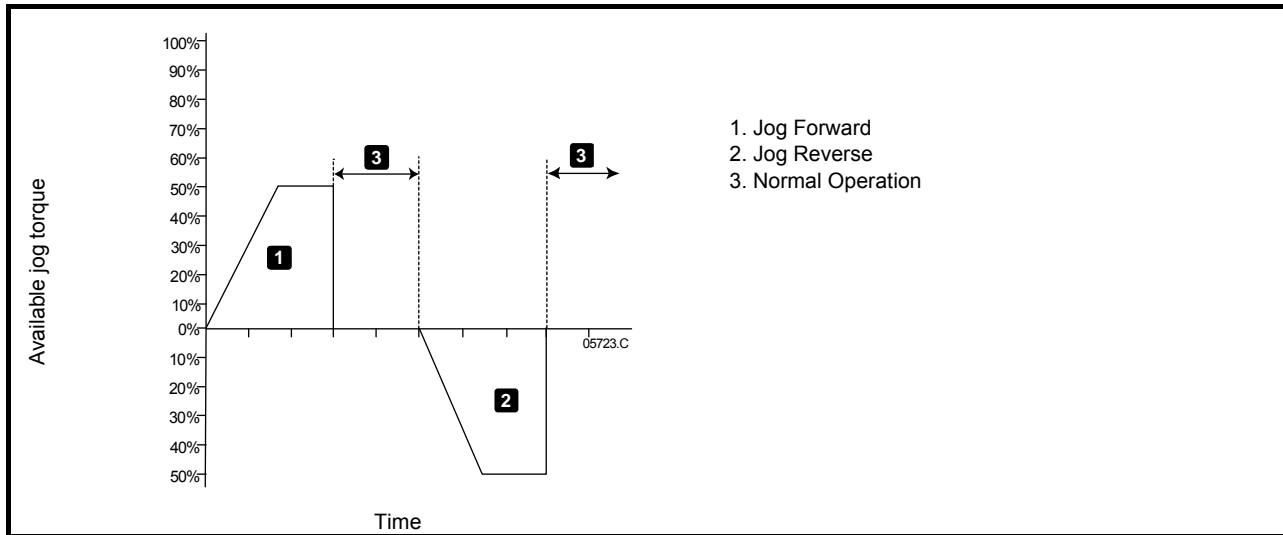
To activate jog operation, use either a programmable input (see Pr **3A** and **3F** (will operate only in Remote Mode)) or a shortcut key (Pr **9J** and **9K**). If any other command is received when jogging the starter will stop and await a new command.

NOTE   Jog is only available for the primary motor. Soft start and soft stop are not available during jog operation.

CAUTION   Slow speed running is not intended for continuous operation due to reduced motor cooling. Jog changes the motor's heating profile and reduces the accuracy of the motor thermal model. Do not rely on motor overload protection to protect the motor during jog operation.

6.5   Inside delta operation

Adaptive Control, Jog, Brake and PowerThrough functions are not supported with inside delta (six-wire) operation.   If these functions are programmed when the starter is connected inside delta the behaviour is as given below:

Table 6-5 Inside delta compatibility

Adaptive Control Start	The starter performs a constant current start.
Adaptive Control Stop	The starter performs a TVR soft stop if Pr **2I** *Stop Time* is >0 secs. If Pr **2I** is set to 0 secs the starter performs a coast to stop.
Jog	The starter issues a warning with the error message Unsupported Option.
Brake	The starter performs a coast to stop.
PowerThrough	The starter trips with the error message Lx-Tx Shorted.

For more information on PowerThrough, see Pr **15D** *Shorted SCR Action* on page 55.

NOTE   When connected in inside delta, current imbalance is the only phase loss protection that is active during run. Do not disable current imbalance protection (Pr **5C**) during inside delta operation.

7.   Programming Menu

⚠️ **WARNING** The motor data parameters are critical to the correct operation of the soft starter's thermal model, and to the motor overload protection. Always set Pr **1A** to suit the motor's characteristics. The default settings of Pr **1B**, **1C** and **1D** are suitable for most applications.   Consult the motor datasheet before changing these settings.

7.1   Programming menu

The Programming Menu lets you view and change programmable parameters that control how the Digistart IS operates.

To open the Programming Menu, press the **M** button while viewing the monitoring screens.

To navigate through the Programming Menu:

- to scroll through parameter groups, press the $\wedge$ or $\vee$ button.
- to open a submenu, press the **M** button.
- to view the parameters in a group, press the **M** button.
- to return to the previous level, press the $\Leftarrow$ button.
- to close the Programming Menu, press $\Leftarrow$ repeatedly.

To change a parameter value:

- scroll to the appropriate parameter in the Programming Menu and press **M** to enter edit mode.
- to alter the parameter setting, use the $\wedge$ and $\vee$ buttons. Pressing $\wedge$ or $\vee$ once will increase or decrease the value by one (1). If the button is held for longer than five seconds, the value will increase or decrease at a faster rate.
- to save changes, press **M**. The setting shown on the display will be saved and the keypad will return to the parameter list.
- to cancel changes, press $\Leftarrow$. The keypad will ask for confirmation, then return to the parameter list without saving changes.

The Programming Menu contains the following sub-menus.

Table 7-1 Programming menu structure

Quick Setup Menu	The Quick Setup Menu allows you to select common applications and guides you through the parameter setup process for these applications.
Standard Menu	The Standard Menu provides access to commonly used parameters, allowing you to configure the Digistart IS to suit your application.
Advanced Menu	The Advanced Menu provides access to all the Digistart IS's programmable parameters, allowing experienced users to take advantage of advanced features.
Setup Tools	Setup Tools provides access to functions to save the current parameter settings to a file, load parameters from a previously saved file, or reset all parameters to default values.
Simulations	Simulations allows you to simulate operation of the soft starter, including input and output functions.
I/O State	I/O State provides access to information on the current state of the analog and digital inputs and outputs.
Logs	The Logs Menu provides access to the Trip Log and Event Log.
Counters	The Counters Menu provides access to information on the starter's operating history.

7.2   Access code

Critical parameters (parameter group 15 and higher) are protected by a four-digit security access code, preventing unauthorised users from viewing or modifying parameter settings.

When a user attempts to enter a restricted parameter group, the keypad prompts for an access code. The access code is requested once for the programming session, and authorisation continues until the user closes the menu.

To enter the access code, use the $\Leftarrow$ and **M** buttons to select a digit, and the $\wedge$ and $\vee$ buttons to change the value. When all four digits match your access code, press **M**. The keypad will display an acknowledgement message before continuing.

```
Enter Access Code
     0###
```
              M
```
Access Allowed
   SUPERVISOR
```

To change the access code, use Pr **15A**.

The simulation tools and counter resets are also protected by the security access code.

The default access code is 0000.

7.3   Adjustment lock

You can lock the Programming Menu to prevent users from altering parameter settings. The adjustment lock can be turned on and off using Pr **15C**.

To lock the programming menu:

1. Open the Programming Menu.
2. Open the Advanced Menu.
3. Select 'Restricted'
4. Enter the Access Code
5. Select Pr **15C** *Adjustment Lock.*
6. Select and store 'Read Only'

If a user attempts to change a parameter value when the adjustment lock is active, an error message is displayed:

```
Access Denied
Adj Lock is On
```

7.4   Quick setup details

To access the Quick Setup Menu, press the **M** button and select Quick Setup Menu.

The Quick Setup Menu makes it easy to configure the Digistart IS for common applications. The Digistart IS selects the parameters relevant to the application and suggests a typical setting, and you can adjust each parameter to suit your exact requirements.

Always set Pr **1A** *Motor Full Load Current* to match the motor's nameplate full load current. The suggested value is the starter's minimum full load current.

Table 7-2 Quick setup menu

Application	Parameter	Pr Number	Suggested value
Pump Centrifugal	*Motor Full Load Current*	**1A**	Model dependent
	Start Mode	**2A**	Adaptive Control
	Adaptive Start Profile	**2E**	Early Acceleration
	Start Ramp Time	**2D**	5 seconds
	Current Limit	**2B**	350%
	Stop Mode	**2H**	Adaptive Control
	Adaptive Stop Profile	**2K**	Late Deceleration
	Stop Time	**2I**	15 seconds
Pump Submersible	*Motor Full Load Current*	**1A**	Model dependent
	Start Mode	**2A**	Adaptive Control
	Adaptive Start Profile	**2E**	Early Acceleration
	Start Ramp Time	**2D**	5 seconds
	Current Limit	**2B**	350%
	Stop Mode	**2H**	Adaptive Control
	Adaptive Stop Profile	**2K**	Late Deceleration
	Stop Time	**2I**	5 seconds
Fan Damped	*Motor Full Load Current*	**1A**	Model dependent
	Start Mode	**2A**	Adaptive Control
	Adaptive Start Profile	**2E**	Constant Acceleration
	Start Ramp Time	**2D**	15 seconds
	Current Limit	**2B**	350%
Fan Undamped	*Motor Full Load Current*	**1A**	Model dependent
	Start Mode	**2A**	Adaptive Control
	Adaptive Start Profile	**2E**	Constant Acceleration
	Start Ramp Time	**2D**	20 seconds
	Current Limit	**2B**	400%
	Excess Start Time	**5A**	30 seconds
	Locked Rotor Time	**1C**	20 Seconds
Compressor Screw	*Motor Full Load Current*	**1A**	Model dependent
	Start Mode	**2A**	Adaptive Control
	Adaptive Start Profile	**2E**	Constant Acceleration
	Start Ramp Time	**2D**	10 seconds
	Current Limit	**2B**	400%
Compressor Recip	*Motor Full Load Current*	**1A**	Model dependent
	Start Mode	**2A**	Adaptive Control
	Adaptive Start Profile	**2E**	Constant Acceleration
	Start Ramp Time	**2D**	10 seconds
	Current Limit	**2B**	450%

Application	Parameter	Pr Number	Suggested value
Conveyor	*Motor Full Load Current*	**1A**	Model dependent
	Start Mode	**2A**	Adaptive Control
	Adaptive Start Profile	**2E**	Late Acceleration
	Start Ramp Time	**2D**	15 seconds
	Current Limit	**2B**	400%
	Stop Mode	**2H**	Adaptive Control
	Adaptive Stop Profile	**2K**	Constant Deceleration
	Stop Time	**2I**	5 seconds
Crusher Rotary	*Motor Full Load Current*	**1A**	Model dependent
	Start Mode	**2A**	Adaptive Control
	Adaptive Start Profile	**2E**	Constant Acceleration
	Start Ramp Time	**2D**	20 seconds
	Current Limit	**2B**	400%
	Excess Start Time	**5A**	30 seconds
	Locked Rotor Time	**1C**	20 seconds
Crusher Jaw	*Motor Full Load Current*	**1A**	Model dependent
	Start Mode	**2A**	Adaptive Control
	Adaptive Start Profile	**2E**	Constant Acceleration
	Start Ramp Time	**2D**	30 seconds
	Current Limit	**2B**	450%
	Excess Start Time	**5A**	40 seconds
	Locked Rotor Time	**1C**	30 seconds

7.5 Standard menu

The standard menu provides access to commonly used parameters. For parameter details, see *Parameter Descriptions* on page 44.

Table 7-3 Standard menu

Parameter Group			Parameters	Default Value
1 - Primary Motor Set	M	**1A**	*Motor Full Load Current*	Model dependent
	⟵			
⋀⋁				
2 - Start/Stop Modes-1	M	**2A**	*Start Mode*	Adaptive Control
	⟵	**2B**	*Current Limit*	350%
⋀⋁		**2C**	*Initial Current*	350%
		2D	*Start Ramp Time*	00:10 (minutes:seconds)
		2H	*Stop Mode*	Coast to Stop
		2I	*Stop Time*	00:03 (minutes:seconds)
		2O	*Auto-Start Type*	Off
		2P	*Auto-Start Time*	00:01 (hours: minutes)
		2Q	*Auto-Stop Type*	Off
		2R	*Auto-Stop Time*	00:01 (hours: minutes)
3 - Digital Inputs	M	**3A**	*Input A Function*	Emergency Stop
	⟵	**3B**	*Input A Name*	Emergency Stop
⋀⋁		**3C**	*Input A Trip*	Always Active
		3D	*Input A Initial Delay*	00:00 (minutes:seconds)
		3E	*Input A Trip Delay*	00:00 (minutes:seconds)
		3F	*Input B Function*	Input Trip (N/O)
		3G	*Input B Name*	Input Trip
		3H	*Input B Trip*	Always Active
		3I	*Input B Initial Delay*	00:00 (minutes:seconds)
		3J	*Input B Trip Delay*	00:00 (minutes:seconds)

Parameter Group		Parameters		Default Value
4 - Digital Outputs	M	4A	*Relay A Action*	Main Contactor
	←	4B	*Relay A On Delay*	00:00 (minutes:seconds)
∧∨		4C	*Relay A Off Delay*	00:00 (minutes:seconds)
		4D	*Relay B Action*	Run
		4E	*Relay B On Delay*	00:00 (minutes:seconds)
		4F	*Relay B Off Delay*	00:00 (minutes:seconds)
		4G	*Relay C Action*	Trip
		4H	*Relay C On Delay*	00:00 (minutes:seconds)
		4I	*Relay C Off Delay*	00:00 (minutes:seconds)
5 - Protection Settings	M	5A	*Excess Start Time*	00:20 (minutes:seconds)
	←	5D	*Phase Sequence*	Any Sequence
∧∨		5E	*Underpower*	20%
		5F	*Overpower*	400%
6 - Protection Delays	M	6B	*Underpower Delay*	00:05 (minutes:seconds)
	←	6C	*Overpower Delay*	00:00 (minutes:seconds)
∧∨				
7 - Set Points	M	7A	*Low Current Flag*	50%
	←	7B	*High Current Flag*	100%
∧∨		7C	*Motor Temperature Flag*	80%
9 - Display	M	9A	*Languages*	
	←	9B	*User Screen - Top Left*	Motor Current
∧∨		9C	*User Screen - Top Right*	Motor pf
		9D	*User Screen - Bottom Left*	Hours Run
		9E	*User Screen - Bottom Right*	kWh
		9J	*F1 Button Action*	Auto-Start/Stop Menu
		9K	*F2 Button Action*	None
		9M	*Display A or kW*	Current

7.6 Advanced menu

The Advanced Menu gives access to all the programmable parameters in the Digistart IS. See *Parameter Descriptions* on page 44.

Table 7-4 Advanced menu

Parameter Group		Parameters		Default Value
1 - Primary Motor Set	M	1A	*Motor Full Load Current*	Model dependent
	←	1B	*Locked Rotor Current*	600%
∧∨		1C	*Locked Rotor Time*	00:10 (minutes:seconds)
		1D	*Motor Service Factor*	105%

Parameter Group		Parameters		Default Value
2 - Start/Stop Modes-1	M	**2A**	*Start Mode*	Adaptive Control
	←	**2B**	*Current Limit*	350%
∧∨		**2C**	*Initial Current*	350%
		2D	*Start Ramp Time*	00:10 (minutes:seconds)
		2E	*Adaptive Start Profile*	Constant Acceleration
		2F	*Kickstart Level*	500%
		2G	*Kickstart Time*	0 ms
		2H	*Stop Mode*	Coast to Stop
		2I	*Stop Time*	00:03 (minutes:seconds)
		2J	*Stop Delay*	00:00 (minutes:seconds)
		2K	*Adaptive Stop Profile*	Constant Deceleration
		2L	*Adaptive Control Gain*	75%
		2M	*Brake Torque*	20%
		2N	*Brake Time*	00:01 (minutes:seconds)
		2O	*Auto-Start Type*	Off
		2P	*Auto-Start Time*	00:01 (hours: minutes)
		2Q	*Auto-Stop Type*	Off
		2R	*Auto-Stop Time*	00:01 (hours: minutes)
3 - Digital Inputs	M	**3A**	*Input A Function*	Emergency Stop
	←	**3B**	*Input A Name*	Emergency Stop
∧∨		**3C**	*Input A Trip*	Always Active
		3D	*Input A Initial Delay*	00:00 (minutes:seconds)
		3E	*Input A Trip Delay*	00:00 (minutes:seconds)
		3F	*Input B Function*	Input Trip (N/O)
		3G	*Input B Name*	Input Trip
		3H	*Input B Trip*	Always Active
		3I	*Input B Initial Delay*	00:00 (minutes:seconds)
		3J	*Input B Trip Delay*	00:00 (minutes:seconds)
		3K	*Input C Function*	Off
		3L	*Input D Function*	Off
		3M	*Local/Remote*	LCL/RMT Anytime
		3N	*Remote Reset Logic*	Normally Closed (N/C)
		3O	*Comms in Remote*	Enable Ctrl in RMT
4 - Digital Outputs	M	**4A**	*Relay A Action*	Main Contactor
	←	**4B**	*Relay A On Delay*	00:00 (minutes:seconds)
∧∨		**4C**	*Relay A Off Delay*	00:00 (minutes:seconds)
		4D	*Relay B Action*	Run
		4E	*Relay B On Delay*	00:00 (minutes:seconds)
		4F	*Relay B Off Delay*	00:00 (minutes:seconds)
		4G	*Relay C Action*	Trip
		4H	*Relay C On Delay*	00:00 (minutes:seconds)
		4I	*Relay C Off Delay*	00:00 (minutes:seconds)
		4J	*Relay D Action*	Off
		4K	*Relay E Action*	Off
		4L	*Relay F Action*	Off

Parameter Group		Parameters		Default Value
5 - Protection Settings	M	**5A**	*Excess Start Time*	00:20 (minutes:seconds)
	←	**5B**	*Excess Start Time-2*	00:20 (minutes:seconds)
∧∨		**5C**	*Current Imbalance*	30%
		5D	*Phase Sequence*	Any Sequence
		5E	*Underpower*	20%
		5F	*Overpower*	400%
		5G	*Undervoltage*	100 V
		5H	*Overvoltage*	800 V
		5I	*Frequency Check*	Start/Run
		5J	*Frequency Variation*	±5 Hz
		5K	*Ground Fault Level*	100 mA
		5L	*Motor Temperature Check*	Do Not Check
6 - Protection Delays	M	**6A**	*Current Imbalance Delay*	00:03 (minutes:seconds)
	←	**6B**	*Underpower Delay*	00:05 (minutes:seconds)
∧∨		**6C**	*Overpower Delay*	00:00 (minutes:seconds)
		6D	*Undervoltage Delay*	00:05 (minutes:seconds)
		6E	*Overvoltage Delay*	00:05 (minutes:seconds)
		6F	*Frequency Delay*	00:01 (minutes:seconds)
		6G	*Restart Delay*	00:10 (minutes:seconds)
		6H	*Ground Fault Delay*	00:03 (minutes:seconds)
7 - Set Points	M	**7A**	*Low Current Flag*	50%
	←	**7B**	*High Current Flag*	100%
∧∨		**7C**	*Motor Temperature Flag*	80%
		7D	*Mains Reference Voltage*	400 V
8 - Analog I/O	M	**8A**	*Analog Input Trip*	Do Not Trip
	←	**8B**	*Analog Input Scale*	2-10 V
∧∨		**8C**	*Analog Trip Point*	50%
		8D	*Analog Output A*	Current (%FLC)
		8E	*Analog A Scale*	4-20 mA
		8F	*Analog A Maximum Adjustment*	100%
		8G	*Analog A Minimum Adjustment*	0%
		8H	*Analog Output B*	Current (%FLC)
		8I	*Analog B Scale*	4-20 mA
		8J	*Analog B Maximum Adjustment*	100%
		8K	*Analog B Minimum Adjustment*	0%
9 - Display	M	**9A**	*Languages*	
	←	**9B**	*User Screen - Top Left*	Motor Current
∧∨		**9C**	*User Screen - Top Right*	Motor pf
		9D	*User Screen - Bottom Left*	Hours Run
		9E	*User Screen - Bottom Right*	kWh
		9F	*Graph Data*	Current (%FLC)
		9G	*Graph Timebase*	10 seconds
		9H	*Graph Maximum Adjustment*	400%
		9I	*Graph Minimum Adjustment*	0%
		9J	*F1 Button Action*	Auto-Start/Stop Menu
		9K	*F2 Button Action*	None
		9L	*Current Calibration*	100%
		9M	*Display A or kW*	Current
10 - Auto-Reset	M	**10A**	*Auto-Reset Action*	Do Not Auto-Reset
	←	**10B**	*Maximum Resets*	1
∧∨		**10C**	*Reset Delay Groups A&B*	00:05 (minutes:seconds)
		10D	*Reset Delay Group C*	5 minutes

Parameter Group		Parameters		Default Value
11 - Secondary Motor Set	M	**11A**	*Motor FLC-2*	Model dependent
	←	**11B**	*Dual Thermal Model*	Single
∧∨		**11C**	*Locked Rotor Current-2*	600%
		11D	*Locked Rotor Time-2*	00:10 (minutes:seconds)
		11E	*Motor Service Factor-2*	105%
12 - Start/Stop Modes-2	M	**12A**	*Start Mode-2*	Adaptive Control
	←	**12B**	*Current Limit-2*	350%
∧∨		**12C**	*Initial Current-2*	350%
		12D	*Start Ramp-2*	00:10 (minutes:seconds)
		12E	*Adaptive Start Profile-2*	Constant Acceleration
		12F	*Kickstart Level-2*	500%
		12G	*Kickstart Time-2*	0 ms
		12H	*Stop Mode-2*	Coast to Stop
		12I	*Stop Time-2*	00:03 (minutes:seconds)
		12J	*Stop Delay-2*	00:00 (minutes:seconds)
		12K	*Adaptive Stop Profile-2*	Constant Deceleration
		12L	*Adaptive Control Gain-2*	75%
		12M	*Brake Torque-2*	20%
		12N	*Brake Time-2*	00:01 (minutes:seconds)
13 - Slip-Ring Motors	M	**13A**	*Motor Data-1 Ramp*	Single Ramp
	←	**13B**	*Motor Data-2 Ramp*	Single Ramp
∧∨		**13C**	*Slip Ring Retard*	50%
		13D	*Changeover Time*	150 ms
14 - RTD/PT100	M	**14A**	*RTD/PT100 A °C*	50 °C
	←	**14B**	*RTD/PT100 B °C*	50 °C
∧∨		**14C**	*RTD/PT100 C °C*	50 °C
		14D	*RTD/PT100 D °C*	50 °C
		14E	*RTD/PT100 E °C*	50 °C
		14F	*RTD/PT100 F °C*	50 °C
		14G	*RTD/PT100 G °C*	50 °C
15 - Restricted	M	**15A**	*Access Code*	0000
	←	**15B**	*Emergency Run*	Disable
∧∨		**15C**	*Adjustment Lock*	Read & Write
		15D	*Shorted SCR Action*	3-Phase Control Only
		15E	*Jog Torque*	50%

Parameter Group		Parameters		Default Value
16 - Protection Action	M	**16A**	*Motor Overload*	Trip Starter
∧∨	←	**16B**	*Excess Start Time*	Trip Starter
		16C	*Current Imbalance*	Trip Starter
		16D	*Underpower*	Trip Starter
		16E	*Overpower*	Trip Starter
		16F	*Undervoltage*	Trip Starter
		16G	*Overvoltage*	Trip Starter
		16H	*Frequency*	Trip Starter
		16I	*Input A Trip*	Trip Starter
		16J	*Input B Trip*	Trip Starter
		16K	*Motor Thermistor*	Trip Starter
		16L	*Starter Communication*	Trip Starter
		16M	*Network Communication*	Trip Starter
		16N	*Heatsink Overtemperature*	Trip Starter
		16O	*Battery/Clock*	Trip Starter
		16P	*Ground Fault*	Trip Starter
		16Q	*RTD/PT100 A*	Trip Starter
		16R	*RTD/PT100 B*	Trip Starter
		16S	*RTD/PT100 C*	Trip Starter
		16T	*RTD/PT100 D*	Trip Starter
		16U	*RTD/PT100 E*	Trip Starter
		16V	*RTD/PT100 F*	Trip Starter
		16W	*RTD/PT100 G*	Trip Starter

7.7 Parameter descriptions

7.7.1 Group 1 - Primary Motor Set

⚠ **WARNING**
The motor data parameters are critical to the correct operation of the soft starter's thermal model, and to the motor overload protection. Always set Pr **1A** to suit the motor's characteristics. The default settings of Pr **1B**, **1C** and **1D** are suitable for most applications. Consult the motor datasheet before changing these settings.

No	Function	Range	Default
1A	*Motor Full Load Current*	Model dependent	Model dependent

Matches the starter to the connected motor's full load current. Set to the full load current (FLC) rating shown on the motor nameplate.

No	Function	Range	Default
1B	*Locked Rotor Current*	400 to 1200% FLC	600%

Sets the locked rotor current of the connected motor, as a percentage of full load current. Set according to the motor datasheet.

No	Function	Range	Default
1C	*Locked Rotor Time*	00:01 to 02:00 (minutes:seconds)	00:10

Sets the maximum length of time the motor can run at locked rotor current from cold before reaching its maximum temperature. Set according to the motor datasheet.

No	Function	Range	Default
1D	*Motor Service Factor*	100 to 130% FLC	105%

Sets the motor service factor used by the thermal model. If the motor runs at full load current, it will reach 100%. Set according to the motor datasheet.

7.7.2 Group 2 - Start/Stop Modes-1

For details of soft start and stop control methods, see *Soft start methods* on page 29 and *Stop methods* on page 32.

No	Function	Range	Default
2A	*Start Mode*	Constant Current, Adaptive Control	Adaptive Control

Selects the soft start mode.

No	Function	Range	Default
2B	*Current Limit*	100 to 600% FLC	350%

Sets the current limit for constant current and current ramp soft starting, as a percentage of motor full load current.

No	Function	Range	Default
2C	*Initial Current*	100 to 600% FLC	350%

Sets the initial start current level for current ramp starting, as a percentage of motor full load current. Set so that the motor begins to accelerate immediately after a start is initiated.
If current ramp starting is not required, set the initial current equal to the current limit.

No	Function	Range	Default
2D	*Start Ramp Time*	00:01 to 03:00 (minutes:seconds)	00:10

Sets the total start time for an Adaptive Acceleration Control start or the ramp time for current ramp starting (from the initial current to the current limit).

No	Function	Range	Default
2E	*Adaptive Start Profile*	Early Acceleration, Constant Acceleration, Late Acceleration	Constant Acceleration

Selects which profile the Digistart IS will use for an Adaptive Acceleration Control soft start.

No	Function	Range	Default
2F	*Kickstart Level*	100 to 700% FLC	500%

Sets the level of the kickstart current.

No	Function	Range	Default
2G	*Kickstart Time*	0 to 2000 ms	0

Sets the kickstart duration. A setting of 0 disables kickstart.

⚠ **CAUTION** Kickstart subjects the mechanical equipment to increased torque levels. Ensure the motor, load and couplings can handle the additional torque before using this feature.

No	Function	Range	Default
2H	*Stop Mode*	Coast To Stop, TVR Soft Stop, Adaptive Control, Brake, STV Soft Stop	Coast To Stop

Selects the stop mode.

No	Function	Range	Default
2I	*Stop Time*	00:00 to 04:00 (minutes:seconds)	00:03

Sets the time for soft stopping the motor using timed voltage ramp or Adaptive Deceleration Control.
If a main contactor is installed, the contactor must remain closed until the end of the stop time. Use the run output (terminals COM2, RLO2) to control the main contactor. Sets the total stopping time when using brake.

No	Function	Range	Default
2J	*Stop Delay*	00:00 to 01:00 (minutes:seconds)	00:00

Sets a delay after the starter receives a stop command, before it stops the motor.

No	Function	Range	Default
2K	*Adaptive Stop Profile*	Early Deceleration, Constant Deceleration, Late Deceleration	Constant Deceleration

Selects which profile the Digistart IS will use for an Adaptive Deceleration Control soft stop.

No	Function	Range	Default
2L	*Adaptive Control Gain*	1 to 200%	75%

Adjusts the performance of Adaptive Control. This setting affects both starting and stopping control.

NOTE We recommend leaving the gain setting at the default level unless performance is not satisfactory.
If the motor accelerates or decelerates too quickly at the end of a start or stop, increase the gain setting by 5% to 10%.
If the motor speed fluctuates during starting or stopping, decrease the gain setting slightly.

No	Function	Range	Default
2M	*Brake Torque*	20 to 100%	20%

Sets the amount of brake torque the Digistart IS will use to slow the motor.

No	Function	Range	Default
2N	*Brake Time*	00:01 to 00:30 (minutes:seconds)	00:01

Sets the duration for DC injection during a braking stop.

NOTE Pr **2N** is used in conjunction with Pr **2I**. See *Brake* on page 35 for details.

Auto-start and auto-stop

The Digistart IS can be programmed to start and stop automatically, after a specified delay or at a specified time of day. Auto-start and auto-stop can be set separately. Auto-start/stop is only available in Remote mode.

> ⚠ **WARNING**
>
> This function should not be used in conjunction with remote two-wire control.
> The soft starter will still accept start and stop commands from the keypad, remote inputs or serial communication network. To disable local or remote control, use Pr **3M**.
> If auto-start is enabled and the user is in the menu system, auto-start will become active if the menu times out (if no keypad activity is detected for five minutes).

No	Function	Range	Default
2O	*Auto-Start Type*	Off, Timer, Clock	Off

Selects whether the soft starter will auto-start after a specified delay, or at a time of day.

No	Function	Range	Default
2P	*Auto-Start Time*	00:01 to 24:00 (hours:minutes)	00:01

Sets the time for the soft starter to auto-start, in 24 hour clock format.

No	Function	Range	Default
2Q	*Auto-Stop Type*	Off, Timer, Clock	Off

Selects whether the soft starter will auto-stop after a specified delay, or at a time of day.

No	Function	Range	Default
2R	*Auto-Stop Time*	00:01 to 24:00 (hours:minutes)	00:01

Sets the time for the soft starter to auto-stop, in 24 hour clock format.

7.7.3   Group 3 - Digital Inputs

The Digistart IS has two programmable inputs, which allow remote control of the soft starter. If required, two extra inputs are available on the input/output expansion card.

No	Function	Range	Default
3A	*Input A Function*	Motor Set Select, Input Trip (N/O), Input Trip (N/C), Local/Remote Select, Emergency Run, Emergency Stop, Jog Forward, Jog Reverse	Emergency Stop

Selects the function of Input A.

Motor Set Select	The Digistart IS can be configured with two separate sets of motor data. To use the secondary motor data, Pr **3A** must be set to Motor Set Select and DI4, +24V must be closed when a start command is given. The Digistart IS checks which motor data to use at a start, and will use that motor data for the entire start/stop cycle.
Input Trip (N/O)	Input A can be used to trip the soft starter. When Pr **3A** is set to Input Trip (N/O), a closed circuit across DI4, +24V trips the soft starter.
Input Trip (N/C)	When Pr **3A** is set to Input Trip (N/C), an open circuit across DI4, +24V trips the soft starter.
Local/Remote Select	Input A can be used to select between local and remote control, instead of using the **LCL/RMT** button on the keypad. When the input is open, the starter is in local mode and can be controlled via the keypad. When the input is closed, the starter is in remote mode. The **Start** and **LCL/RMT** buttons are disabled, and the soft starter will ignore any Local/Remote select command from the serial communications network. To use Input A to select between local and remote control, Pr **3M** must be set to LCL/RMT Anytime or LCL/RMT when Off.
Emergency Run	In emergency run the soft starter continues to run until stopped, ignoring all trips and warnings (see Pr **15B** for details). Closing the circuit across DI4, +24V activates emergency run. Opening the circuit ends emergency run and the Digistart IS stops the motor.
Emergency Stop	The Digistart IS can be commanded to emergency stop the motor, ignoring the soft stop mode set in Pr **2H**. When the circuit across DI4, +24V is opened, the soft starter allows the motor to coast to stop.
Jog Forward	Activates jog operation in a forward direction (will operate only in Remote mode).
Jog Reverse	Activates jog operation in reverse direction (will operate only in Remote mode).

No	Function	Range	Default
3B	*Input A Name*	Input Trip, Low Pressure, High Pressure, Pump Fault, Low Level, High Level, No Flow, Emergency Stop, Controller, PLC, Vibration Alarm	Emergency Stop

Selects a message for the keypad to display when Input A is active.   This setting is only relevant if Pr **3A** is set to input trip (N/O or N/C).

No	Function	Range	Default
3C	*Input A Trip*	Always Active, Operating Only, Run Only	Always Active

Selects when an input trip can occur.

Always Active	A trip can occur at any time when the soft starter is receiving power.
Operating Only	A trip can occur while the soft starter is running, stopping or starting.
Run Only	A trip can only occur while the soft starter is running.

No	Function	Range	Default
3D	*Input A Initial Delay*	00:00 to 30:00 (minutes:seconds)	00:00

Sets a delay before an input trip can occur. The initial delay is counted from the time a start signal is received. The state of the input is ignored until the initial delay has elapsed.

No	Function	Range	Default
3E	*Input A Trip Delay*	00:00 to 04:00 (minutes:seconds)	00:00

Sets a delay between the input activating and the soft starter tripping.

No	Function	Range	Default
3F	*Input B Function*	Motor Set Select, Input Trip (N/O), Input Trip (N/C), Local/Remote Select, Emergency Run, Emergency Stop, Jog Forward, Jog Reverse	Input Trip (N/O)
3G	*Input B Name*	Input Trip, Low Pressure, High Pressure, Pump Fault, Low Level, High Level, No Flow, Emergency Stop, Controller, PLC, Vibration Alarm	Input Trip
3H	*Input B Trip*	Always Active, Operating Only, Run Only	Always Active
3I	*Input B Initial Delay*	00:00 to 30:00 (minutes:seconds)	00:00
3J	*Input B Trip Delay*	00:00 to 04:00 (minutes:seconds)	

See Pr **3A** to **3E** for details of parameter options.

No	Function	Range	Default
3K	*Input C Function*	Motor Set Select, Local/Remote Select, Emergency Run, Emergency Stop, Off	Off
3L	*Input D Function*		

See Pr **3A** for details of parameter options.

NOTE	Inputs C and D are only available if the input/output expansion card is installed.

No	Function	Range	Default
3M	*Local/Remote*	LCL/RMT Anytime, LCL/RMT When Off, Local Control Only, Remote Control Only	LCL/RMT Anytime

Selects when the **LCL/RMT** button can be used to switch between local and remote control, and enables or disables the local control buttons and remote control inputs.

The **STOP** button on the keypad is always enabled.

LCL/RMT Anytime	**LCL/RMT** button is always enabled.
LCL/RMT When Off	**LCL/RMT** button is enabled when the starter is off.
Local Control Only	All remote inputs are disabled.
Remote Control Only	Local control buttons (**START**, **RESET**, **LCL/RMT**) are disabled.

⚠️ **CAUTION** The **STOP** button on the keypad is always enabled. When using two-wire remote control, the soft starter will restart if the remote start/stop and reset inputs are still active.

No	Function	Range	Default
3N	*Remote Reset Logic*	Normally Closed (N/C), Normally Open (N/O)	Normally Closed

Selects whether the Digistart IS's remote reset input (terminals DI3, +24V) is normally open or normally closed.

No	Function	Range	Default
3O	*Comms in Remote*	Disable Ctrl in RMT, Enable Ctrl in RMT	Enable Ctrl in RMT

Selects whether the starter will accept Start and Stop commands from the serial communication network when in Remote mode.
The Reset, Force Comms Trip and Local/Remote Control commands are always enabled.

7.7.4 Group 4 - Digital Outputs

The Digistart IS has three programmable outputs, which can be used to signal different operating conditions to associated equipment. Three additional outputs are available on the input/output expansion card.

No	Function	Range	Default
4A	*Relay A Action*	Off, Main Contactor, Run, Trip, Warning, Low Current Flag, High Current Flag, Motor Temp Flag, Input A Trip, Input B Trip, Motor Overload, Current Imbalance, Underpower, Overpower, Frequency, Ground Fault, Heatsink Overtemp, Phase Loss, Motor Thermistor, Changeover Contactor	Main Contactor

Selects the function of Relay A (normally open). Relay A is terminals COM1, RLO1.

Off	Relay A is not used.
Main Contactor	The relay closes when the Digistart IS receives a start command, and remains closed as long as the motor is receiving voltage.
Run	The relay closes when the starter changes to run state.
Trip	The relay closes when the starter trips.
Warning	The relay closes when the starter issues a warning.
Low Current Flag	The relay closes when the low current flag activates (see Pr **7A** *Low Current Flag*).
High Current Flag	The relay closes when the high current flag activates (see Pr **7B** *High Current Flag*).
Motor Temp Flag	The relay closes when the motor temperature flag activates (see Pr **7C** *Motor Temperature Flag*).
Input A Trip	The relay closes when Input A activates to trip the soft starter.
Input B Trip	The relay closes when Input B activates to trip the soft starter.
Motor Overload	The relay closes when the starter trips on Motor Overload.
Current Imbalance	The relay closes when the starter trips on Current Imbalance.
Underpower	The relay closes when the starter trips on Underpower.
Overpower	The relay closes when the starter trips on Overpower.
Frequency	The relay closes when the starter trips on Frequency.
Ground Fault	The relay closes when the starter trips on Ground Fault.
Heatsink Overtemp	The relay closes when the starter trips on Heatsink Overtemperature.
Phase Loss	The relay closes when the starter trips on Phase Loss.
Motor Thermistor	The relay closes when the starter trips on Motor Thermistor.
Changeover Contactor	The relay closes when the high rotor resistance current ramp has reached full voltage, allowing use with a slip-ring motor.

No	Function	Range	Default
4B	*Relay A On Delay*	00:00 to 05:00 (minutes:seconds)	00:00
4C	*Relay A Off Delay*		

Sets the delay for closing or re-opening Relay A.

No	Function	Range	Default
4D	*Relay B Action*	Off, Main Contactor, Run, Trip, Warning, Low Current Flag, High Current Flag, Motor Temp Flag, Input A Trip, Input B Trip, Motor Overload, Current Imbalance, Underpower, Overpower, Frequency, Ground Fault, Heatsink Overtemp, Phase Loss, Motor Thermistor, Changeover Contactor	Run
4E	*Relay B On Delay*	00:00 to 05:00 (minutes:seconds)	00:00
4F	*Relay B Off Delay*		

See Pr **4A** to **4C** for details of parameter options.

No	Function	Range	Default
4G	*Relay C Action*	Off, Main Contactor, Run, Trip, Warning, Low Current Flag, High Current Flag, Motor Temp Flag, Input A Trip, Input B Trip, Motor Overload, Current Imbalance, Underpower, Overpower, Frequency, Ground Fault, Heatsink Overtemp, Phase Loss, Motor Thermistor, Changeover Contactor	Trip
4H	*Relay C On Delay*	00:00 to 05:00 (minutes:seconds)	00:00
4I	*Relay C Off Delay*		

See Pr **4A** to **4C** for details of parameter options.

No	Function	Range	Default
4J	*Relay D Action*	Off, Main Contactor, Run, Trip, Warning, Low Current Flag, High Current Flag, Motor Temp Flag, Input A Trip, Input B Trip, Motor Overload, Current Imbalance, Underpower, Overpower, Frequency, Ground Fault, Heatsink Overtemp, Phase Loss, Motor Thermistor, Changeover Contactor	Off
4K	*Relay E Action*		
4L	*Relay F Action*		

See Pr **4A** for details of parameter options.

NOTE   Outputs D, E and F are only available if the input/output expansion card is installed.

7.7.5   Group 5 - Protection Settings

These parameters determine when the soft starter's protection mechanisms will activate. The activation point for each protection mechanism can be set to suit the installation.

The soft starter responds to protection events by tripping, warning, or writing the event to the event log. The response is determined by the Protection Action settings (parameter group 16). The default response is a trip.

> **CAUTION**
> The protection settings are vital for safe operation of the soft starter and motor. Defeating the protection may compromise the installation and should only be done in the case of emergency.

No	Function	Range	Default
5A	*Excess Start Time*	00:00 to 04:00 (minutes:seconds)	00:20
5B	*Excess Start Time-2*		

Excess start time is the maximum time the Digistart IS will attempt to start the motor. If the motor does not transition to Run mode within the programmed limit, the starter will trip. Set for a period slightly longer than required for a normal healthy start. A setting of 0 disables excess start time protection.

Pr **5A** sets the time for the primary motor and Pr **5B** sets the time for the secondary motor.

No	Function	Range	Default
5C	*Current Imbalance*	10 to 50%	30%

Sets the trip point for current imbalance protection.

The Digistart IS can be configured to trip if the currents on the three phases vary from each other by more than a specified amount. The imbalance is calculated as the difference between the highest and lowest currents on all three phases, as a percentage of the highest current.

Current imbalance detection is desensitised by 50% during starting and soft stopping.

No	Function	Range	Default
5D	*Phase Sequence*	Any Sequence, Positive Only, Negative Only	Any Sequence

Selects which phase sequences the soft starter will allow at a start. During its pre-start checks, the starter examines the sequence of the phases at its input terminals and trips if the actual sequence does not match the selected option.

No	Function	Range	Default
5E	*Underpower*	0 to 100%	20%

Sets the trip point for underpower protection. Set as required.

No	Function	Range	Default
5F	*Overpower*	80 to 600%	400%

Sets the trip point for overpower protection. Set as required.

No	Function	Range	Default
5G	*Undervoltage*	100 to 690 V	100 V

Sets the trip point for undervoltage protection. Set as required.

NOTE	Voltage protection and calibration only operate if the voltage measurement card is fitted.

No	Function	Range	Default
5H	*Overvoltage*	100 to 800 V	800 V

Sets the trip point for overvoltage protection. Set as required.

NOTE	Voltage protection and calibration only operate if the voltage measurement card is fitted.

No	Function	Range	Default
5I	*Frequency Check*	Do Not Check, Start Only, Start/Run, Run Only	Start/Run

Determines when and if the starter will monitor for a frequency trip.

No	Function	Range	Default
5J	*Frequency Variation*	±2, ±5, ±10, ±15 Hz	±5 Hz

Selects the soft starter's tolerance for frequency variation.

> ⚠ **CAUTION** Running a motor outside its specified frequency for long periods can cause damage and premature failure.

No	Function	Range	Default
5K	*Ground Fault Level*	20mA, 30mA, 50mA, 75mA, 100mA, 150mA, 200mA, 300mA, 500mA, 750mA, 1A, 1.5A, 2A, 3A, 5A, 7.5A, 10A, 15A, 20A, 30A, 50A	100mA

Sets the trip point for ground fault protection.

The Digistart IS can be configured to trip if ground fault exceeds a specified level while the motor is running. Ground fault is a dynamic trip based on phase current measurements every half-cycle.

NOTE	Ground fault protection is only available if the RTD/PT100 and ground fault protection card is fitted.

No	Function	Range	Default
5L	*Motor Temperature Check*	Do Not Check, Check	Do Not Check

Selects whether the Digistart IS will verify the motor has sufficient thermal capacity for a successful start. The soft starter compares the motor's calculated temperature with the temperature rise from the last motor start and only operates if the motor is cool enough to start successfully.

7.7.6 Group 6 - Protection Delays

Protection delays slows the Digistart IS's response to the trip condition, avoiding trips due to momentary fluctuations.

No	Function	Range	Default
6A	*Current Imbalance Delay*	00:00 to 04:00 (minutes:seconds)	00:03
6B	*Underpower Delay*	00:00 to 04:00 (minutes:seconds)	00:05
6C	*Overpower Delay*	00:00 to 01:00 (minutes:seconds)	00:00
6D	*Undervoltage Delay*	00:00 to 04:00 (minutes:seconds)	00:05
6E	*Overvoltage Delay*	00:00 to 04:00 (minutes:seconds)	00:05
6F	*Frequency Delay*	00:00 to 04:00 (minutes:seconds)	00:01

No	Function	Range	Default
6G	*Restart Delay*	00:01 to 60:00 (minutes:seconds)	00:10

The Digistart IS can be configured to force a delay between the end of a stop and the beginning of the next start. During the restart delay period, the display shows the time remaining before another start can be attempted.

No	Function	Range	Default
6H	*Ground Fault Delay*	00:01 to 04:00 (minutes:seconds)	00:03

NOTE	Ground fault protection is only available if the RTD/PT100 and ground fault protection card is fitted.

7.7.7 Group 7 - Set Points

The Digistart IS has low and high current flags to give early warning of abnormal operation. The current flags can be configured to indicate an abnormal current level during operation, outside the normal operating level. The flags can signal the situation to external equipment via one of the programmable outputs. The flags clear when the current returns within the normal operating range by 10% of the programmed motor full load current.

No	Function	Range	Default
7A	*Low Current Flag*	1% to 100% FLC	50%
7B	*High Current Flag*	50% to 600% FLC	100%
7C	*Motor Temperature Flag*	0% to 160%	80%

Sets the level at which the motor temperature flag operates, as a percentage of the motor's thermal capacity.

No	Function	Range	Default
7D	*Mains Reference Voltage*	100 V to 690 V	400 V

Sets the nominal mains voltage for the keypad's monitoring functions. This is used to calculate motor kilowatts and kilovolt amperes (kVA) but does not affect the Digistart IS's motor control or protection.

If the voltage measuring card is installed, the Digistart IS will use measured voltage instead.

7.7.8 Group 8 - Analog I/O

The Digistart IS has one analog output (terminals AO1, 0V).

If required, a second analog output and an analog input are available on the input/output expansion card.

No	Function	Range	Default
8A	*Analog Input Trip*	Do Not Trip, Trip High, Trip Low	Do Not Trip

Selects the soft starter's response to the analog input signal. The soft starter can be configured to trip if the voltage measured at the analog input falls below or rises above the level set in Pr **8C** *Analog Trip Point* (as a percentage of the maximum value of Pr **8B** *Analog Input Scale*).

No	Function	Range	Default
8B	*Analog Input Scale*	0-10, 2-10 V	2-10 V

Selects the scale of the analog input.

No	Function	Range	Default
8C	*Analog Trip Point*	0 to 100%	50%

Sets the signal level at which an analog input trip will occur, as a percentage of the maximum signal on the input.

NOTE   The analog input is only available if the input/output expansion card is installed.

No	Function	Range	Default
8D	*Analog Output A*	Current (%FLC), Motor Temp (%), Motor kW (%), Motor kVA (%), Motor pf, Voltage (%Mains)	Current (%FLC)

Selects which information will be reported via the analog output.

Current (% FLC)	Current as a percentage of motor full load current.
Motor Temp (%)	Motor temperature as a percentage of the motor service factor (calculated by the soft starter's thermal model).
Motor kW (%)	Motor kilowatts. 100% is motor FLC (Pr **1A**) multiplied by line voltage (measured voltage if the voltage measurement card is installed, otherwise reference voltage, Pr **7D**). Power factor is assumed to be 1.0.

$$\frac{\sqrt{3} . V . I_{FLC} . pf}{1000}$$

Motor kVA (%)	Motor kilovolt amperes. 100% is motor FLC (Pr **1A**) multiplied by line voltage (measured voltage if the voltage measurement card is installed, otherwise reference voltage, Pr **7D**).

$$\frac{\sqrt{3} . V . I_{FLC}}{1000}$$

Motor pf	Motor power factor, measured by the soft starter.
Voltage (% Mains)	The average voltage measured on three phases (this information is only available if the voltage measurement option is installed).

No	Function	Range	Default
8E	*Analog A Scale*	0-20, 4-20 mA	4-20 mA

Selects the range of the analog output.

No	Function	Range	Default
8F	*Analog A Maximum Adjustment*	0 to 600%	100%
8G	*Analog A Minimum Adjustment*		0%

Calibrates the analog output to match the signal measured on an external current measuring device.

No	Function	Range	Default
8H	*Analog Output B*	Current (%FLC), Motor Temp (%), Motor kW (%), Motor kVA (%), Motor pf, Voltage (%Mains)	Current (%FLC)
8I	*Analog B Scale*	0-20, 4-20 mA	4-20 mA
8J	*Analog B Maximum Adjustment*	0 to 600%	100%
8K	*Analog B Minimum Adjustment*		0%

See Pr **8D** to **8G** for details of parameter options.

NOTE	Analog Output B is only available if the input/output expansion card is installed.

7.7.9 Group 9 - Display

No	Function	Range	Default
9A	*Languages*	English, Français, Italiano, Deutsch, Español, Chinese	

Selects which language the keypad will use to display messages and feedback.

No	Function	Range	Default
9B	*User Screen - Top Left*	Blank, Starter State, Motor Current, Motor pf, Mains Frequency, Motor kW, Motor HP, Motor Temp, kWh, Hours Run, Analog Input, Mains Voltage, Motor kVA, % Rated kW, Motor Parameter Set	Motor Current

Selects which information will be displayed on the programmable monitoring screen.

Blank	Displays no data in the selected area, allowing long messages to be shown without overlapping.
Starter State	The starter's operating state (starting, running, stopping or tripped). Only available for top left and bottom left positions on the screen.
Motor Current	The average current measured on three phases.
Motor pf	The motor's power factor, measured by the soft starter.
Mains Frequency	The average frequency measured on three phases.
Motor kW	The motor's running power in kilowatts.
Motor HP	The motor's running power in horsepower.
Motor Temp	The motor's temperature, calculated by the thermal model.
kWh	The number of kilowatt hours the motor has run via the soft starter.
Hours Run	The number of hours the motor has run via the soft starter.
Analog Input	The level of analog input A (see Pr **8A** to **8C**). This setting is only available if the input/output expansion option is installed.
Mains Voltage	The average voltage measured on three phases (this setting is only available if the voltage measurement option is installed).
Motor kVA	The motor's apparent running power in kVA.
% Rated kW	The motor's running power as a percentage of rated kW. Power factor is assumed to be 1.0 at 100% kW.
Motor Parameter Set	Whether the starter is controlling the motor using the primary motor set (M1) or the secondary motor set (M2).

No	Function	Range	Default
9C	*User Screen - Top Right*	Blank, Motor Current, Motor pf, Mains Frequency, Motor kW, Motor HP, Motor Temp, kWh, Hours Run, Analog Input, Mains Voltage, Motor kVA, % Rated kW	Motor pf
9D	*User Screen - Bottom Left*	Blank, Starter State, Motor Current, Motor pf, Mains Frequency, Motor kW, Motor HP, Motor Temp, kWh, Hours Run, Analog Input, Mains Voltage, Motor kVA, % Rated kW, Motor Parameter Set	Hours Run
9E	*User Screen - Bottom Right*	Blank, Motor Current, Motor pf, Mains Frequency, Motor kW, Motor HP, Motor Temp, kWh, Hours Run, Analog Input, Mains Voltage, Motor kVA, % Rated kW	kWh

No	Function	Range	Default
9F	*Graph Data*	Current (%FLC), Motor Temp (%), Motor kW (%), Motor kVA (%), Motor pf, Voltage (%Mains)	Current (%FLC)

Selects which information the graph will display. See Pr **8D** for details of parameter options.

No	Function	Range	Default
9G	*Graph Timebase*	10 seconds, 30 seconds, 1 minute, 5 minutes, 10 minutes, 30 minutes, 1 hour	10 seconds

Sets the graph time scale. The graph will progressively replace the old data with new data.

No	Function	Range	Default
9H	*Graph Maximum Adjustment*	0 to 600%	400%
9I	*Graph Minimum Adjustment*		0%

Adjusts the upper and lower limits of the performance graph.

No	Function	Range	Default
9J	*F1 Button Action*	None, Setup Auto-Start/Stop	Setup Auto-Start/Stop
9K	*F2 Button Action*	Jog Forward, Jog Reverse	None

Selects the function of the shortcut buttons on the keypad.

NOTE   If the adjustment lock is on (Pr **15C** *Adjustment Lock* is set to Read Only), users will not be able to change the auto-start/stop settings.

No	Function	Range	Default
9L	*Current Calibration*	80 to 115%	100%

Calibrates the soft starter's current monitoring circuits to match an external current metering device.

Calibration (%) = $\dfrac{\text{Current shown on Digistart IS display}}{\text{Current measured by external device}}$

e.g. 102% = $\dfrac{66A}{65A}$

NOTE   This adjustment affects all current-based functions and protections.

No	Function	Range	Default
9M	*Display A or kW*	Current, Motor kW	Current

Selects whether the Digistart IS will display current (amperes) or motor kilowatts on the main monitoring screen.

7.7.10 Group 10 - Auto-Reset

The Digistart IS can be programmed to automatically reset certain trips, which can help minimise operating downtime. Trips are divided into three categories for auto-reset, depending on the risk to the soft starter:

Table 7-5 Auto-reset groups

Group	Trips
A	Current Imbalance Phase loss Power loss Frequency
B	Underpower Overpower Input A trip Input B trip
C	Motor overload RTD/PT100 temperature trips Motor thermistor Heatsink overtemperature

Other trips cannot be automatically reset.

No	Function	Range	Default
10A	*Auto-Reset Action*	Do Not Auto-Reset, Reset Group A, Reset Group A & B, Reset Group A, B & C	Do Not Auto-Reset

Selects which trips can be auto-reset.

No	Function	Range	Default
10B	*Maximum Resets*	1 to 5	1

Sets how many times the soft starter will auto-reset, if it continues to trip. The reset counter increases by one each time the soft starter auto-resets, and decreases by one after each successful start/stop cycle.

No	Function	Range	Default
10C	*Reset Delay Groups A&B*	00:05 to 15:00 (minutes:seconds)	00:05
10D	*Reset Delay Group C*	5 to 60 minutes	5

The Digistart IS can be configured to wait before auto-resetting a trip. Separate delays can be set for trips in Groups A and B, or in Group C.

7.7.11 Group 11 - Secondary Motor Set

The Digistart IS can support two different starting and stopping motor data sets.

- To use the Digistart IS with two separate motors (such as a duty-standby configuration), use Pr **11B** to select dual thermal modelling and configure Pr **11A** to **12N** to suit the second motor.
- To use the Digistart IS with two different motor data sets for the same motor (for dual speed motors or applications where starting conditions may vary), use Pr **11B** to select a single thermal model, and configure the starting and stopping profiles as required in Pr **12A** to **12N**. The soft starter will ignore Pr **11A** to **11E** and will use settings from the primary motor.

To select the secondary motor data set, a programmable input must be configured to parameter set selection (Pr **3A** and **3F**) and the input must be active when the soft starter receives a start signal.

For details of parameter options, see *Group 1 - Primary Motor Set* on page 44.

NOTE	You can only choose which motor data set to use while the soft starter is stopped.

No	Function	Range	Default
11A	*Motor FLC-2*	Model dependent	Model dependent

Sets the secondary motor's full load current.

No	Function	Range	Default
11B	*Dual Thermal Model*	Single, Dual	Single

Activates dual thermal modelling. The dual thermal model is required only if the Digistart IS is controlling two physically separate motors.

NOTE	The second thermal model is only active if Pr **11B** *Dual Thermal Model* is set to 'Dual' and the starter is using the secondary motor set (a programmable input is set to 'Motor Set Select' and the input is active).

No	Function	Range	Default
11C	*Locked Rotor Current-2*	400 to 1200% FLC	600%
11D	*Locked Rotor Time-2*	00:01 to 02:00 (minutes:seconds)	00:10
11E	*Motor Service Factor-2*	100 to 130%	105%

7.7.12 Group 12 - Start/Stop Modes-2

For details of soft start and stop control methods, see *Soft start methods* on page 29 and *Stop methods* on page 32.

For details of parameter options, see *Group 2 - Start/Stop Modes* on page 44.

No	Function	Range	Default
12A	*Start Mode-2*	Constant Current, Adaptive Control	Adaptive Control
12B	*Current Limit-2*	100 to 600%	350%
12C	*Initial Current-2*	100 to 600%	350%
12D	*Start Ramp-2*	00:01 to 03:00 (minutes:seconds)	00:10
12E	*Adaptive Start Profile-2*	Early Acceleration, Constant Acceleration, Late Acceleration	Constant Acceleration
12F	*Kickstart Level-2*	100 to 700% FLC	500%
12G	*Kickstart Time-2*	0 to 2000 ms	0 ms
12H	*Stop Mode-2*	Coast To Stop, TVR Soft Stop, Adaptive Control, Brake, STV Soft Stop	Coast To Stop
12I	*Stop Time-2*	00:01 to 04:00 (minutes:seconds)	00:03
12J	*Stop Delay-2*	00:00 to 01:00 (minutes:seconds)	00:00
12K	*Adaptive Stop Profile-2*	Early Deceleration, Constant Deceleration, Late Deceleration	Constant Deceleration
12L	*Adaptive Control Gain-2*	1 to 200%	75%
12M	*Brake Torque-2*	20 to 100%	20%
12N	*Brake Time-2*	00:01 to 00:30 (minutes:seconds)	00:01

7.7.13 Group 13 - Slip Ring Motors

No	Function	Range	Default
13A	*Motor Data-1 Ramp*	Single Ramp, Dual Ramp	Single Ramp
13B	*Motor Data-2 Ramp*		

Selects whether to use a single or dual current ramp profile for soft starting. Set to single ramp for non-slip ring induction motors, or dual ramp for slip-ring induction motors. Pr **13A** selects the ramp configuration for the primary motor and Pr **13B** selects the ramp configuration for the secondary motor.

No	Function	Range	Default
13C	*Slip Ring Retard*	10 to 90%	50%

Sets the level of conduction while the rotor resistor closes, as a percentage of full conduction.
Set so that no current pulse occurs, but the motor retains enough speed to start correctly.

No	Function	Range	Default
13D	*Changeover Time*	100 to 500 ms	150 ms

Sets the delay between the rotor resistance relay closing and the low resistance current ramp starting. Set so that the contactor has enough time to close, but the motor does not slow down.
Pr **13D** only applies if Pr **13A** or **13B** is set to 'Dual Ramp', and an output relay is set to 'Changeover Contactor'.

7.7.14 Group 14 - RTD/PT100

The Digistart IS has one RTD/PT100 input and can be fitted with another six PT100 inputs by using the RTD/PT100 and ground fault protection card. The inputs can trip the soft starter when the temperature exceeds a specified point, and different trip temperatures can be set for each input.

PT100 inputs B to G are only available if the RTD/PT100 and ground fault protection card has been installed.

No	Function	Range	Default
14A	*RTD/PT100 A °C*		
14B	*RTD/PT100 B °C*		
14C	*RTD/PT100 C °C*		
14D	*RTD/PT100 D °C*	50 to 250 °C	50 °C
14E	*RTD/PT100 E °C*		
14F	*RTD/PT100 F °C*		
14G	*RTD/PT100 G °C*		

Sets the trip points for the RTD/PT100 inputs.

7.7.15 Group 15 - Restricted

No	Function	Range	Default
15A	*Access Code*	0 to 9999	0000

Sets the access code to control access to restricted sections of the menus.
Use the ← and **M** buttons to select which digit to alter and use the ∧ and ∨ buttons to change the value.

NOTE	In the event of a lost access code, contact your supplier for a master access code that allows you to re-program a new access code.

No	Function	Range	Default
15B	*Emergency Run*	Disable, Enable	Disable

Selects whether the soft starter will permit emergency run operation. In emergency run, the soft starter will start (if not already running) and continue to operate until emergency run ends, ignoring stop commands and trips.
Emergency run is controlled using a programmable input.

⚠ **CAUTION**   Emergency run may compromise starter life.

No	Function	Range	Default
15C	*Adjustment Lock*	Read & Write, Read Only	Read & Write

Selects whether the keypad will allow parameters to be changed via the Programming Menu.

No	Function	Range	Default
15D	*Shorted SCR Action*	3-Phase Control Only, PowerThrough	3-Phase Control Only

Selects whether the soft starter will allow PowerThrough operation. For critical applications this allows the soft starter to control the motor with two-phase control, if the soft starter is damaged on one phase. PowerThrough only operates after the soft starter has tripped on "Lx-Tx Shorted" and has been reset.

> ⚠ **CAUTION**
>
> PowerThrough uses a two-phase soft start technology and additional care is required when sizing circuit breakers and protection. Contact your local supplier for assistance.
>
> PowerThrough remains active until '3-Phase Control Only' is reselected.
>
> PowerThrough operation does not support Adaptive Control soft starting or soft stopping. In PowerThrough, the Digistart IS will automatically select constant current soft starting and timed voltage ramp soft stopping. If PowerThrough is enabled, Pr **2C** and **2B** must be set appropriately.

> **NOTE** PowerThrough only operates with in-line connected motors.

No	Function	Range	Default
15E	*Jog Torque*	20 to 100%	50%

Sets the torque level for jog operation. See *Jog Operation* on page 35 for details.

7.7.16 Group 16 - Protection Action

These parameters define how the soft starter will respond to different protection events. The soft starter can trip, issue a warning, or ignore different protection events as required. All protection events are written to the event log. The default action for all protections is to trip the soft starter.

Protections **16P** *Ground Fault* and **16R** to **16W** *RTD/PT100* are only available if the RTD/PT100 and ground fault protection card has been fitted. Protections **16F** *Undervoltage* and **16G** *Overvoltage* are only available if the voltage measurement card has been fitted.

> ⚠ **CAUTION** Defeating the protection may compromise the starter and motor, and should only be done in the case of emergency.

No	Function	Range	Default
16A	*Motor Overload*		
16B	*Excess Start Time*		
16C	*Current Imbalance*		
16D	*Underpower*		
16E	*Overpower*		
16F	*Undervoltage*		
16G	*Overvoltage*		
16H	*Frequency*		
16I	*Input A Trip*		
16J	*Input B Trip*		
16K	*Motor Thermistor*		
16L	*Starter Communication*	Trip Starter, Warn & Log, Log Only	Trip Starter
16M	*Network Communication*		
16N	*Heatsink Overtemperature*		
16O	*Battery/Clock*		
16P	*Ground Fault*		
16Q	*RTD/PT100 A*		
16R	*RTD/PT100 B*		
16S	*RTD/PT100 C*		
16T	*RTD/PT100 D*		
16U	*RTD/PT100 E*		
16V	*RTD/PT100 F*		
16W	*RTD/PT100 G*		

Selects the soft starter's response to each protection.

7.8   Maintenance tools

7.8.1   Setup tools

NOTE   These functions are protected by the security access code.

Load/Save settings

The Load/Save Settings menu requires an access code and allows users to:

- Load the Digistart IS's parameters with default values
- Reload previously saved parameter settings from an internal file
- Save the current parameter settings to an internal file

In addition to the factory default values file, the Digistart IS can store two user-defined parameter files. These files contain default values until a user file is saved.

The available options are:

Table 7-6 Load/Save settings options

Load Defaults	Restores the starter to the factory default settings for all parameters except Pr **9A** *Language*. This does not reset the access code.
Load Backup	Synchronises parameters between the starter and the keypad. See *Synchronising the keypad and the starter* on page 27 for details of the synchronisation process.
Save User Set 1	Saves the current parameter settings to a file. This file contains default parameter settings until a user file is saved.
Load User Set 1	Reloads the parameter settings from User Set 1.
Save User Set 2	Saves the current parameter settings to a file. This file contains default parameter settings until a user file is saved.
Load User Set 2	Reloads the parameter settings from User Set 2.

NOTE   The saved files and current operating settings are stored in both the keypad and in the soft starter. The keypad will prompt you to synchronise the settings whenever it is plugged into a new Digistart IS.

To load or save parameter settings:

1. Open the Programming Menu and select Setup Tools. Enter the access code.

2. Scroll to the required function and press the **M** button.

```
    Load Defaults
    Load Backup
    Save User Set 1
```
```
     Load Defaults
 No
 Yes
```

3. At the confirmation prompt, select YES to confirm or NO to cancel and then **M** to load/save the selection.

When the action has been completed, the screen will briefly display a confirmation message, then return to the status screens.

Set date and time

To set the date and time:

1. Open the Programming Menu and select Setup Tools. Enter the access code.
2. Scroll to the date/time screen.
3. Press the **M** button to enter edit mode.
4. Press the **M** and ⟵ buttons to select which part of the date or time to edit.
5. Use the ⋀ and ⋁ buttons to change the value.
6. To save changes, press the **M** button. The Digistart IS will confirm the changes. To cancel changes, press the ⟵ button.

Reset thermal models

The Digistart IS's advanced thermal modelling software constantly monitors the motor's performance. This allows the Digistart IS to calculate the motor's temperature and ability to start successfully at any time. If the Digistart IS is configured for use on two motors, each motor's temperature is modelled separately.

The thermal model for the active motor can be reset if required.

1. Open the Programming Menu and select Setup Tools. Enter the access code.

2. Scroll to Reset Thermal Models and press **M**.

```
Reset Thermal Models
        M1 X%
        M2 X%
     M to Reset
```

3. Use ∨ to select Reset and press **M** to confirm.

```
Do Not Reset
Reset
```

4. When the thermal model has been reset, the screen will display a confirmation message then return to the previous screen.

NOTE   This action will reset both thermal models.

NOTE   The second thermal model is only active if Pr **11B** *Dual Thermal Model* is set to 'Dual' and the starter is using the secondary motor set (a programmable input is set to 'Motor Set Select' and the input is active).

⚠ **CAUTION**   Resetting the motor thermal model may compromise motor life and should only be done in the case of emergency.

7.8.2   Simulations

Software simulation functions let you test the soft starter's operation and control circuits without connecting the soft starter to mains voltage. The simulations are accessed via the Simulations menu.

The Digistart IS has three simulation functions:

- The **protection simulation** simulates activation of each protection mechanism to confirm that the soft starter and associated control circuits are responding correctly. See *Protection simulation* on page 58 for details.
- The **run simulation** simulates a motor starting, running and stopping to confirm that the soft starter and associated equipment have been installed correctly. The run simulation follows the protection simulations in the Simulations menu. See *Run simulation* on page 59 for details.
- The **output signal simulation** simulates output signalling to confirm that outputs and associated control circuits are operating correctly. The output signal simulation follows the run simulation in the Simulations menu. See *Output signal simulations* on page 59 for details.

The simulations are only available when the soft starter is in Ready state, control voltage is available and the keypad is active.

NOTE   Access to the simulation tools is protected by the security access code.
The default access code is 0000.

Protection simulation

To use the protection simulation:

1. Open the Programming Menu and select Simulations.

2. Use the ∧ and ∨ buttons to select the protection you want to simulate.

3. Press and hold **M** to simulate the selected protection.

4. The screen is displayed momentarily. The soft starter's response depends on the Protection Action setting (parameter group 16).

```
         0.0A
Tripped
Selected Protection
```

5. Use ∧ or ∨ to select another simulation, or press ← to exit.

Run simulation

You can end the simulation at any time by pressing ⇐.

To use the run simulation:

1. Open the Programming Menu and select Simulations.
2. Scroll to Run Simulation and press **M**.
3. Press **START** or activate the start input.

```
Run Simulation
Ready
Apply Start Signal
```

4. If the Mains voltage is connected an error message is shown. Remove the Mains voltage and proceed to next step.

```
Run Simulation
ATTENTION!
Remove Mains Volts
STORE to Continue
```

5. Press **M**. The Digistart IS simulates its pre-start checks and closes the main contactor (if installed). The Run LED flashes.

```
Run Simulation
Pre-Start Checks
STORE to Continue
```

6. Press **M**. The Digistart IS simulates starting. The Run LED flashes.

```
Run Simulation
Starting X:XXs
STORE to Continue
```

7. Press **M**. The Digistart IS simulates running. The Run LED stays on without flashing and the bypass relays close.

```
Run Simulation
Running
Apply Stop Signal
```

8. Press **STOP** or activate the stop input. The Digistart IS simulates stopping. The Run LED flashes.

```
Run Simulation
Stopping X:XXs
STORE to Continue
```

9. Press **M** to finish the simulation and exit. The Ready LED flashes.

```
Run Simulation
Stopped
STORE to Continue
```

Output signal simulations

The following outputs are available to simulate:

- Programmable relay A
- Programmable relay B
- Programmable relay C
- Run relay
- Low current flag
- High current flag
- Motor temperature flag
- Analog output A
- Analog output B

NOTE   To test operation of the flags (motor temperature and low/high current), set an output relay to the appropriate function and monitor the relay's behaviour.

To use the signal simulation:

1. Open the Menu and select Simulation.

2. Use the ∧ and ∨ buttons to select a function to simulate, then press **M**.

3. Use the ∧ and ∨ buttons to turn the signal on and off.
   To confirm correct operation, monitor the state of the output.

```
Prog Relay A
Off
On
```

4. Press ⇐ to return to the simulation list.

The analog output simulation uses the ∧ and ∨ buttons to change the current at the analog output terminals.

```
Analog Output A
0%
4.0mA
```

Attach a current measuring device to the analog output terminals. Use the ∧ or ∨ button to adjust the percentage value on the display. The current measuring device should indicate the same level of current as shown on the display.

If the input/output expansion card is fitted, the simulation can also be used to test the operation of Relays D, E, F and Analog Output B.

7.8.3   I/O state

Analog I/O state

This screen shows the current status of the Analog I/O

```
Analog I/O State
Input: - - - - %
Output A: 04.0mA
```

This screen will also show Analog Output B if the expansion card is fitted.

Digital I/O state

This screen shows the current status of the digital inputs and outputs.

```
Digital I/O State
Inputs:   0110000
Outputs: 0000100
```

The top line of the screen shows the start, stop, reset and programmable inputs (A and B, then inputs on the I/O expansion card (if fitted).

The bottom line of the screen shows programmable output A, the fixed Run output, programmable inputs B and C, then the outputs on the expansion card (if fitted).

Temperature sensors state

This screen shows the state of the motor thermistors and RTD/PT100s.

```
Temp Sensors State
Thermistor: O
RTD/PT100s:0000000
S = Shrt H=Hot C=Cld O=Opn
```

RTD/PT100s B to G are only available if the RTD/PT100 and Ground Fault expansion card is fitted.

7.8.4   Logs menu

The Logs Menu provides information on events, trips and starter performance.

To open the Logs Menu, press the **M** button, then scroll to Logs and press **M** again.

Trip log

The Trip Log stores details of the eight most recent trips, including the date and time the trip happened. Trip 1 is the most recent and trip 8 is the oldest stored trip.

To open the Trip Log:
1. Open the Logs Menu.
2. Scroll to Trip Log and press **M**.
3. Use the ∧ and ∨ buttons to select a trip to view, and press **M** to display details.

To close the log and return to the main display, press ← repeatedly.

Event log

The Event Log stores time-stamped details of the starter's 99 most recent events (actions, warnings and trips), including the date and time of the event. Event 1 is the most recent and event 99 is the oldest stored event.

To open the Event Log:
1. Open the Logs Menu.
2. Scroll to Event Log and press **M**.
3. Use the ∧ and ∨ buttons to select an event to view, and press **M** to display details.

To close the log and return to the main display, press ← repeatedly.

7.8.5   Performance counters

The performance counters store statistics on the starter's operation:

- Hours run (lifetime and since counter last reset)
- Number of starts (lifetime and since counter last reset)
- Motor kWh (lifetime and since counter last reset)
- Number of times the thermal model has been reset

The resettable counters (hours run, starts and motor kWh) can only be reset if the Adjustment Lock (Pr **15C**) is set to Read & Write.

To view the counters:

1. Open the Programming Menu and select Counters.
2. Use the $\wedge$ and $\vee$ buttons to scroll through the counters. Press **M** to view details.
3. To reset a counter, press **M** then press **M** to confirm the action.

To return to the previous level, press $\Leftarrow$.

NOTE   The reset counters function is protected by the access code.

8. Quick Start Commissioning

This procedure is written from default parameter settings as the starter would be delivered from the factory.

> ⚠ **WARNING**
>
> Always apply control voltage before (or with) mains voltage.

8.1 Control wiring

Figure 8-1 Control terminals for basic connection
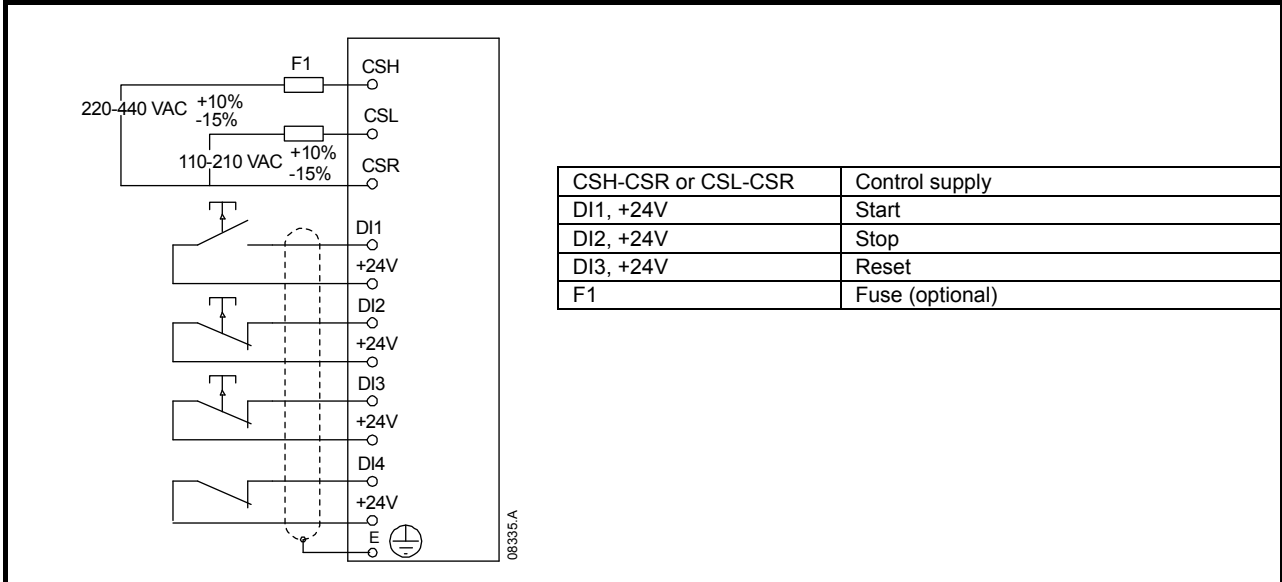
CSH-CSR or CSL-CSR	Control supply
DI1, +24V	Start
DI2, +24V	Stop
DI3, +24V	Reset
F1	Fuse (optional)

For keypad control, the soft starter requires:
- control supply connections (terminals CSH, CSL, CSR depending on the control voltage)
- programmable input A (DI4, +24V) must be closed or Pr **3A** *Input A Function* must be changed from Emergency Stop

8.2 Setup procedure

Table 8-1 Basic setup procedure

Action	Detail
Before power-up	Ensure: • The starter is not receiving a start signal • The motor is connected to the starter • The motor connection is correct • The correct supply voltage is available
Power up the starter	Ensure: • The Ready LED activates
Program parameters	The Quick Setup Menu makes it easy to configure the Digistart IS for common applications. The Digistart IS selects the parameters relevant to the application and suggests a typical setting, and you can adjust each parameter to suit your exact requirements. The following applications are available through the Quick Setup Menu: • Pump (centrifugal, submersible) • Fan (damped, undamped) • Compressor (screw, reciprocating) • Conveyor • Crusher (rotary, jaw) For more information on the Quick Setup Menu, see *Quick setup details* on page 38.
	For applications not covered by the Quick Setup Menu, the following parameters should be set to suit the requirements of the application: • **1A** *Motor Full Load Current* • **2A** *Start Mode* • **2B** *Current Limit* • **2D** *Start Ramp Time* • **2I** *Stop Time* • **2H** *Stop Mode* (if required) For parameter details, see *Parameter descriptions* on page 44.

9. Diagnostics

NOTE   The Digistart IS soft starter is not user serviceable. The unit should only be serviced by authorised service personnel. Unauthorised tampering with the unit will void the product warranty.

9.1 Protection responses

When a protection condition is detected, the Digistart IS will write this to the event log and may also trip or issue a warning. The soft starter's response to some protections may depend on the Protection Action settings (parameter group 16).

If the Digistart IS trips you will need to reset the soft starter before restarting. If the Digistart IS has issued a warning, the soft starter will reset itself once the cause of the warning has been resolved.

Some protections cause a fatal trip. This response is pre-defined and cannot be overridden. These protection mechanisms are designed to protect the soft starter, or can be caused by a fault within the soft starter.

9.2 Trip messages

This table lists soft starter's protection mechanisms and the probable cause of the trip. Some of these can be adjusted using parameter group 4 *Protection Settings* and parameter group 16 *Protection Action*, other settings are built-in system protections and cannot be set or adjusted.

Table 9-1 Trip messages

Display	Possible cause/Suggested solution
Analog Input Trip	This fault only occurs if the Input/Output expansion card is fitted. Identify and resolve the condition which caused Analog Input A to activate. Related Pr: **8A**, **8B**, **8C**
Battery/Clock	A verification error has occurred on the real time clock, or the backup battery voltage is low. If the battery is low and the power is off, date/time settings will be lost. Reprogram the date and time. Related Pr: **16O**
Current Imbalance	Current imbalance can be caused by problems with the motor, the environment or the installation, such as: • An imbalance in the incoming mains voltage • A problem with the motor windings • A light load on the motor Current imbalance can also be caused by incorrect cabling between the external bypass contactor and the soft starter or an internal problem with the soft starter, particularly an SCR that has failed open circuit. A failed SCR can only be definitely diagnosed by replacing the SCR and checking the starter's performance. Related Pr: **5C**, **6A**, **16C** Please contact Control Techniques or your local distributor.
Excess Start Time	Excess start time trip can occur in the following conditions: • Pr **1A** *Motor Full Load Current* is not appropriate for the motor • Pr **2B** *Current Limit* has been set too low • Pr **2D** *Start Ramp Time* has been set greater than the setting for **5A** *Excess Start Time* setting • Pr **2D** *Start Ramp Time* is set too short for a high inertia load when using Adaptive Acceleration Control Related Pr: **1A**, **2B**, **2D**, **5A**, **5B**, **11A**, **12D**, **12B**, **16B**
FLC Too High	The Digistart IS can support higher motor full load current values when connected to the motor using inside delta configuration rather than in-line connection. If the soft starter is connected in-line but the programmed setting for Pr **1A** *Motor Full Load Current* is above the in-line maximum, the soft starter will trip at start. Related Pr: **1A**, **11A**
Frequency	The mains frequency has gone beyond the specified range. Check for other equipment in the area that could be affecting the mains supply (particularly variable speed drives). If the Digistart IS is connected to a generator set supply, the generator may be too small or could have a speed regulation problem. Related Pr: **5I**, **5J**, **6F**, **16H**
Ground Fault	This fault only occurs if the RTD/PT100 and Ground Fault card is fitted. Test the insulation of the output cables and the motor. Identify and resolve the cause of any ground fault. Related Pr: **5K**, **6H**, **16P**

Display	Possible cause/Suggested solution
Heatsink Overtemp	Check if cooling fans are operating. If mounted in an enclosure check if ventilation is adequate. On models with internal bypass, the cooling fans will operate: • During the Start sequence and for 10 minutes after transition to Run. • For 10 minutes after Stop. Models without internal bypass will operate the cooling fans from a Start until 10 minutes after a Stop. Related Pr: **16N**
Input A Trip	Identify and resolve the condition which caused Input A to activate. Related Pr: **3A**, **3B**, **3C**, **3D**, **3E**, **16I**
Input B Trip	Identify and resolve the condition which caused Input B to activate. Related Pr: **3F**, **3G**, **3H**, **3I**, **3J**, **16J**
Internal Fault X	The Digistart IS has tripped on an internal fault. Contact your local supplier with the fault code (X). Related Pr: None
L1 Phase Loss L2 Phase Loss L3 Phase Loss	During pre-start checks the starter has detected a phase loss as indicated. In run state, the starter has detected that the current on the affected phase has dropped below 3.3% of the programmed motor FLC for more than 1 second, indicating that either the incoming phase or connection to the motor has been lost. Check the supply and the input and output connections at the starter and at the motor end. Phase loss can also be caused by a failed SCR, particularly an SCR that has failed open circuit. A failed SCR can only be definitely diagnosed by replacing the SCR and checking the starter's performance. Related Pr: None Please contact Control Techniques or your local distributor.
L1-T1 Shorted L2-T2 Shorted L3-T3 Shorted	During pre-start checks the starter has detected a shorted SCR or a short within the bypass contactor as indicated. If the starter is connected in-line with the motor, consider using PowerThrough to allow operation until the starter can be repaired. Related Pr: **15D**
Motor Overload	The motor has reached its maximum thermal capacity. Overload can be caused by: • The soft starter protection settings not matching the motor thermal capacity • Excessive starts per hour • Excessive throughput • Damage to the motor windings Resolve the cause of the overload and allow the motor to cool. Related Pr: **1A**, **1B**, **1C**, **1D**, **16A**
Motor 2 Overload	See 'Motor Overload' above Note: Applicable only if the second motor set has been programmed. Related Pr: **11A**, **11B**, **11C**, **11D**, **11E**, **16A**
Motor Connection	The motor is not connected correctly to the soft starter for in-line or inside delta use. • Check individual motor connections to the soft starter for power circuit continuity. • Check connections at the motor terminal box.
Motor Thermistor	The motor thermistor input has been enabled and: • The resistance at the thermistor input has exceeded 3.6 kΩ for more than one second. • The motor winding has overheated. Identify the cause of the overheating and allow the motor to cool before restarting. • The motor thermistor input has been opened. Note: If a valid motor thermistor is no longer used, a 1.2 kΩ resistor must be fitted across terminals TH1, TH2. Related Pr: **16K**
Network Comms	The network master has sent a trip command to the starter, or there may be a network communication problem. Check the network for causes of communication inactivity. Related Pr: **16M**
Overpower	The motor has experienced a sharp rise in power, probably caused by a locked rotor condition while running. This may indicate a jammed load. Related Pr: **5F**, **6C**, **16E**
Overvoltage	There has been a voltage surge on the mains. Causes can include problems with a transformer tap regulator or off-loading of a large transformer load. • Check that the starter is configured appropriately for local conditions. • Monitor the mains voltage to determine the cause of the voltage fluctuation, and resolve the cause. Related Pr: **5H**, **6E**, **16P** Voltage data is only available from the Digistart IS if the voltage measuring card is installed.

Display	Possible cause/Suggested solution
Par xx Out of Range	• A parameter value is outside the valid range. The keypad will indicate the first invalid parameter. This can occur if: • An error occurred loading data from the EEPROM to RAM when the keypad powered up. • The parameter set or values in the keypad do not match the parameters in the starter. • "Load User Set" has been selected but no saved file is available. Reset the fault then reload the default settings. If the problem persists, contact your local distributor. Related Pr: None
Phase Sequence	The phase sequence on the soft starter's input terminals (L1, L2, L3) is not valid. Check the phase sequence on L1, L2, L3 and ensure the setting in Pr **5D** is suitable for the installation. Related Pr: **5D**
Power Loss	The starter is not receiving mains supply on one or more phases when a Start Command is given. Check that the main contactor closes when a start command is given, and remains closed until the end of a soft stop. Related Pr: **20B**
RTD/PT100 A RTD/PT100 B to G	The RTD/PT100 set temperature has been exceeded and tripped the soft starter. Identify and resolve the condition which caused the appropriate input to activate. : PT100 B to PT100 G are applicable only if a RTD/PT100 and Ground Fault card is fitted. Related Pr: **14A**, **14B**, **14C**, **14D**, **14E**, **14F**, **14G**, **16Q** to **16W**
RTD/PT100 X Circuit	Indicates that the indicated RTD/PT100 has short circuited. Check and resolve this condition. Related Pr: None.
Starter/Comms	• There is a problem with the connection between the soft starter and the optional communications module. Remove and reinstall the module. If the problem persists, contact your local distributor. • There is an internal communications error within the soft starter. Contact your local distributor. Related Pr: **16L**
Thermistor Cct	The thermistor input has been enabled and: • The resistance at the input has fallen below 20 Ω (the cold resistance of most thermistors will be over this value) or • A short circuit has occurred. Check and resolve this condition. Related Pr: None
Time - Overcurrent	The Digistart IS is internally bypassed and has drawn high current during running. (The 10A protection curve trip has been reached or the motor current has risen to 600% of the motor FLC setting.) Related Pr: None
Underpower	The motor has experienced a sharp drop in power, caused by loss of load. Causes can include broken components (shafts, belts or couplings), or a pump running dry. Related Pr: **5E**, **6B**, **16D**
Undervoltage	Mains voltage has fallen below the level selected in Pr **5G**. Causes can include an undersized supply or adding a large non-linear load to the system. • Check that the starter is configured appropriately for local conditions. • Monitor the mains voltage to determine the cause of voltage fluctuation. Related Pr: **5G**, **6D**, **16H** Voltage data is only available from the Digistart IS if the voltage measuring card is installed.
Unsupported Option	The selected function is not available (e.g. jog is not supported in inside delta configuration). Related Pr: None

9.3 General faults

This table describes situations where the soft starter does not operate as expected but does not trip or give a warning.

Table 9-2 General faults

Symptom	Probable Cause
Soft starter does not respond to commands.	• If the soft starter does not respond to the **START** or **RESET** button on the keypad: - The soft starter may be in Remote control mode. When the soft starter is in Remote control mode, the Remote LED on the keypad is active. Press the **LCL/RMT** button once to change to Local control (see Pr **3M** *Local/Remote* for details). • If the soft starter does not respond to commands from the control inputs: - The soft starter may be in Local control mode. When the soft starter is in Local control mode, the Remote LED on the keypad is not active. Press the **LCL/RMT** button once to change to Remote control (see Pr **3M** *Local/Remote* for details). - The control wiring may be incorrect. Check that the remote start, stop and reset inputs are configured correctly (see *Control Wiring* on page 15 for details). - The signals to the remote inputs may be incorrect. Test the signalling by activating each input signal in turn. The appropriate remote control input LED should activate on the keypad. - The soft starter will only execute a start command from the remote inputs if the remote reset input is activated. Check that the remote reset input is also active (the

Symptom	Probable Cause
	Reset LED on the starter will be on).
	• If the soft starter does not respond to a start command from either the local or remote controls:
	- The soft starter may be waiting for the restart delay to elapse. The length of the restart delay is controlled by Pr **6G** *Restart Delay*.
	- The motor may be too hot to permit a start. If Pr **5L** *Motor Temperature Check* is set to Check, the soft starter will only permit a start when it calculates that the motor has sufficient thermal capacity to complete the start successfully. Wait for the motor to cool before attempting another start.
	- The emergency stop function may be active. If Pr **3A** or **3F** is set to Emergency Stop and there is an open circuit on the corresponding input, the Digistart IS will not start. If the emergency stop situation has been resolved, close the circuit on the input.
The soft starter does not control the motor correctly during starting.	• Start performance may be unstable when using a low Motor Full Load Current setting (Pr **1A**). This can affect use on a small test motor with full load current between 5 A and 50 A.
	• Power factor correction (PFC) capacitors must be installed on the supply side of the soft starter. To control a dedicated PFC capacitor contactor, connect the contactor to run relay terminals.
Motor does not reach full speed.	• If the start current is too low, the motor will not produce enough torque to accelerate to full speed. The soft starter may trip on excess start time.
NOTE	Make sure the motor starting parameters are appropriate for the application and that you are using the intended motor starting profile. If Pr **3A** or **3F** is set to Motor Set Select, check that the corresponding input is in the expected state.
	• The load may be jammed. Check the load for severe overloading or a locked rotor situation.
Erratic motor operation.	• The SCRs in the Digistart IS require at least 5 A of current to latch. If you are testing the soft starter on a motor with full load current less than 5 A, the SCRs may not latch correctly.
Soft stop ends too quickly.	• The soft stop settings may not be appropriate for the motor and load. Review the settings of Pr **2H**, **2I**, **12H** and **12I**.
	• If the motor is very lightly loaded, soft stop will have limited effect.
Corrupted text shown on keypad display.	• The keypad may not be screwed down, resulting in an intermittent connection. Screw down the keypad or hold squarely in place.
Adaptive Control, brake, jog and PowerThrough functions not working	• These features are only available with in-line installation. If the Digistart IS is installed inside delta, these features will not operate.
A reset does not occur after an Auto-Reset, when using a remote two-wire control.	• The remote 2-wire start signal must be removed and reapplied for a re-start.
Remote start/stop command is overriding Auto Start/Stop settings when using remote two-wire control.	• Auto Start/Stop function should only be used in Remote mode, 3 and 4-wire control.
After selecting Adaptive Control the motor used an ordinary start and/or the second start was different to the first.	• The first Adaptive Acceleration Control start is current limit so that the starter can learn from the motor characteristics. Subsequent starts use Adaptive Acceleration Control.
Non-resettable THERMISTOR FAIL trip, when there is a link between the thermistor input TH1, TH2 or when the motor thermistor connected between TH1, TH2 is permanently removed.	• The thermistor input is enabled once a link is fitted and short circuit protection has activated.
	- Remove the link then load the default parameter set. This will disable the thermistor input and clear the trip.
	- Place a 1k2 Ω resistor across the thermistor input.
	- Turn thermistor protection to 'Log only' (Pr **16K**).
Display is distorted	• Check that the keypad has not been screwed down too tightly. Loosen screws slightly.
Parameter settings cannot be stored.	• Make sure you are saving the new value by pressing the **M** button after adjusting a parameter setting. If you press ⬅, the change will not be saved.
	• Check that the adjustment lock (Pr **15C**) is turned off. If the adjustment lock is on, settings can be viewed but not changed. You need to know the security access code to change the adjustment lock setting.
	• The EEPROM may be faulty on the keypad. A faulty EEPROM will also trip the soft starter, and the keypad will display the message Parameter Out Of Range. Contact your local supplier for advice.

10. Application Examples

A selection of Application Notes are available describing advanced installation or configuration of the Digistart IS for situations with specific performance requirements. Application notes are available for situations including brake and jog operation, pumping and advanced protection options.

10.1 Installation with main contactor

The Digistart IS is installed with a main contactor (AC3 rated). Control voltage must be supplied from the input side of the contactor.

The main contactor is controlled by the Digistart IS Main Contactor output, which by default is assigned to Output Relay A (terminals COM1, RLO1).

Figure 10-1 Installation with main contactor

1	Control voltage
2	Remote control inputs
3	Motor thermistor input
4	RTD/PT100 input
5	24 Vdc output
6	Relay outputs
7	Analog output
8	Three-phase supply
9	Motor terminals
KM1	Main contactor
F1	Semiconductor fuses (optional)
S1	Start/stop contact
S2	Reset contact
COM1, RLO1	Relay output A
COM2, RLO2	Run relay output
COM3, RLC3, RLO3	Relay output B
COM4, RLC4, RLO4	Relay output C
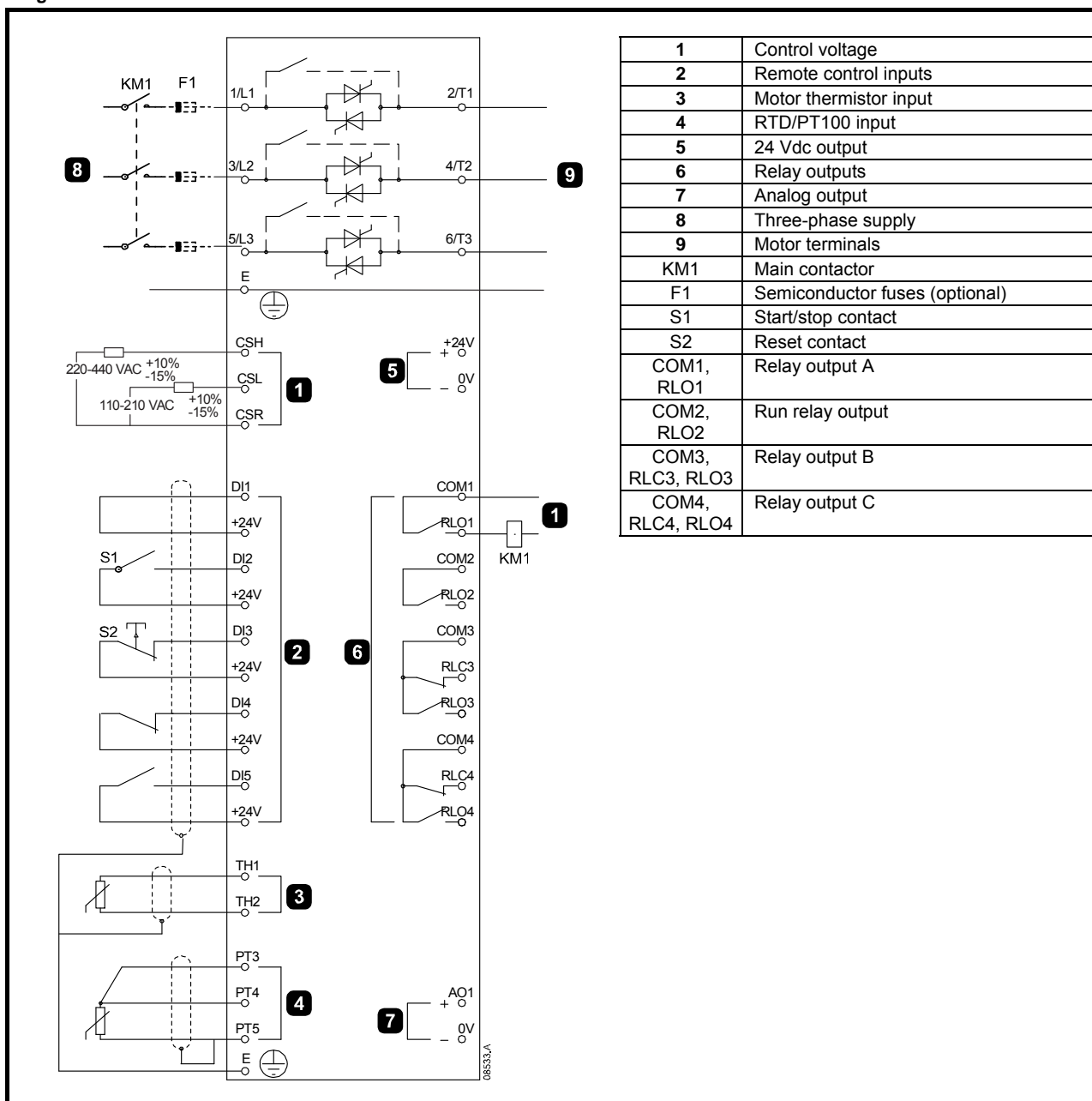
Parameter settings:

- Pr **4A** *Relay A Action*
    - Select 'Main Contactor' - assigns the Main Contactor function to Relay Output A (default setting)

10.2 Installation with bypass contactor

The Digistart IS is installed with a bypass contactor (AC1 rated). The bypass contactor is controlled by the Digistart IS Run Output (terminals COM2, RLO2).

Figure 10-2 Installation with bypass contactor

1	Control voltage
2	Remote control inputs
3	Motor thermistor input
4	RTD/PT100 input
5	24 Vdc output
6	Relay outputs
7	Analog output
8	Three-phase supply
9	Motor terminals
KM1	Bypass contactor
F1	Semiconductor fuses (optional)
S1	Start contact
S2	Stop contact
S3	Reset contact
COM1, RLO1	Relay output A
COM2, RLO2	Run relay output
COM3, RLC3, RLO3	Relay output B
COM4, RLC4, RLO4	Relay output C
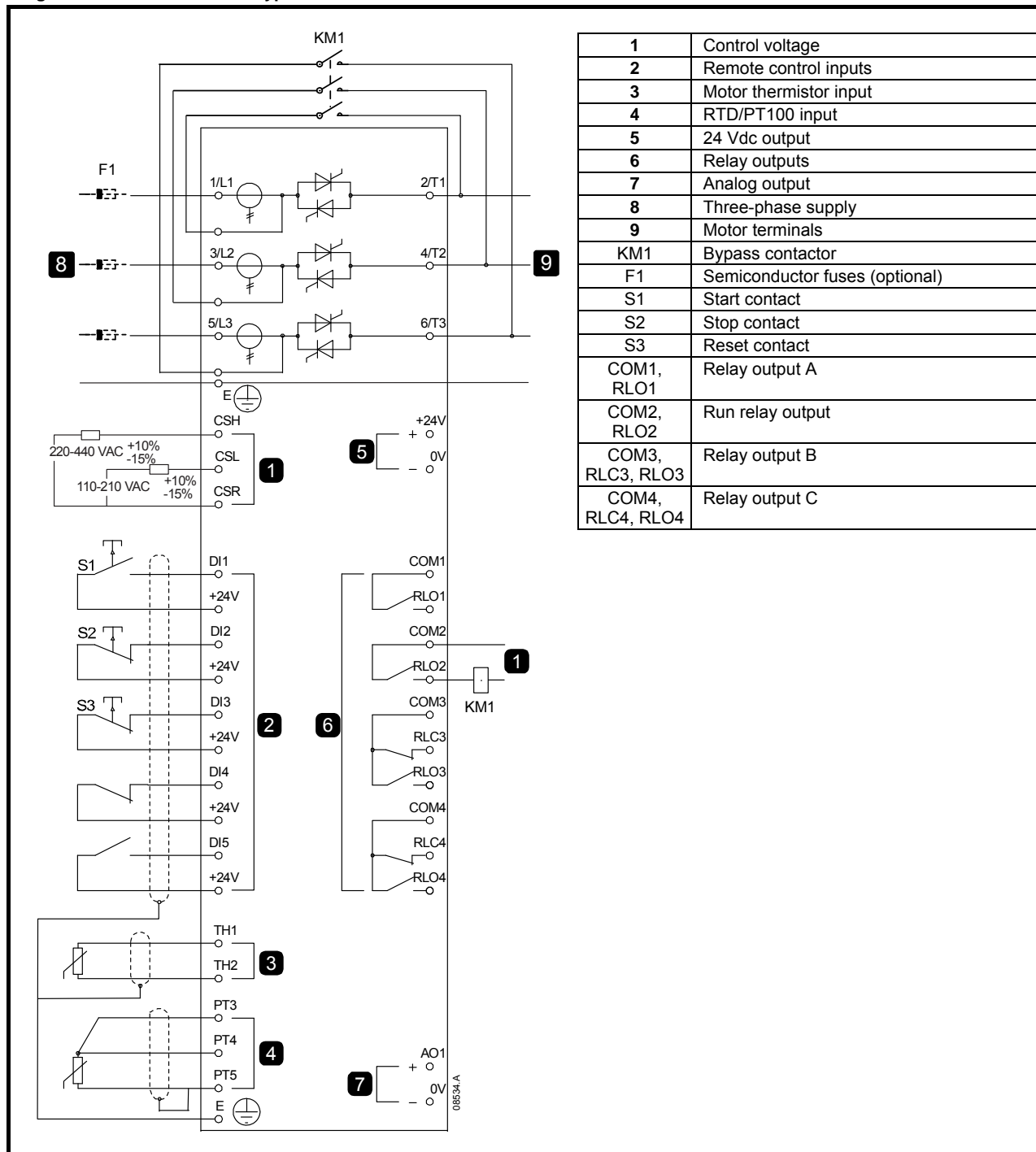
Parameter settings:

- No special settings required.

10.3   Emergency run operation

In normal operation the Digistart IS is controlled via a remote two wire signal (terminals DI2, +24V).

Emergency Run is controlled by a two wire circuit connected to Input A (terminals DI4, +24V). Closing Input A causes the Digistart IS to run the motor and ignore certain trip conditions.

Figure 10-3 Emergency run operation

1	Control voltage
2	Remote control inputs
3	Motor thermistor input
4	RTD/PT100 input
5	24 Vdc output
6	Relay outputs
7	Analog output
8	Three-phase supply
9	Motor terminals
S1	Start/stop contact
S2	Reset contact
S3	Emergency Run Contact
F1	Semiconductor fuses (optional)
COM1, RLO1	Relay output A
COM2, RLO2	Run relay output
COM3, RLC3, RLO3	Relay output B
COM4, RLC4, RLO4	Relay output C
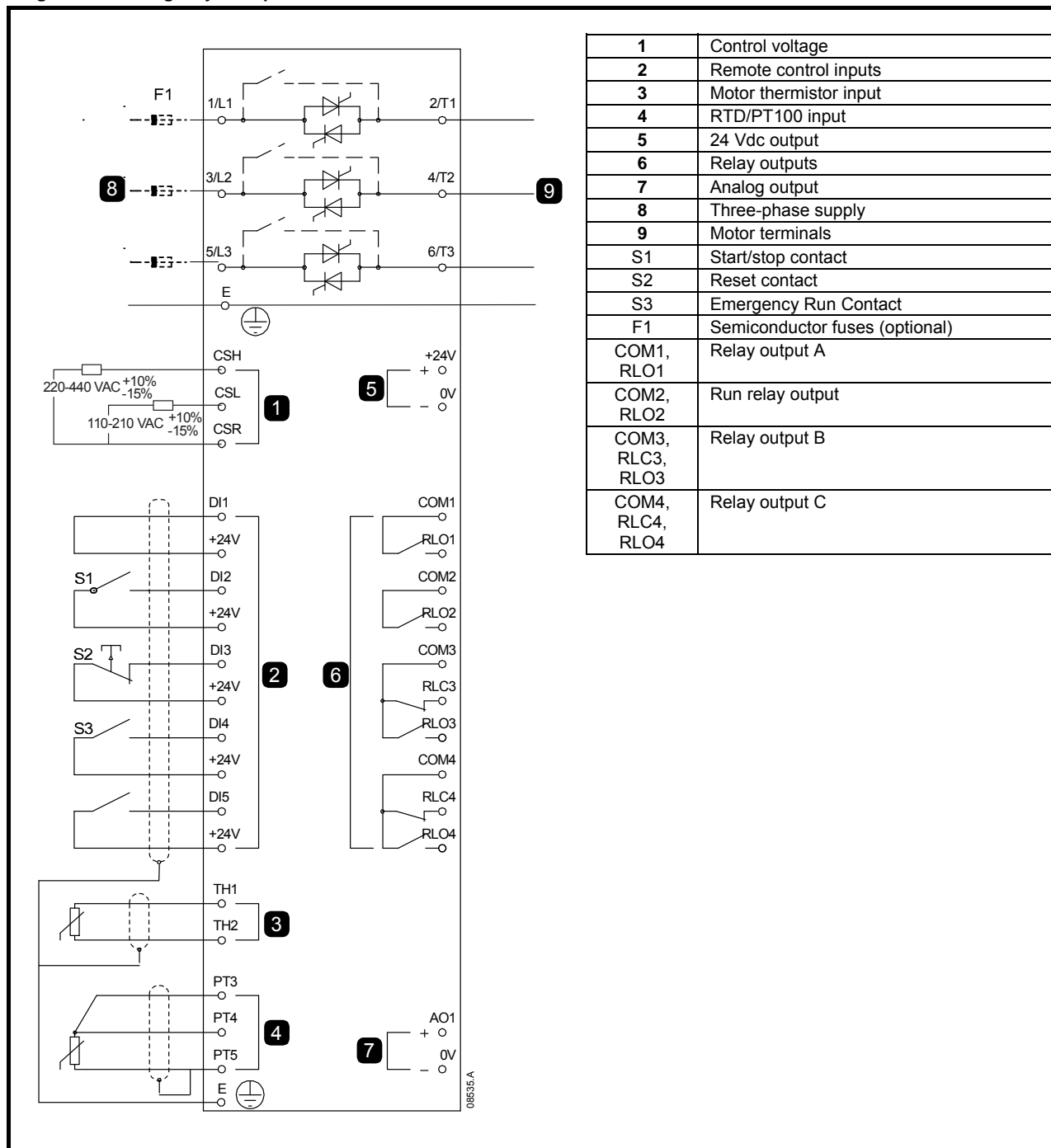
Parameter settings:

- Pr **3A** *Input A Function*
  - Select 'Emergency Run' - assigns Input A for Emergency Run function.
- Pr **15B** *Emergency Run*
  - Select 'Enable' - Enables Emergency Run mode

10.4 Auxiliary trip circuit

In normal operation the Digistart IS is controlled via a remote two wire signal (terminals DI2, +24V).

Input A (terminals DI4, +24V) is connected to an external trip circuit (such as a low pressure alarm switch for a pumping system). When the external circuit activates, the soft starter trips, which stops motor.

Figure 10-4 Auxiliary trip circuit

1	Control voltage
2	Remote control inputs
3	Motor thermistor input
4	RTD/PT100 input
5	24 Vdc output
6	Relay outputs
7	Analog output
8	Three-phase supply
9	Motor terminals
S1	Start/stop contact
S2	Reset contact
S3	Auxiliary trip contact
F1	Semiconductor fuses (optional)
COM1, RLO1	Relay output A
COM2, RLO2	Run relay output
COM3, RLC3, RLO3	Relay output B
COM4, RLC4, RLO4	Relay output C
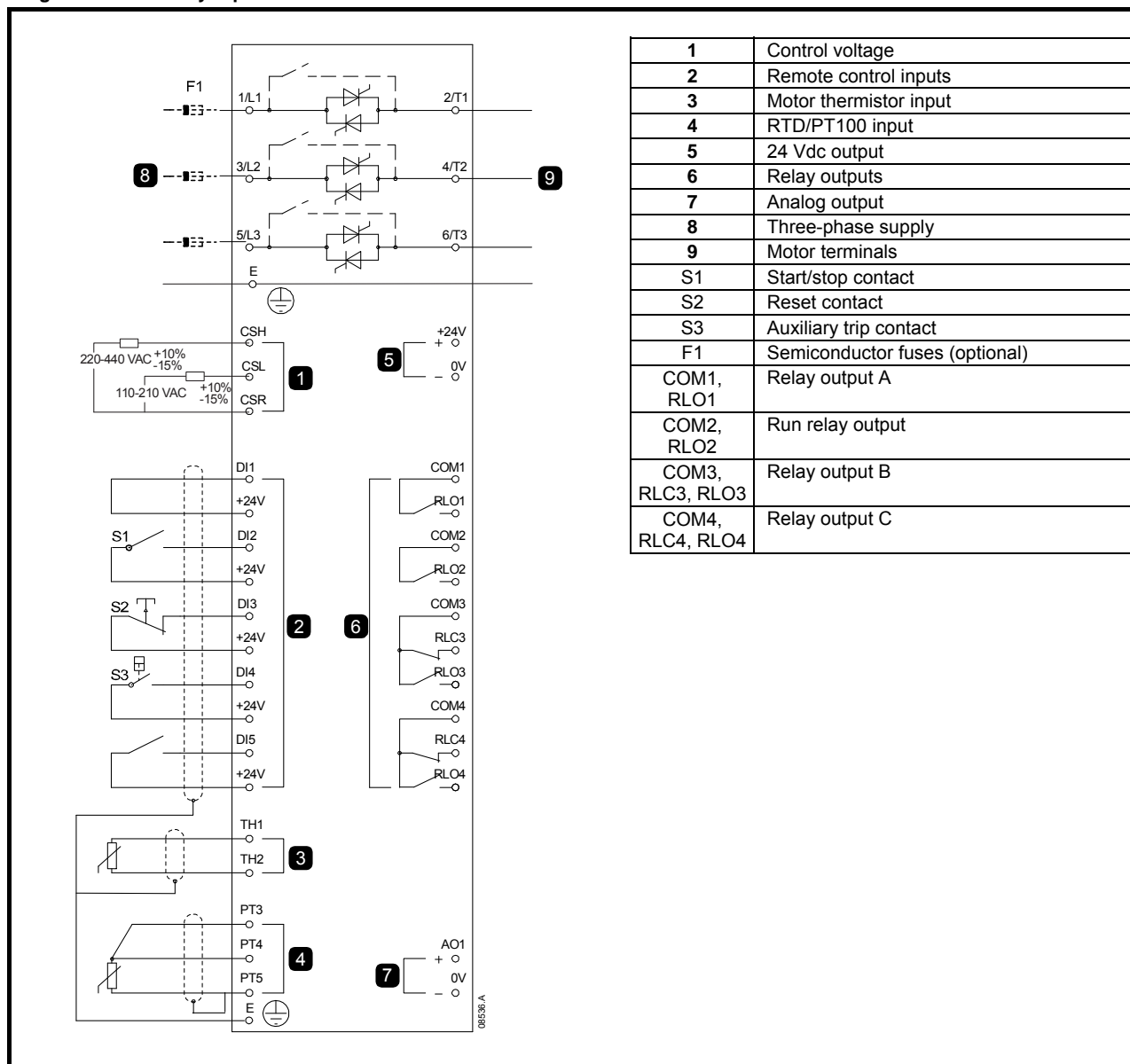
Parameter settings:

- Pr **3A** *Input A Function*
  - Select 'Input Trip (N/O)'. Assigns the Input A to Auxiliary Trip (N/O) function)
- Pr **3B** *Input A Name*
  - Select a name e.g. Low Pressure. Assigns a name to Input A.
- Pr **3C** *Input A Trip*
  - Set as required. For example, Run Only limits the input trip to when the soft starter is running only.
- Pr **3E** *Input A Trip Delay*
  - Set as required. Sets a delay between the input activating and the soft starter tripping.
- Pr **3D** *Input A Initial Delay*
  - Set at around 120 seconds. Limits operation of the input trip to 120 seconds after the start signal. This allows time for pressure to build up in the piping before the low pressure input becomes active.

10.5   Soft braking

For applications with a variable load, the Digistart IS can be configured for soft braking.

In this application the Digistart IS is employed with forward run and braking contactors. When the Digistart IS receives a start signal (pushbutton S1), it closes the forward run contactor (KM1) and controls the motor according to the programmed primary motor settings.

When the Digistart IS receives a stop signal (pushbutton S2), it opens the forward run contactor (KM1) and closes the braking contactor (KM2) after a delay of approximately 2-3 seconds (KT1). KA3 is also closed to activate the secondary motor settings, which should be user programmed for the desired stopping performance characteristics.

When motor speed approaches zero, the shaft rotation sensor (A2) stops the soft starter and opens the braking contactor (KM2).

Figure 10-5 Soft braking
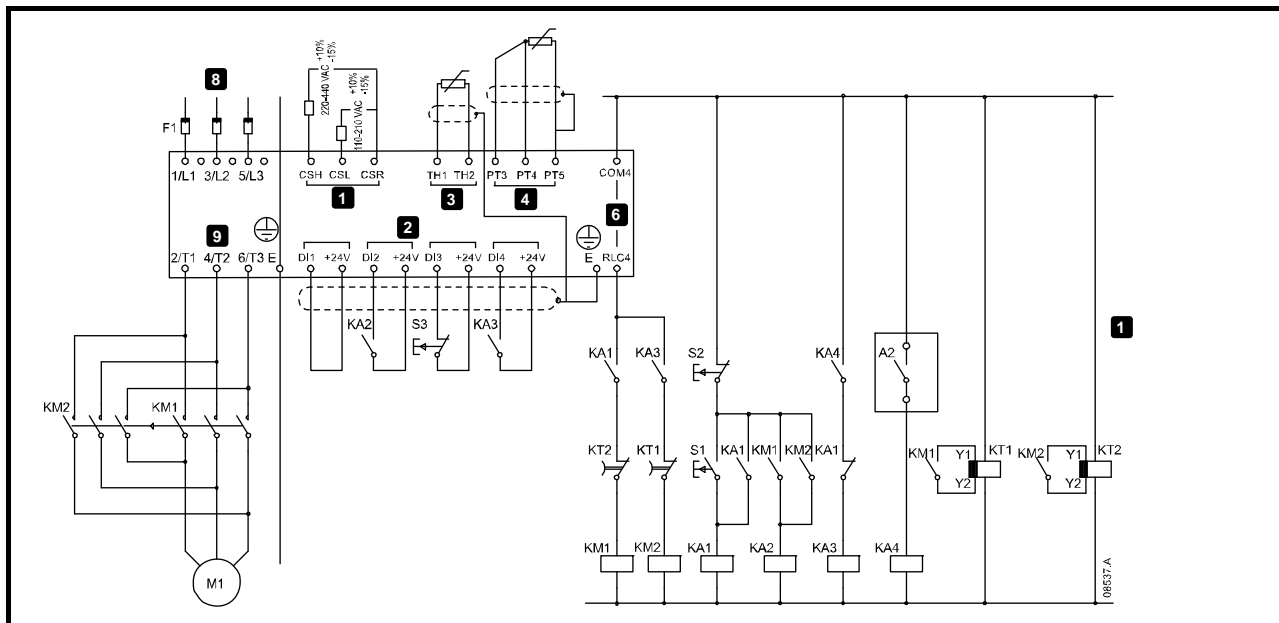
1	Control voltage	KA1	Run relay
2	Remote control inputs	KA2	Start relay
3	Motor thermistor input	KA3	Brake relay
4	RTD/PT100 input	KA4	Rotation sensing relay
6	Relay outputs	KM1	Line contactor (Run)
8	Three-phase supply	KM2	Line contactor (Brake)
9	Motor terminals	KT1	Run delay timer
A2	Shaft rotation sensor	KT2	Brake delay timer
F2	Semiconductor fuses (optional)	S1	Start contact
		S2	Stop contact
		S3	Reset contact

Parameter settings:

- Pr **3A** *Input A Function*
    - Select 'Motor Set Select' - assigns Input A for Motor set selection.
    - Set starting performance characteristics using the primary motor set.
    - Set braking performance characteristics using the secondary motor settings.
- Pr **4G** *Relay C Function*
    - Select 'Trip' - assigns Trip function to Relay Output C.

NOTE   If the Digistart IS trips on supply frequency (Pr **16H** *Frequency*) when the braking contactor KM2 opens, modify the frequency protection settings.

10.6 Two-speed motor

The Digistart IS can be configured for control of dual speed Dahlander type motors, using a high speed contactor (KM1), low speed contactor (KM2) and a star contactor (KM3).

NOTE Pole Amplitude Modulated (PAM) motors alter the speed by effectively changing the stator frequency using external winding configuration. Soft starters are not suitable for use with this type of two-speed motor.

When the soft starter receives a high speed start signal, it closes the high speed contactor (KM1) and star contactor (KM3), then controls the motor according to the primary motor settings.

When the soft starter receives a low speed start signal, it closes the low speed contactor (KM2). This closes Input A and the Digistart IS controls the motor according to the secondary motor settings.

Figure 10-6 Two-speed motor

1	Control voltage
2	Remote control inputs
3	Motor thermistor input
4	RTD/PT100 input
6	Relay outputs
8	Three-phase supply
9	Motor terminals
10	Remote low speed start input
11	Remote high speed start input
F2	Semiconductor fuses (optional)
KA1	Remote start relay (low speed)
KA2	Remote start relay (high speed)
KM1	Line contactor (high speed)
KM2	Line contactor (low speed)
KM3	Star contactor (high speed)
S1	Reset contact
COM4, RLC4, RLO4	Relay output C

NOTE Contactors KM2 and KM3 must be mechanically interlocked.

Parameter settings:

- Pr **3A** *Input A Function*
    - Select 'Motor Set Select' - assigns Input A for Motor set selection.
    - Set high speed performance characteristics using the primary motor settings.
    - Set low speed performance characteristics using the secondary motor settings.
- Pr **3K** *Input C Function*
    - Select 'Trip' - assigns Trip function to Relay Output C

NOTE If the Digistart IS trips on supply frequency (Pr **16H** *Frequency*) when the high-speed start signal (11) is removed, modify the frequency protection settings.

10.7 Slip-ring motor

The Digistart IS can be used to control a slip-ring motor, using rotor resistance.

Figure 10-7 Slip-ring motor

1	Control voltage
2	Remote control inputs
3	Motor thermistor input
4	RTD/PT100 input
5	24 Vdc output
6	Relay outputs
7	Analog output
8	Three-phase supply
9	Slip-ring induction motor
KM1	Changeover contactor
F1	Semiconductor fuses (optional)
S1	Start/stop contact
S2	Reset contact
R1	Rotor resistance (external)
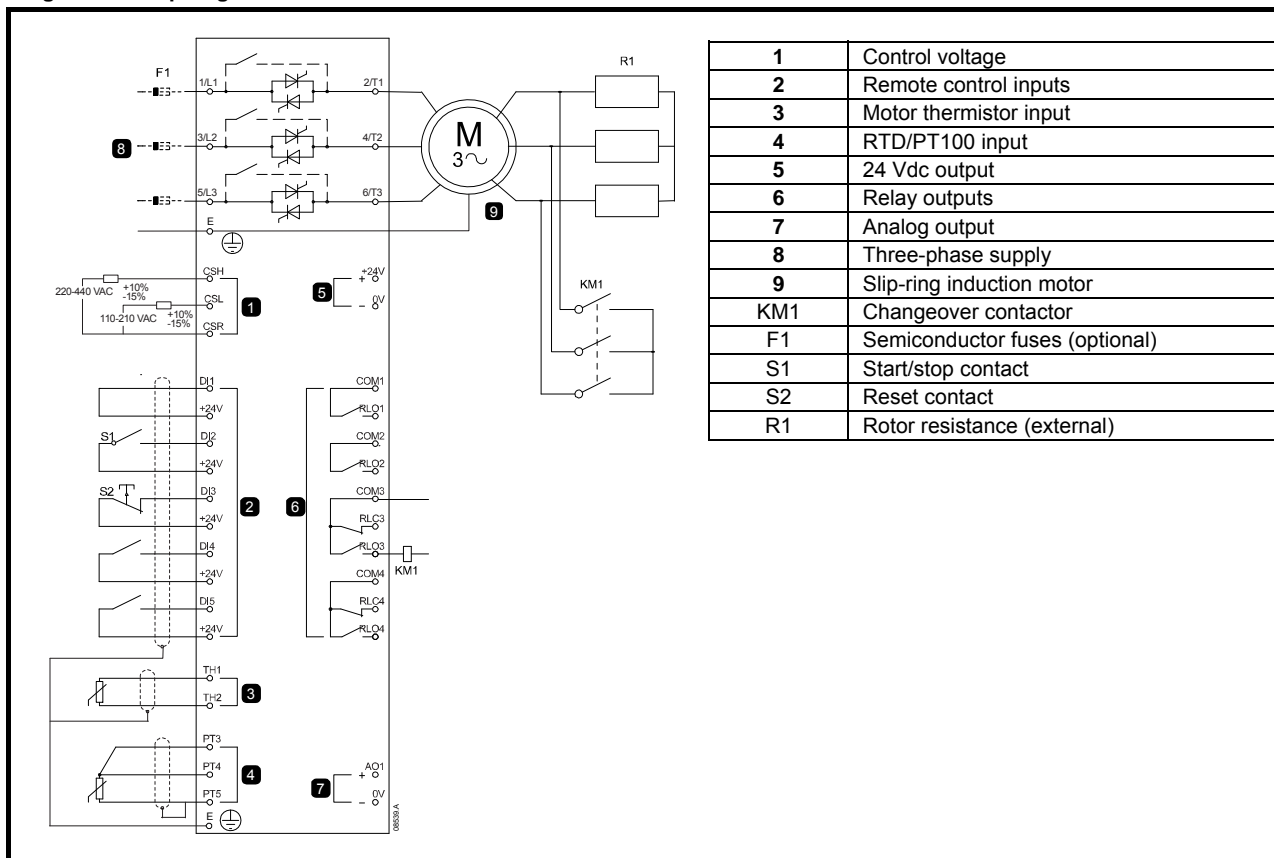
Parameter settings:

- Pr **4D** *Relay B Action*
  - Select 'Changeover Contactor'
- Pr **4E** *Relay B On Delay*
  - Set this to the maximum time (5m:00s).
- Pr **13A** *Motor Data-1 Ramp*
  - Select 'Dual Ramp' (for slip-ring induction motor control)
- Pr **13D** *Changeover Time*
  - Default setting is 150 milliseconds. Set this to a value just greater than the changeover contactor (KM1) pole closing time.
- Pr **13C** *Slip Ring Retard*
  - Default setting is 50%. Set this parameter to a value which is high enough to cause the motor to instantly accelerate once the rotor resistance (R1) has been bridged out and low enough to avoid a motor current pulse.

NOTE   For this installation to function correctly, only use the primary motor settings. Only use the constant current start method (Pr **2A** *Start Mode*).

11. Technical Data

Supply

Mains voltage (L1, L2, L3)

    ISx4xxxx .... 200 Vac to 440 Vac (± 10%)

    ISx6xxxx .... 380 Vac to 600 Vac (± 10%) (in-line or inside delta connection)

    ISx6xxxx .... 380 Vac to 690 Vac (± 10%) (grounded star supply system only)

Control voltage (CSH, CSL, CSR) .... 110 to 210 Vac or 220 to 440 Vac (+ 10% / -15%), 1 A

    Recommended fuse .... 1 A continuous (30 A max, 10 A typical half cycle inrush)

Mains frequency .... 45 Hz to 66 Hz

Rated insulation voltage to ground .... 600 Vac

Rated impulse withstand voltage .... 4 kV

Form designation .... Bypassed or continuous, semiconductor motor starter form 1

Short circuit capability

Coordination with semiconductor fuses .... Type 2

Coordination with HRC fuses... Type 1

    IS1x0023B to IS1x0105B .... prospective current 10 kA

    IS2x0145B to IS2x0220B .... prospective current 18 kA

    IS3x0255N to IS4x0930N .... prospective current 85 kA

    IS561200N to IS561600N .... prospective current 100 kA

Electromagnetic capability (compliant with EU Directive 89/336/EEC)

EMC Emissions... IEC 60947-4-2 Class B

EMC Immunity .... IEC 60947-4-2

Inputs

Input rating .... Active 24 Vdc, 8 mA approx

Start (DI1, +24V) .... Normally open

Stop (DI2, +24V) .... Normally closed

Reset (DI3, +24V) .... Normally closed

Programmable inputs

    Input A (DI4, +24V) .... Normally open

    Input B (DI5, +24V) .... Normally open

Motor thermistor (TH1, TH2) .... Trip >3.6 kΩ, reset <1.6kΩ

PT100 RTD (PT3, PT4, PT5) .... Accuracy 0 to 100 °C ± 0.5 °C, 100 °C to 150 °C ± 2 °C, -20 to 0 °C ± 2°C

Outputs

Relay outputs .... 10A @ 250 Vac resistive, 5A @ 250 Vac AC15 pf 0.3

Run relay (COM2, RLO2) .... Normally open

Programmable outputs

    Relay A (COM1, RLO1) .... Normally open

    Relay B (COM3, RLC3, RLO3) .... Changeover

    Relay C (COM4, RLC4, RLO4) .... Changeover

Analog output (AO1, 0V) .... 0-20 mA or 4-20 mA (selectable)

    Maximum load .... 600 Ω (12 Vdc @ 20 mA)

    Accuracy .... ± 5%

24 Vdc output (+24V, 0V) Maximum load .... 200 mA

    Accuracy .... ± 10%

Environmental

Protection

    IS1x0023B to IS1x0105B IP20

    IS2x0145B to IS561600N IP00

    Keypad (when installed with remote mounting kit) .... IP65 & NEMA12

Operating temperature .... -10 ˚C to 60 ˚C, above 40 ˚C with derating

Storage temperature .... - 25 ˚C to + 60 ˚C

Operating altitude.. 0 - 1000 m, above 1000 m with derating

Humidity .... 5% to 95% Relative Humidity

Pollution degree .... Pollution Degree 3

Vibration .... IEC 60068-2-6

Heat dissipation

During start .... 4.5 watts per ampere
During run
    IS1x0023B to IS1x0053B .... ≤ 39 watts approx
    IS1x0076B to IS1x0105B .... ≤ 51 watts approx
    IS2x0145B to IS2x0220B .... ≤ 120 watts approx
During run
    IS3x0255N to IS4x0930N .... 4.5 watts per ampere approx
    IS561200N to IS561600N .... 4.5 watts per ampere approx

Certification

UL/ C-UL .... UL 508
    IS1x0023B to IS1x0105B ....IP20 & NEMA1, UL Indoor Type 1
    IS2x0145B to IS561600N ....IP00, UL Indoor Open Type
CE   .... IEC 60947-4-2
C✓   .... IEC 60947-4-2
RoHS .... Compliant with EU Directive 2002/95/EC

12. Maintenance

NOTE   The Digistart IS soft starter is not user serviceable. The unit should only be serviced by authorised service personnel. Unauthorised tampering with the unit will void the product warranty.

- Before carrying out any work, disconnect and lock the starter's power supply and wait 2 minutes to ensure that the capacitors have discharged.
- When the starter trips, fatal residual voltages may remain at the output terminals and in the starter.
- During maintenance operations performed with the starter switched on, the operator must stand on an insulated surface which is not connected to ground.
- During work on a motor or its power supply cables, ensure that the power supply of the corresponding starter is disconnected and locked.
- Protective covers must remain in place during tests.

There are very few maintenance and repair operations for the user to perform on Digistart IS soft starters. Regular servicing operations and simple methods for checking that the starter is operating correctly are described below.

12.1 Care

Printed circuits and internal components do not normally require any maintenance. Contact your local distributor or the nearest approved repair company in the event of a problem,

⚠️ CAUTION   Do not dismantle the printed circuits while the starter is still under warranty. Unauthorised tampering with the unit will void the product warranty.

Do not touch the integrated circuits or the microprocessor either with your fingers or with materials which are charged or live. Ground yourself, as well as the workbench or the soldering iron, while performing any work on the circuits.

From time to time, check that the power circuits are correctly tightened.

12.2 Measuring the motor current

The current drawn by the motor and the starter input current can be measured approximately using a conventional moving coil ammeter.

12.3 Measuring the input and output power

The starter input and output power can be measured using an electrodynamic instrument.

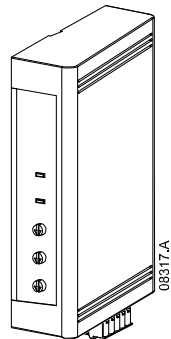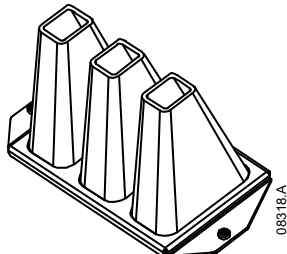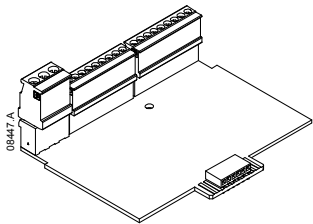## 12.4 Spare parts list

Please consult Control Techniques.

12.5 Exchanging products

⚠️ CAUTION   Products must be returned in their original packaging or, if this is not possible, in similar packaging, to prevent their being damaged. Otherwise, replacement under warranty could be refused.

13. Options

Table 13-1 Digistart IS options

Option name	Function	Picture
Digistart - DeviceNet Interface	Fieldbus communications modules	
Digistart - Modbus Interface		
Digistart - Profibus Interface		
DSSoft	DSSoft can be used with Control Techniques soft starters to provide the following functionality for networks of up to 99 soft starters: • Operational control (Start, Stop, Reset, Quick Stop) • Starter status monitoring (Ready, Starting, Running, Stopping, Tripped) • Performance monitoring (motor current, motor temperature) To use DSSoft with the Digistart IS, the soft starter must be fitted with a Modbus Module.	
Digistart IS - Finger Guard	Finger guards may be specified for personnel safety and can be used on Digistart IS soft starter models 0145B to 0220B. Finger guards fit over the soft starter terminals to prevent accidental contact with live terminals. Finger guards provide IP20 protection.	
Digistart IS - I/O Expansion	The input/output expansion card provides the following additional inputs and outputs: • 2 x inputs • 3 x output relays • 1 x analog input • 1 x analog output	
Digistart IS - RTD/PT100 and Ground Fault Card	The RTD/PT100 and ground fault protection card provides the following additional inputs: • 6 x PT100 RTD inputs • 1 x ground fault input To use ground fault protection a 1000:1, 5 VA current transformer is also required.	
Digistart IS - Volt Measure Card	The voltage measurement card provides additional functionality for voltage monitoring and protection.	
Digistart IS - Keypad Digistart IS - Keypad Mounting Kit	Allows remote mounting of the keypad up to 3 m away from the soft starter. Packing list: 1 x cable, 1 x gasket, 4 x screw M3, 4 x flat washer M3, 4 x spring washer M3, 4 x nut M3, 2 x jack screw, 1 x instructions.	

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