

EnviroStart™ I-Limit™ Current Limit Controller Installation & Commissioning Guide

Version 2.2 October 2017



EnviroStart™ I-Limit Control

IMPORTANT WARNING

Failure to read and comply with this manual may result in damage to the EnviroStart Unit and driven equipment and may render the warranty invalid.

- 1. Only a competent electrician should carry out the electrical installation.**
- 2. EnviroStart must be earthed with an earthing conductor connected to the earthing terminal.**
- 3. Before installation check the CT Rating is consistent with the running current of the circuit into which the I-Limit is being fitted and has a xxx/5 ratio.**
- 4. Internal components and areas of the control circuit boards, (except the isolated I/O terminals), can be at mains potential when the EnviroStart I-Limit is connected to a supply. The voltage is extremely dangerous and may cause death or severe injury if you come into contact with it.**
- 5. The control I/O terminals are isolated from mains potential but the adjacent relay outputs may have dangerous voltages present even if the mains are not connected.**
- 6. Do not make any connections when the EnviroStart I-Limit is connected to a live supply.**
- 7. Do not make voltage withstand tests on any part of the EnviroStart I-Limit without isolating the unit.**
- 8. Make sure the cover is closed before applying mains voltage to the EnviroStart I-Limit.**
- 9. Updated and current Installation and Commissioning Guides are maintained on the EMS (European) web site at <http://www.EnviroStart.com>; always check the web site for latest issue documents before commencing installation.**

INTRODUCTION

Thank you for choosing to use the EnviroStart I-Limit Control. The system has been designed with ease of use and set up in mind providing you with the ability to digitally set a current limit on your system and “change a relay(s) state” to control additional systems such as switching off your control and/or setting an alarm.

The key features of the control are set up on the Current Detection Relay, this is programmed by using a sequential ladder structure as is detailed within Appendix 1 of this Installation and Commissioning Guide. Read these instructions carefully as the parameters that are set on this relay determine the nature of the current limit operation.

In the unlikely event that you do need further support please contact your local EMS (European) Distributor or failing that contact us directly by e-mail. All details of how to contact us are available on our web site at <http://www.EnviroStart.com>, please remember that we are constantly updating documentation and information about EnviroStart, all such information is posted and publicly available on the web site.

Please note that there are two versions of the I-Limit Control, that for Direct On-Line motor start systems and that for Star Delta motor start systems. The two controls are not interchangeable therefore it is important that you use the right control for the application that you have

The Parts are identified on their part number label as “I-Limit DOL” and “I-Limit SD” for Direct On-Line and Star Delta respectively.

FEATURES

The **EnviroStart I-Limit** is a high specification digital Current Limit Control suitable for applications up to 600A.

- ▶ CONFIGURABLE TO OPERATE ON EITHER 50Hz or 60Hz
- ▶ 0.1A to 10A AC DIRECT INPUT AND UP TO 600A WITH EXTERNAL CT
- ▶ CAN BE SET TO AN UPPER LIMIT STATE CHANGE
- ▶ CAN BE SET TO A LOWER LIMIT STATE CHANGE
- ▶ CAN BE SET TO AN UPPER AND LOWER LIMIT STATE CHANGE
- ▶ SWITCH ON HYSTERISIS 5% to 50%
- ▶ SWITCH OFF DELAY CAN BE SET TO BETWEEN 0.1s TO 12s
- ▶ START DELAY CAN BE SET BETWEEN 0.1s TO 20S

CE DECLARATION OF CONFORMITY



MANUFACTURERS DECLARATION OF CONFORMITY

This declaration covers all **EnviroStart I-Limit** Control units.

This product fulfils the following European Community Directives when applied as follows:

Low Voltage Directive

The above products fulfil the Low Voltage Directive 73/23/EEC, 89/336/EEC and 93/68/EEC amendment for industrial equipment; however, they must be installed to general good electrical engineering practices and regulations by a suitably qualified person with strict reference to the instructions in the product's Technical Manual.

EMC Directive

The above products are intended to be a component in a system or a machine. They must be mounted into an appropriate enclosure and system designed to fulfil the CE directives plus IEC and local industrial standards. Units must be installed by a suitably qualified person to comply with general good electrical engineering practices and regulations with strict reference to the instructions in the product's Technical Manual. To meet all EMC directives, the above products are available with an optional RFI Filter.

IEC-1000-4-2 Level 3; IEC-1000-4-3 Level 3; IEC-1000-4-4 Level 4; IEC-1000-4-5 Level 3; IEC-1000-4-12 Level 3.

The above is based on test results from an independent test laboratory (Steatite Group Ltd.) to test specification EN 50081-2, EN 50082-1 and EN 50082-2.

Harmonised Standards Applicable

BS EN 6094.4.4 (which calls on EN 56011); EN 55022; EN 51000.4.2;
EN 61000.4.3; EN 51000.4.4; EN 61000.4.5; EN 61000.4.6; EN 61000.4.8;
EN 61000.4.11; BS EN 50081.1; BS EN 50081.2; BS EN 50082.2; EN 6094.4.2;
IEC-947-4-1; IEC-68-2-6, (NFC2076; BV1); IEC-947-4-2.

Electrical Requirements Specification G5/4 - 2 (2008)

Dated: July 2017

GENERAL SPECIFICATION

HARMONICS

EnviroStart I-Limit, like all electronic systems, does produce low level harmonics.

U.K. electricity council engineering recommendations contained within their documents G5/4 (2002), specifies that the short-term generation of harmonics by any electronic system on a typical 100kVA supply should not exceed 56A of 5th harmonic and 40A of 7th harmonic. Assuming a 415V supply this equates to one motor of around 145A, therefore the maximum 5th harmonic is 37% and the 7th 28%. The specification also details that the concern is primarily with the possibility of damage to frequency dependent components (such as capacitors) through long-term exposure to such harmonics.

As the **EnviroStart I-Limit** units produce negligible harmonic levels during normal running it is excluded from the constraints of such specifications by definition; however, with our policy of ensuring maximum compliance and minimum environmental pollution our design standards ensure that we fall well below the limits set.

HEAT LOSES

For heat calculation purposes, it should be assumed that EnviroStart I-Limit units have a power loss of 0.02W/A, (based on the CT primary current).

At maximum current, the maximum dissipation of the unit would therefore be:

$$600 \times 0.02 = 12W$$

GENERAL INSTALLATION CONSIDERATIONS

IMMUNITY FROM INTERFERENCE

The EnviroStart I-Limit generally has a high level of immunity to externally generated interference, however the following good practices should be observed:

COIL SUPPRESSION

Any coil that is connected to the **EnviroStart I-Limit** and shares a common control supply or is mounted in the same enclosure must be suppressed using appropriate R-C filter circuits.

LIGHTNING STRIKES/VERY HIGH VOLTAGE TRANSIENTS

In areas subject to frequent lightning strikes or other high voltage transients, a suitably rated metal oxide Varistor (MOV) or transient voltage suppressor (TVS) should connect each input line to earth.

CONTROL VOLTAGE TRANSIENTS

Where the control supply to the **EnviroStart** is thought to be subject to mains-borne interference a suitable line filter with transient interference suppression should be fitted between the control supply and the **EnviroStart I-Limit**.

INPUT/OUTPUT CONTROL CONNECTIONS

To avoid 'interference pick up' all input and output control cables should be kept as short as possible and should wherever possible, be shielded. If noise free lines cannot be guaranteed, an interposing relay with suitable suppression must be used, this should be mounted as close to the **EnviroStart** I-Limit as possible.

EMISSIONS

EnviroStart I-Limit units produce very low Radio Frequency Interference (RFI) and no external filters are required in normal circumstances.

CONNECTIONS AND COMMISSIONING

TERMINAL FUNCTION DIRECT ON LINE CONTROL

Table 1

TERMINAL	LOCATION	FUNCTION
1	DIN Rail	External CT Connection Negative
2	DIN Rail	External CT Connection Positive
3	DIN Rail	Parallel Connection to Control Panel K1 Relay Coil A2
4	DIN Rail	Parallel Connection to Control Panel K1 Relay Coil A1
5	DIN Rail	Series/Interrupt Connection into Control Panel K1 Start Circuit
6	DIN Rail	Series/Interrupt Connection into Control Panel K1 Start Circuit
7	DIN Rail	Not Connected
8	DIN Rail	Not Connected
9	DIN Rail	Not Connected
10	DIN Rail	Normally Open Contact on Fault Relay [¥]
11	DIN Rail	Normally Open Contact on Fault Relay [¥]
E	DIN Rail	Earth Connection ^Φ
MCB 1	DIN Rail	Nominal 400V AC 50Hz [€]
MCB 2	DIN Rail	Nominal 400V AC 50Hz [€]

Notes:

- ¥ The Fault Relay contacts are rated at 5A 230V
- Φ It is imperative that the unit be earthed effectively
- € This 400V 50Hz has to be a permanent live ideally from the Control Panel isolator

INSTALLATION AND COMMISSIONING DOL (See Appendix 2)

Fit the I-Limit as close to the control panel, (and EnviroStart if fitted), as possible.

The CT, (sized according to the FLC, full load current of the motor), needs to be fitted to one of the three phase feeds to the motor. This can be either on the supply to the contactor or from the

contactor to the motor in the existing control panel. Follow the polarity and flow direction indicated on the CT. CT's used should be xxx/5 ratio such that there stated rating provides a maximum of 5A output. It is necessary that the running current of the system always remains above 10% of the rating of this CT. (If in doubt please speak with your supplier).

A minimum of eight cables, ($\geq 1.5\text{mm}$ for each cable) plus Earth is required. Two of these cables are for a user defined fault indication present on Connectors 10 and 11. It is acceptable to use a multi-core cable if that is practical.

Two cables from the CT in the Control Panel go to Connectors 1 and 2 in the I-Limit. Keep these cables as short as possible. If greater than three metres in length it is recommended that screened cables be used

A parallel feed from the K1 Coil, (A1 and A2), in the existing Control Panel should be connected to Connections 3 and 4 in the I-Limit with the polarity as shown.

The Start-Stop circuit in the existing Control Panel needs to be interrupted and fed via Connectors 5 and 6 in the I-Limit.

If an EnviroStart Motor Energy Control is used and a soft start capability is not required then the Ramp-up Time of the EnviroStart Motor Energy Control should be set to the DOL configuration; in this see the EnviroStart Motor Energy Control Installation and Commissioning Guide. There should be permanent links between Connectors 1 and 3 and 2 and 4 on the EnviroStart.

If an EnviroStart Motor Energy Control is used and a soft start function is required then the Ramp-up Time of the EnviroStart Motor Energy Control should be set to 15s or less to allow the I-Limit Current Detection Delay to be set to 2s greater than that set time.

A permanent 400V 50Hz feed should be provided to the I-Limit via the fitted MCB's. This supply should be taken after the isolator and fuses within the Control Panel.

The installation is now finished. The I-Limit is now ready to have the appropriate parameters set. You should undertake the following steps after reading through Appendix 1 of this Installation and Commissioning Guide. All of the settings are established on the Current Detection Relay.

SETTING UP THE I-LIMIT PARAMETERS

It is imperative that you do not try and start the motor prior to setting up the I-Limit Parameters

Ensure that the I-Limit is in Programme Mode by putting the labelled switch to Programme

Ensure that the Control Panel Isolator is now On and that the system is now powered.

Be aware that terminals within the I-Limit may be live and as such caution should be exercised at all times

Ensure that the Current Control Relay is in Programming Mode by simultaneously pressing the Select and Set buttons for three seconds.

Ensure that you set the following parameters according to the needs of your circuit or where specifically stipulated:

Set first parameter to AC

Set second parameter to CT Feed

Set third parameter to either Over, (Up) or Under, (Low) Current Detection as required

Set fourth parameter to the Over or Under Current Value as required

Set the fifth parameter Hysteresis value in Amps

Set the sixth parameter Delay in seconds before the I-Limit triggers when target current has been reached (this can be set between 0.1s and 12s)

Set the seventh parameter Delay in seconds before the I-Limit starts to register current. This should typically be set to ≥ 5 seconds

Set the eighth parameter Storage Mode to Yes

Confirm End

Ensure that the I-Limit is in Run Mode by putting the labelled switch to Run

The cover should be replaced on the I-Limit. The system is now ready to operate

The motor should now operate when started in the normal manner but with the I-Limit providing appropriate detection of either over or under current levels as set in the parameters above. When the limit has been reached and the delay time before reaction has been exceeded then the motor will be turned off and the normally open contact on the I-Limit Connectors 10 and 11 will close allowing for an external warning to be given.

The motor will not re-start until the I-Limit Reset Button has been pushed to re-enable the detection circuit within the I-Limit.

TERMINAL FUNCTION STAR DELTA CONTROL

Table 2

TERMINAL	LOCATION	FUNCTION
1	DIN Rail	External CT Connection Negative
2	DIN Rail	External CT Connection Positive
3	DIN Rail	Parallel Connection to Control Panel K1 Relay Coil A2
4	DIN Rail	Parallel Connection to Control Panel K1 Relay Coil A1
5	DIN Rail	Series/Interrupt Connection into Control Panel K1 Start Circuit
6	DIN Rail	Series/Interrupt Connection into Control Panel K1 Start Circuit
7	DIN Rail	To Control Panel K3 Relay A1 Connection
8	DIN Rail	Start Signal for EnviroStart if Fitted. To EnviroStart Connection 2
9	DIN Rail	Start Signal for EnviroStart if Fitted. To EnviroStart Connection 4
10	DIN Rail	Normally Open Contact on Fault Relay [¥]
11	DIN Rail	Normally Open Contact on Fault Relay [¥]
E	DIN Rail	Earth Connection ^Φ
MCB 1	DIN Rail	Nominal 400V AC 50Hz [€]
MCB 2	DIN Rail	Nominal 400V AC 50Hz [€]

Notes:

¥ The Fault Relay contacts are rated at 5A 230V

Φ It is imperative that the unit be earthed effectively

€ This 400V 50Hz has to be a permanent live ideally from the Control Panel isolator

INSTALLATION AND COMMISSIONING STAR-DELTA (See Appendix 3)

Fit the I-Limit as close to the control panel, (and EnviroStart if fitted), as possible.

The CT, (sized according to the FLC, full load current of the motor), needs to be fitted to one of

the three phase feeds to the motor. This can be either on the supply to the contactor or from the contactor to the motor in the existing control panel. Follow the polarity and flow direction indicated on the CT. CT's used should be xxx/5 ratio such that there stated rating provides a maximum of 5A output. It is necessary that the running current of the system always remains above 10% of the rating of this CT. (If in doubt please speak with your supplier).

A minimum of eleven cables, ($\geq 1.5\text{mm}$ for each cable) plus Earth is required. Two of these cables are for a user defined fault indication present on Connectors 10 and 11. It is acceptable to use a multi-core cable if that is practical.

Two cables from the CT in the Control Panel go to Connectors 1 and 2 in the I-Limit. Keep these cables as short as possible. If greater than three metres in length it is recommended that screened cables be used

A parallel feed from the K1 Coil, (A1 and A2), in the existing Control Panel should be connected to Connections 3 and 4 in the I-Limit with the polarity as shown.

The Start-Stop circuit in the existing Control Panel needs to be interrupted and fed via Connectors 5 and 6 in the I-Limit.

An additional feed from the K3 Coil, (A1), in the existing Control Panel should be bought to Connector 7 in the I-Limit.

If an EnviroStart Motor Energy Control is fitted, then a start signal should be taken from Connectors 8 and 9 in the I-Limit to Connectors 2 and 4 within the EnviroStart. (There should additionally be a link between Connectors 1 and 3 within the EnviroStart).

Note that if an EnviroStart Motor Energy Control is used, then the Ramp-up Time of the EnviroStart Motor Energy Control should be set to 15s or less to allow the I-Limit Current Detection Delay to be set to 2s greater than that set time.

If an EnviroStart Motor Energy Control is not being used then the I-Limit Current Detection Delay should be set to 2s greater than the Star Contactor Timer set time.

A permanent 400V 50Hz feed should be provided to the I-Limit via the fitted MCB's. This supply should be taken after the isolator and fuses within the Control Panel.

The installation is now finished. The I-Limit is now ready to have the appropriate parameters set. You should undertake the following steps after reading through Appendix 1 of this Installation and Commissioning Guide. All of the settings are established on the Current Detection Relay.

SETTING UP THE I-LIMIT PARAMETERS

It is imperative that you do not try and start the motor prior to setting up the I-Limit Parameters

Ensure that the I-Limit is in Programme Mode by putting the labelled switch to Programme

Ensure that the Control Panel Isolator is now On and that the system is now powered.

Be aware that terminals within the I-Limit may be live and as such caution should be exercised at all times

Ensure that the Current Control Relay is in Programming Mode by simultaneously pressing the Select and Set buttons for three seconds.

Ensure that you set the following parameters according to the needs of your circuit or where specifically stipulated:

Set first parameter to AC

Set second parameter to CT Feed

Set third parameter to either Over, (Up) or Under, (Low) Current Detection as required

Set fourth parameter to the Over or Under Current Value as required

Set the fifth parameter Hysteresis value in Amps

Set the sixth parameter Delay in seconds before the I-Limit triggers when target current has been reached (this can be set between 0.1s and 12s)

Set the seventh parameter Delay in seconds before the I-Limit starts to register current. (If an EnviroStart Motor Energy Control is being used then this time should be set to 5s greater than the Start-up Ramp Time set on the EnviroStart Motor Energy Control; if an EnviroStart Motor Energy Control is not being used then this time should be set to 5s greater than the Star Contactor Timer Setting)

Set the eighth parameter Storage Mode to Yes

Confirm End

Ensure that the I-Limit is in Run Mode by putting the labelled switch to Run

The cover should be replaced on the I-Limit. The system is now ready to operate

The motor should now operate when started in the normal manner but with the I-Limit providing appropriate detection of either over or under current levels as set in the parameters above. When the limit has been reached and the delay time before reaction has been exceeded then the motor will be turned off and the normally open contact on the I-Limit Connectors 10 and 11 will close allowing for an external warning to be given.

The motor will not re-start until the I-Limit Reset Button has been pushed to re-enable the detection circuit within the I-Limit.

INSTALLATION AND COMMISSIONING GUIDE
END

Appendix 1

Finder 71-51 Current Sense Relay

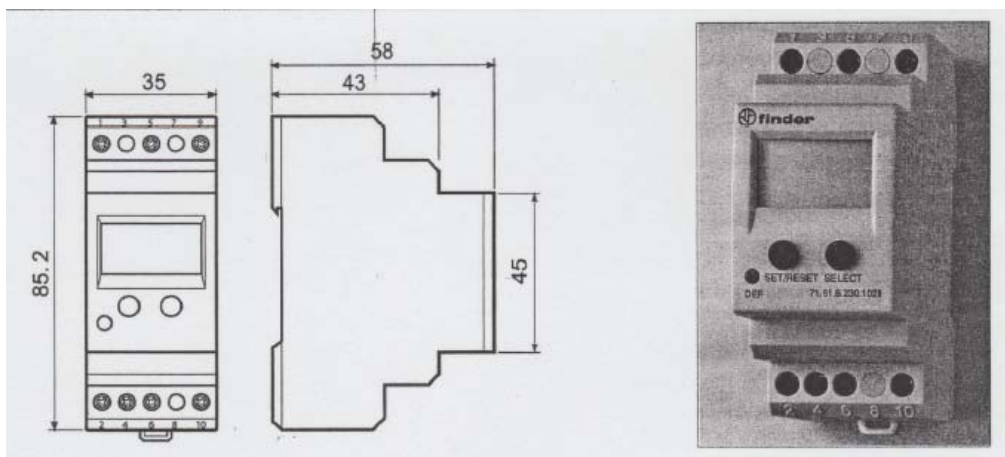
Simultaneously press both the **Set** and the **Select/Reset** buttons for three seconds, this will put the control relay into programming mode. Prog is displayed for one second when this mode is enabled.

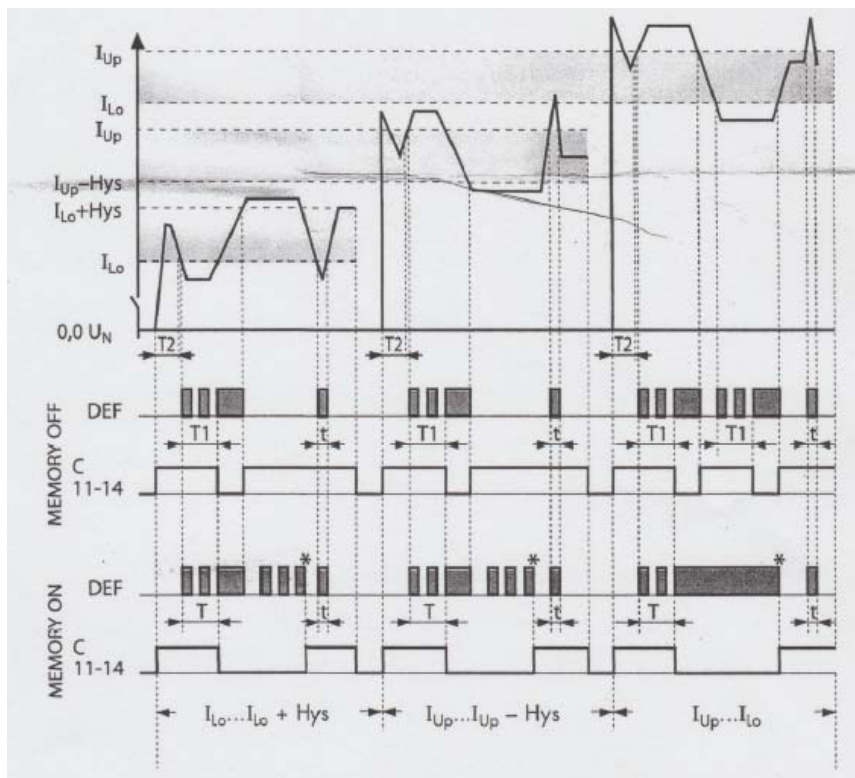
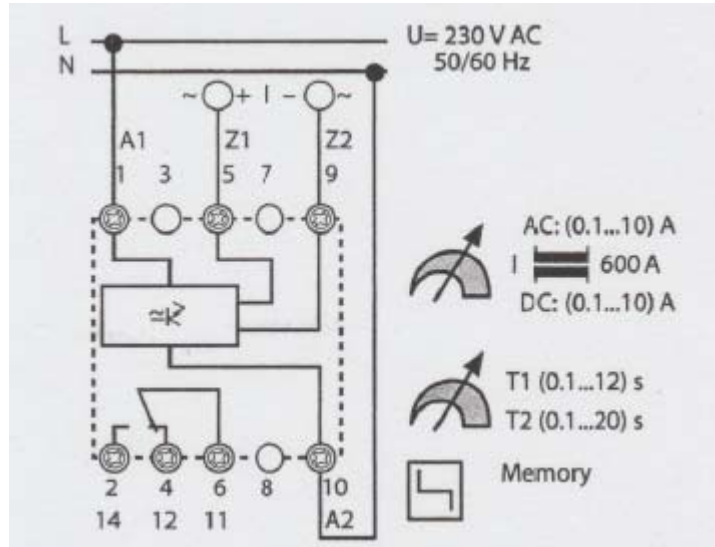
The **Set** button is used to validate any selection made.

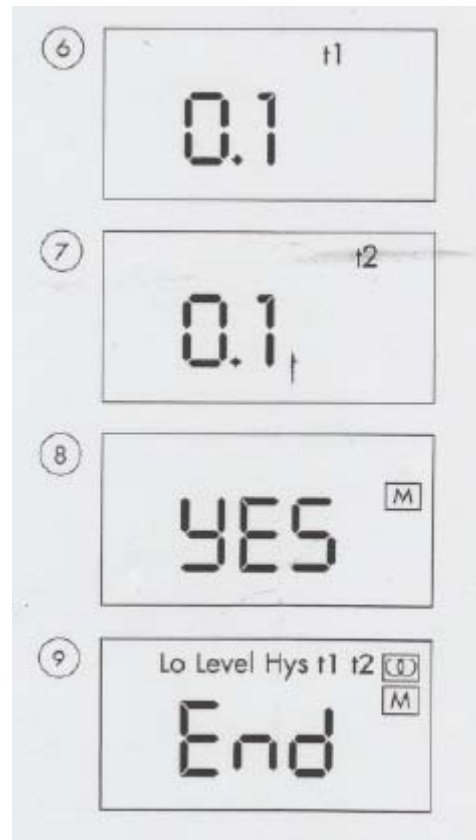
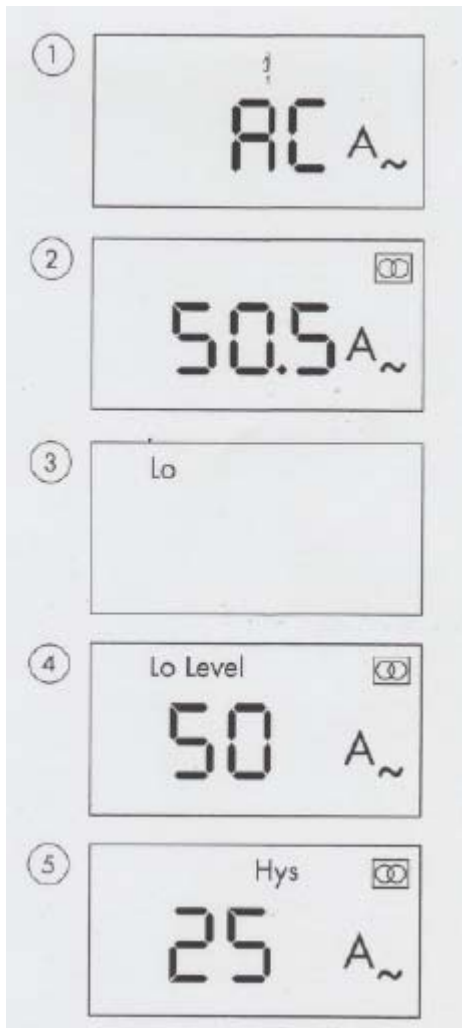
The **Select** button is used to scroll through the various options available under each programme identity.

The programming sequence is as follows:

- Select input signal type AC or DC
- Select either direct measurement, (for DC or AC to 10A) or CT for AC up to 600A
- Select monitoring operation mode:
 - Overcurrent monitoring (Up)
 - Undercurrent monitoring (Lo)
 - Band (Up Lo)
- Select threshold current level
 - High threshold if Up or Up Lo (Band Upper Limit)
 - Low threshold if Lo or Up Lo (Band Lower Limit)
- Define hysteresis Hys (Shown in Amps)
- Select the t1 delay before unit switches on reaching defined threshold (0.1s to 12s)
- Select the t2 delay before the unit starts monitoring the defined current (0.1 to 20s)
- Select the storage function
 - Yes M stores parameters
 - No M does not stores parameters
- End





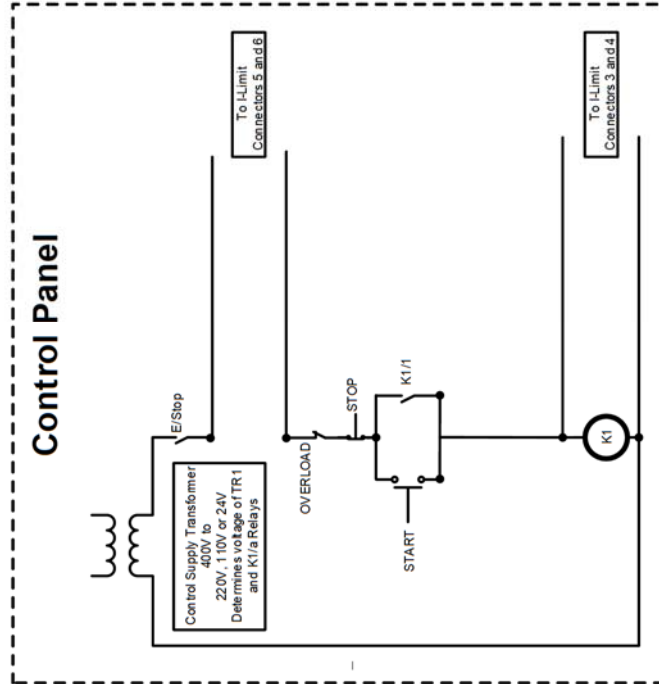
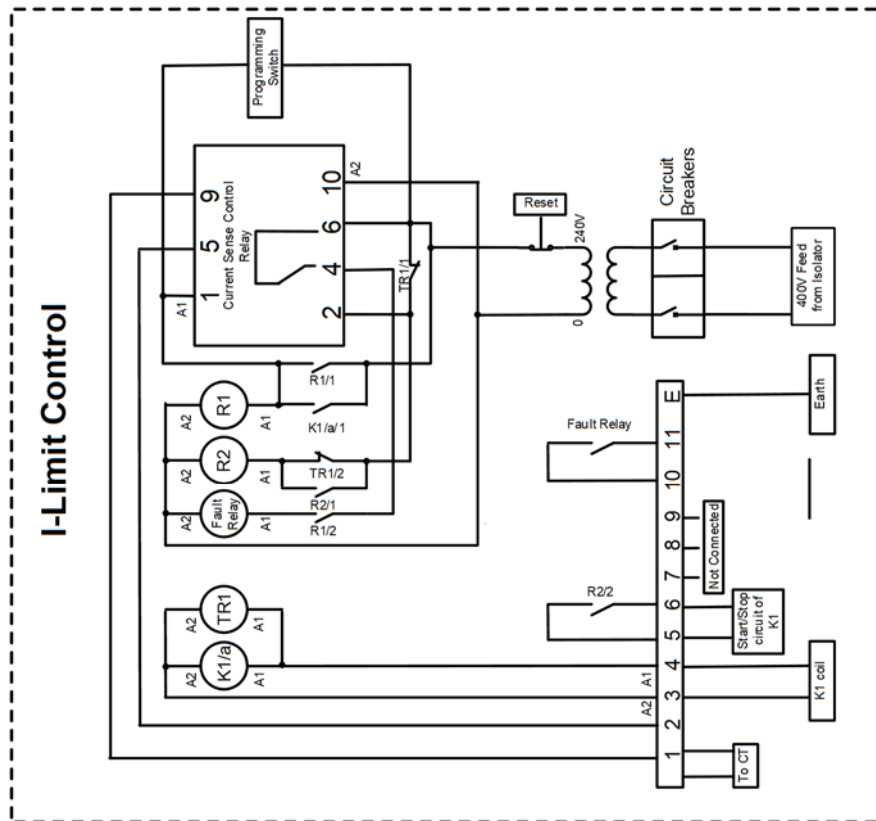
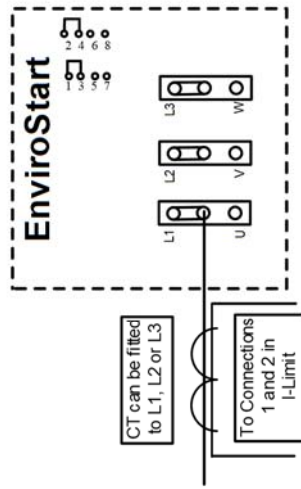


Appendix 2 Circuit Diagram Direct on Line Configuration

I-Limit Control Circuit Diagram DOL Connection



Coil Voltages	400V	240V/110V	24V	Contacts
R1 – 240V (Fixed)	-	X	-	2 x N/O
R2 – 240V (Fixed)	-	X	-	2 x N/O
Fault Relay – 240V (Fixed)	-	X	-	SFCO
TR1 – Reflects Contactor Voltage	-	X	-	2 x N/C
K1/a – Reflects Contactor Voltage	-	-	X	1 x N/O



Appendix 3

Circuit Diagram Star Delta Configuration



saving energy through the control of power

I Limit Control Circuit Diagram Star Delta Connection

Coil Voltages	400V	240V	110V	24V	Contacts
R1 - 240V (Fixed)	-	X	-	-	2 x N/C
R2 - 240V (Fixed)	-	X	-	-	2 x N/C
Fault Relay - 240V (Fixed)	-	X	-	-	SPOO
K1/a - Reflects Contactor Voltage	-	-	X	-	2 x N/C
K3/a - Reflects Contactor Voltage	-	-	-	X	2 x N/C

