Soft Starters and Energy Optimising Soft Starters

Installation and Operation of the 6 to 44 Amp Cfe StartMaster IP55

The Digital Electronic Starter that provides the Complete Start Solution

Concept

This Cfe range of Fairford SoftStarters has been introduced to provide the complete starter solution, for direct replacement of star/delta and DOL starters. Constructed in a rugged IP55 box, this Soft Starter gives the customer complete flexibility in the siting of the box. Only three wires in and three wires out via IP55 gland entry points are required for the Cfe to be ready for operation.

Inside the box is a soft start, a main contactor, a bypass contactor and an adjustable thermal overload. The soft start is internally bypassed as soon as the start is finished, so that internal heating within the box is minimised. One other feature of the Cfe is the choice of 10 pre-programmed start/stop ramp profiles that may be selected via the Application Selector switch on the inside of the unit.

Soft Start Performance

Operation of the Cfe

The customer must first set the start/stop profile that he wishes to use (see ***Internal Block Diagram***); the customer must wire in the unit correctly (see ***Internal Wiring Diagram***); the isolator (largest switch on the outside of the box) must then be turned to '**1 ON**'; to start the unit the **GREEN** button must be pressed for at least ¼ second; to soft stop the unit the **RED** button must be pressed for at least ¼ second.

Soft Start Process

The Cfe controls the torque produced by the motor from an initial low value to the maximum. Following the switching of the 3-phase supply to the Cfe there is a very short delay, typically 100mS, after which the pedestal voltage is applied to the motor to achieve breakaway torque (**note:** the value of the pedestal voltage varies with the application selected by the user - see the 'Application Selector' on the following pages). The soft starter output voltage is then gradually increased to the maximum. The time taken for the pedestal voltage to rise to the maximum voltage is the ramp time (or start time) and has a range of 1 to 15 seconds depending on the application selected.

Full Voltage Operation

When the start is completed and full voltage is reached, the bypass contactor is closed, bypassing the soft starter internally. The Cfe will remain in this bypassed state until the Stop button is pressed or the 3-phase power is removed from the unit.

Soft Stop Operation

The soft stop prevents sudden deceleration of the motor at switch-off. It can be useful in various mechanical handling and hydraulic pumping operations to reduce shock or to reduce fluid hammer in pipelines. Where the selected application includes a soft-stop time, it is initiated by pressing the Stop button. The soft starter will ramp down the voltage over a pre-specified time to a pre-specified voltage pedestal, at which point the unit will switch-off.

Kick Start Function

Some applications require a very high breakaway torque for a short time. Application setting 3 gives a 'kick' of 50% of full load torque for less than half a second. The torque is then reduced to a quarter and the starting ramp is completed as normal.

Protection Features

Phase Loss Protection

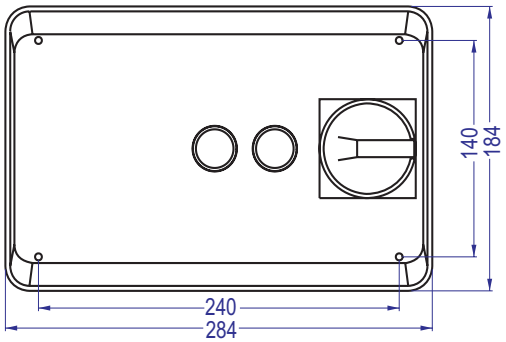
The Soft Starter will detect a phase loss in the 3-phase supply to the unit. A single phase loss will only be detected when the start button is pressed but a multiple loss can be detected at any time. When this is detected, the Soft Starter is disabled and the motor is isolated from the three-phase supply. The Soft Starter must be reset by pressing the Stop button, or by disconnecting and reconnecting the 3-phase supply.

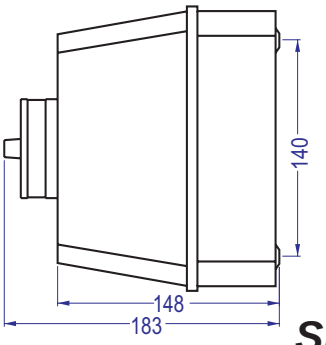
Overload Protection

The Cfe range is fitted with a suitably rated Class 10A thermal overload.

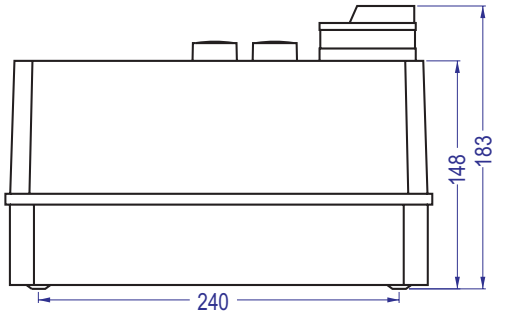
Dimensions and Mounting Centres

SIZE 1 - up to 22 Amps

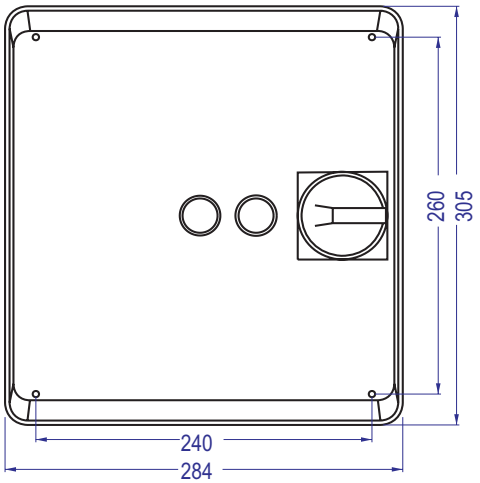


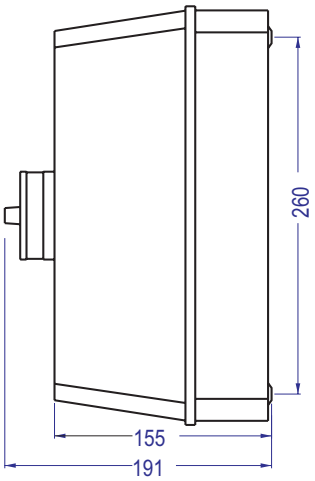


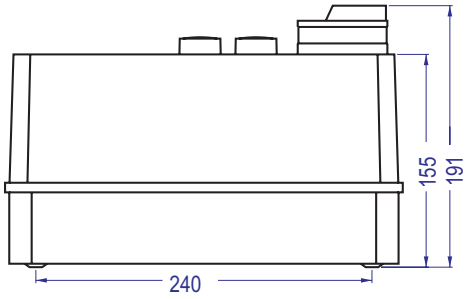
All dimensions in mm. Allow clearance of 75mm all around for airflow. Mounting holes are M4 clearance



SIZE 2 - 30 and 44 Amps



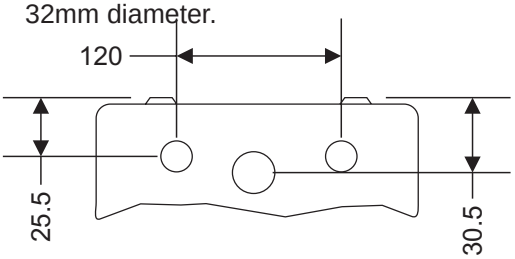




All dimensions in mm. Allow clearance of 75mm all around for airflow. Mounting holes are M4 clearance

Conduit Entries

For both the size1 and the size 2 there are three knockouts along the 'top' and the 'bottom' sides of the base. There are four knockouts with a 25mm diameter, and two with a 32mm diameter.



SERVICING

WARNING

NEVER CARRY OUT ANY WORK ON ELECTRICAL OR MECHANICAL EQUIPMENT BEFORE ISOLATING ALL POWER SUPPLIES. UNDER CERTAIN OPERATING CONDITIONS LIVE OUTPUTS MAY BE PRESENT WITHOUT MOTOR ROTATION

Unit Fails To Start

May be due to a phase loss in the system. Check the connections from the supply to the Cfe and from the Cfe to the motor. The Cfe is not phase rotation sensitive.

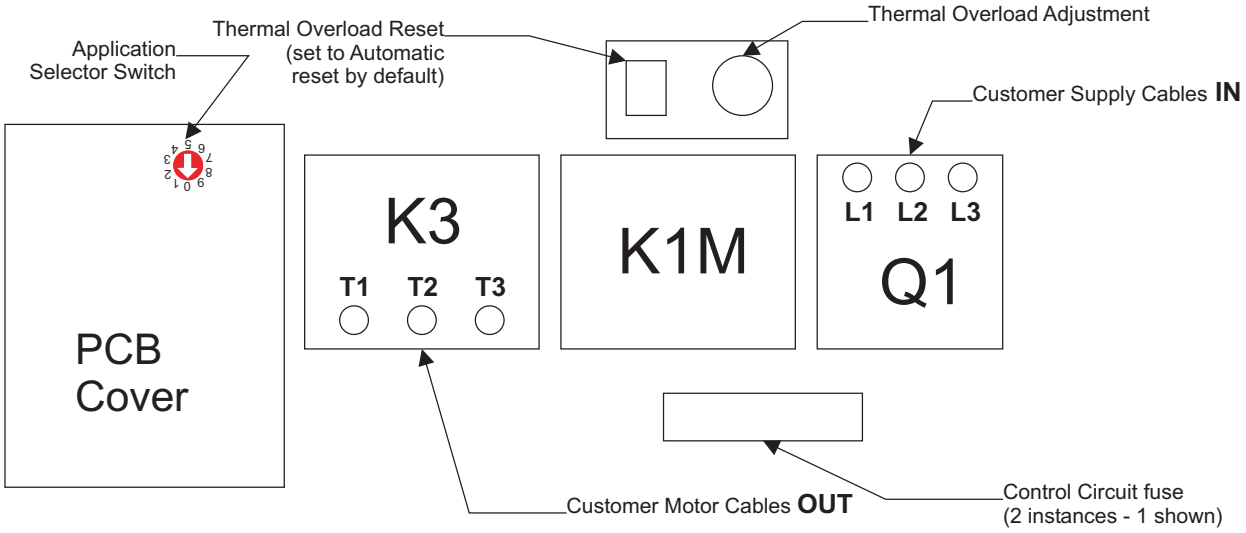
Unit Starts but then Stops

The most likely cause is operation of the shearpin trip due to excessive starting currents. The shearpin is preset at 5 x the current rating of the unit (unless the unit is under 16A in which case the shearpin is set at 80A). Assuming that there is no mechanical problem, choosing an application setting with a longer start time may help. If the problem persists, a unit with a higher current rating may be required.

Unit Starts and Runs for some Time before Stopping

The most probable cause is a thermal overload trip. This is may be caused by a mechanical problem which, when rectified, will result in correct operation. The Cfe has a thermal overload incorporated internally, which is used to protect the motor. Should this overload trip it will automatically reset when it has cooled to normal operating temperature, and at this point the Cfe will start when the GREEN start button is pushed. If the customer tries to start the unit whilst the thermal overload is still cooling, the unit will not start.

Internal Block Diagram



Application Selector Switch:

The Application Selector switch (shown above), enables the customer to select from one of ten pre-programmed start/stop ramp profiles, details of which are shown in the table to the right.

Switch Setting	Start Time seconds	Application	Pedestal Voltage % line volts	Stop Time seconds
0	5	Standard	30%	10
1	5	High Torque	60%	5
2	5	Pump	40%	15
3	5	Pump Kick -Start	50%	15
4	2	Light Conveyer	40%	10
5	15	Heavy Conveyer	60%	10
6	10	Low Inertia Fan	30%	0
7	15	High Inertia Fan	50%	0
8	1	Recip Compressor	50%	0
9	10	Screw Compressor	40%	0

K3, the Bypass Contactor

The block labelled K3 is where the customer connects his output wiring.

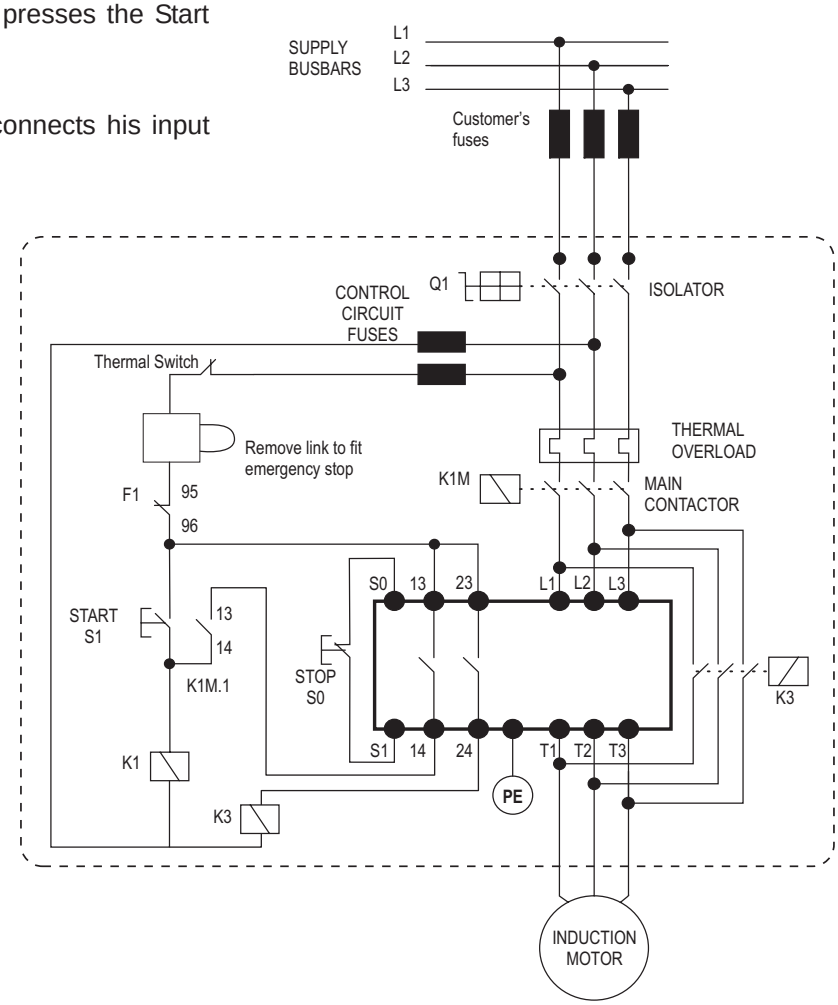
K1M, the Main Contactor and Thermal Overload

K1M is the main contactor for the unit and the thermal overload is attached to this contactor. The thermal overload is set by default to automatic reset (it can be set to manual reset in the normal way). If the thermal overload should trip (whilst in automatic mode) the customer will not be able to restart the unit until the overload has cooled. Once the overload has cooled, it will automatically reset and the unit will start when the customer presses the Start button.

Q1, the Isolator

This block labelled Q1 is where the customer connects his input wiring.

Internal Wiring Diagram



NOTES ON THE CIRCUIT

Fuse selection: Semiconductor fuses (for short circuit Type 2 co-ordination) must be as shown in the fuse selection table overleaf. HRC protection fuses should be rated to allow for the extended start duration.

Correction capacitors: Power factor correction capacitors must NOT be positioned on the output of the Cfe.

Motor cable length: The cable length between the Cfe and the Motor must not exceed 100 meters.

Broken line shows wiring contained within Cfe StartMaster 55

Fuse Selection, Heat Generated and Rating Index

Model name; 400V range	Ie Amps rms	Motor kW @400V	Index Ratings	Fuse-Amps	Fuse manufacturer/Type Options		
					Ferraz	Bussmann	SIBA
Cfe6 IP55	6	3	AC-53b: 3-12: 1188	50	6,9 URB 00 D08L 050	-	20 189 20-50
Cfe9 IP55	9	4	AC-53b: 3-12: 1188	50	6,9 URB 00 D08L 050 or 6,6 URD 30 D08 A 0050	-	20 189 20-50
Cfe13 IP55	13	6.3	AC-53b: 3-12: 1188	50	6,9 URB 00 D08L 050 or 6,6 URD 30 D08 A 0050	-	20 189 20-50
Cfe16 IP55	16	7.5	AC-53b: 3-12: 1188	63	6,9 URB 00 D08L 063 or 6,6 URD 30 D08 A 0063	170M3010 or 170M3110	20 189 20-63
Cfe22 IP55	22	11	AC-53b: 3-12: 1188	80	6,9 URB 00 D08L 080 or 6,6 URD 30 D08 A 0080	170M3011 or 170M3111	20 189 20-80
Cfe30 IP55	30	16	AC-53b: 3-12: 1188	100	6,9 URB 00 D08L 100 or 6,6 URD 30 D08 A 0100	170M3012 or 170M3112	20 189 20-100
Cfe44 IP55	44	22	AC-53b: 3-12: 1188	160	6,9 URB 00 D08L 160 or 6,6 URD 30 D08 A 0160	170M3014 or 170M3114	20 189 20-160

Operational Voltage (Ue) 400VAC rms
3-Phase (-15% +10%).
Rated Frequency 50/60Hz +/- 2Hz.
Form Designation Form 1 (See Note 1).
Auxiliary Circuits Input - none, Output - none.
Soft Stop Control Set an application with a stop time, and press the stop button.
Control Supply supplied internally.
Application Selection 10 position rotary switch.
Start Times 1 to 15 seconds.
Stop Times 0 to 15 seconds.
Start Duty 4 x FLC for 6 seconds
3 x FLC for 12 seconds.
2 x FLC for 26 seconds.

Shearpin Cutoff Level
Units **>** 7.5kW: currents in excess of 5 x FLC for 500ms.
Units **<=** 7.5kW: currents in excess of 80A for 500ms.

Starts / Hour
3 starts per hour, starting interval 20 min. Allow a minimum of 2 minutes cooling time before starting.

Power Terminals:
Input: L1, L2 & L3.
Output: T1, T2 & T3.

Max Cable Sizes:
=< 11kW = 4mm^2;
> 11kW = 10mm^2.

Earth Terminal Internal M5 stud.

Rated Impulse withstand Voltage (Uimp) 4.0kV
Rated Insulation Voltage (Ui) 400V
Pollution Degree 3
Rated Short Circuit Current (Iq) Note 4 5kA
Type of Short Circuit Co-ordination See Note 3
Ambient Temperature Min. 0°C, Max. 40°C.
Transport and Storage -25°C to +60°C max (+70ºC for < 24hrs).
Altitude Not exceeding 1000m. Above 1000m derate linearly by 1% of unit FLC per 100m to a max. altitude of 2000m.
Humidity Max. 85% non-condensing, not exceeding 50% at 40°C.
IP Rating IP55
Design Standards IEC 60947-4-2; EN 60947-4-2 "AC Semiconductor Motor Controllers and Starters"

Notes:
1. Built-in isolator, main contactor and thermal overload in series with a bypassed semiconductor motor controller.
2. Refer to the table at the top of the page.
3. Type 2 co-ordination when protected by semiconductor fuses (see note 2).
4. When protected by recommended fuse.

EMC EMISSION AND IMMUNITY LEVELS			
E.M. phenomena	**Basic Standard**	**Port**	**Level**
ESD immunity	IEC 61000-4-2	Enclosure	4kV contactor 8kV air discharge
Radio Frequency immunity	IEC 61000-4-6	Power Ports	140dBuV over 0.15-80MHz
	IEC 61000-4-3	Enclosure	10V/m over 80 - 1000MHz
Fast Transient immunity	IEC 61000-4-4	Power Ports	2kV/5kHz
		Control Ports	See Note 1
Surge immunity	IEC 61000-4-5	Power Ports	2kV line to gnd 1kV line to line
		Control Ports	See Note 1
Conducted RF emissions	EN 55011	Power Ports	Class B
Radiated RF emissions	EN 55011	Enclosure	Class B

WARNING

The owner, installer and user of the Cfe is responsible for the correct installation and use, and must ensure that only qualified personnel install the Cfe and the installation, operation and maintenance of the unit complies with the relevant Codes of Practice, Regulations and Statutory Requirements. The Manufacturer or his agent do not assume any liability, expressed or implied, for any consequence resulting from inappropriate, negligent or incorrect installation, application, use or adjustment of the product or circuit design, or from the mismatch of the unit to a motor. To prevent an electrical shock hazard the Cfe must be connected to a safety earth. The unit is not designed for use in hazardous areas. Its use in such an area may invalidate the hazardous area certification.

Fairford Electronics Ltd.,
Coombe Works,
Derby Road,
Kingsbridge,
Devon, TQ7 1JL, UK

Contact us on:
Tel: +44 (0)1548 857494
Fax: +44 (0)1548 853118
email: sales@fairford.co.uk
web: www.fairford.co.uk

Copyright ©2007 Fairford Electronics
Document No. FD8A4104 M-8A41-F