

synergy™

fairford
Soft Start Technology

Quick Start Guide



CONFORMS
TO STD UL 508
CSA 22.2
No. 14

The original pioneers of soft start technology, Fairford Electronics Limited have been at the forefront of motor control innovation since the 1970's. Fairford have manufactured and supplied over 1 million products into the market place and are recognised as the reference point for many control solution providers worldwide.

In 2009, the need for a new technology that bridged the gap between drive technology and soft start was recognised and the development process began for synergy™, a new form of motor control that met the needs of those requiring the functionality of a drive in a fixed speed application. The key aspects of a drive, energy saving and communications, as well as incorporating original features of a soft start internal bypass and cost, meant the base design was enhanced even further.

iERS (intelligent energy recovery system) is Fairford's patented energy saving system with a combined internal bypass to save energy on lightly loaded motors. iERS reduces the voltage and current supplied to lightly loaded motors to only allow the motor to consume the exact amount of energy required to maintain the speed at that load.

When the motor is at full load the internal bypass closes, this reduces the losses produced by the control element. This combined approach enables iERS to save more energy in more applications than any other competing technology.

iERS has been market proven over the past 10 years and has now reached its latest development realising even greater savings. Applications such as fans, pumps and chillers can typically see savings of around 8-40% of total energy consumption.

With size and cabinet capacity an ever increasing focus, Fairford developed the world's smallest power to size ratio motor controller. Synergy™ utilised Fairford's globally renowned Automatic Setup feature to programme the unit to each individual application using only a 8 button process. Since then it has removed buttons and uses touch screen technology bringing the user interface to even greater management levels.

With built in SCR failure protection as standard, and full motor overload protection as well as full data logging, field serviceable and upgradeable software and extensive input/output programmability, synergy™ meets all of the key design criteria.

Important information

Installers should read and understand the instructions in this guide prior to installing, operating and maintaining the soft start. The following symbols may appear in this guide or on the soft start to warn of potential hazards or to draw attention to certain information.



Dangerous Voltage

Indicates the presence of a hazardous voltage which could result in personal injury or death.

Tension dangereuse

Indique la présence d'une tension dangereuse qui peut entraîner des blessures ou la mort.



Warning/Caution

Indicates a potential hazard. Any instructions that follow this symbol should be obeyed to avoid possible damage to the equipment, and personal injury or death.

Avertissement/Mise en garde

Indique un danger potentiel. Toutes les instructions suivant ce symbole doivent être observées, afin d'éviter les dommages de l'équipement et les blessures ou la mort.



Protective Earth (Ground)

Indicates a terminal which is intended for connection to an external conductor for protection against electric shock in case of a fault.

Mise à la terre (Masse)

Indique une borne dont l'usage prévu est d'être connecter à conducteur externe pour assurer la protection contre les chocs électriques en cas de défauts.

Caution Statements

The examples and diagrams in this manual are included solely for illustrative purposes. The information contained in this manual is subject to change at any time and without prior notice. In no event will responsibility or liability be accepted for direct, indirect or consequential damages resulting from the use or application of this equipment.

Mises en garde

Les exemples et les schémas de ce manuel ne sont donnés qu'à titre illustratif. Les informations présentées dans ce manuel peuvent être modifiées sans avis préalable.

En aucun cas nous n'assumons la responsabilité ou l'obligation pour les dommages directs, indirects ou consécutifs qui résultent de l'utilisation ou application de cet équipement.

Short Circuit

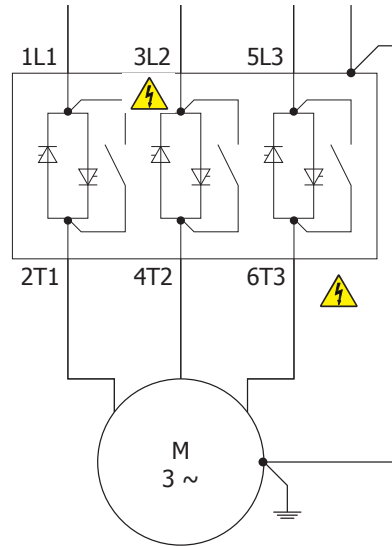
Fairford soft starts are not short circuit proof. After severe overload or short circuit, the operation of the soft start should be fully tested by an authorised service agent.

Court-circuit

Les démarreurs progressifs Fairford ne sont pas à l'épreuve des courts-circuits. Après une forte surcharge ou un court-circuit, le fonctionnement du démarreur progressif doit être intégralement vérifié par un agent de maintenance agréé.



- Synergy™ soft starts contain dangerous voltages when connected to the mains supply. Only qualified personnel that have been completely trained and authorised, should carry out installation, operation and maintenance of this equipment.
- *Les démarreurs progressifs Synergy™ contiennent des tensions dangereuses, lorsqu'ils sont connectés à la tension secteur. Les activités d'installation, d'utilisation et d'entretien de cet équipement doivent être effectuées par un personnel qualifié, dûment formé et habilité.*
- Installation of the soft start must be made in accordance with existing local and national electrical codes and regulations and have a minimum protection rating.
- *Le démarreur progressif doit être installé conformément au code local et nationale d'électricité et à la réglementation en vigueur, et il doit avoir un indice de protection minimal.*
- It is the responsibility of the installer to provide suitable grounding and branch circuit protection in accordance with local electrical safety codes.
- *Il appartient à l'installateur d'assurer la mise à la terre et la protection du circuit de branchement, conformément au code de sécurité électrique local.*
- This soft start contains no serviceable or re-usable parts.
- *Ce démarreur progressif ne contient pas de pièces réparables ou réutilisables.*
- The STOP function of the soft start does not isolate dangerous voltages from the output of the soft start. An approved electrical isolation device must be used to disconnect the soft start from the incoming supply before accessing electrical connections.
- *La fonction STOP du démarreur progressif n'isole pas les tensions dangereuses en sortie du démarreur progressif. Avant d'accéder aux raccordements électriques, il faut utiliser un dispositif d'isolation électrique approuvé pour déconnecter le démarreur progressif de la tension d'entrée.*

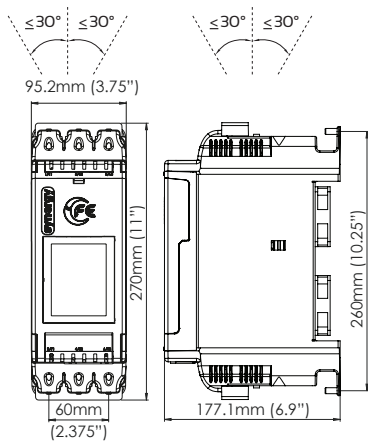


Environment - installation

synergy™

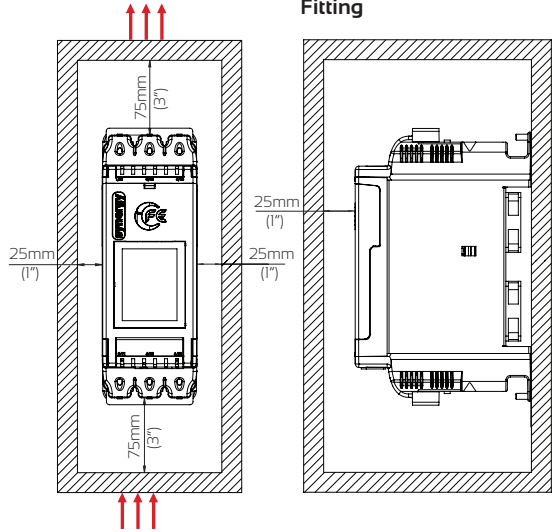
synergy™ Size 1.

Dimensions



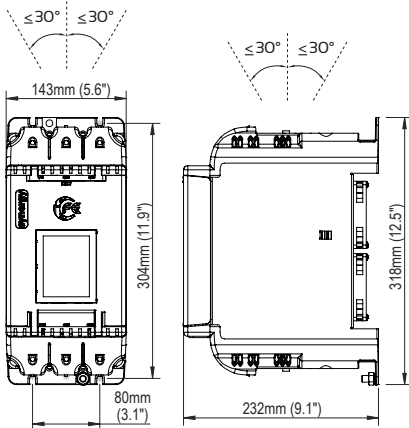
Weight = 3.5 kg (7.7 lbs)

Fitting



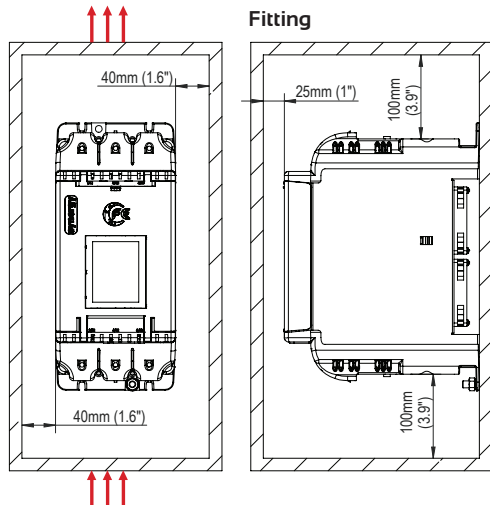
synergy™ Size 2.

Dimensions



Weight = 6.5 kg (14.3 lbs)

Fitting

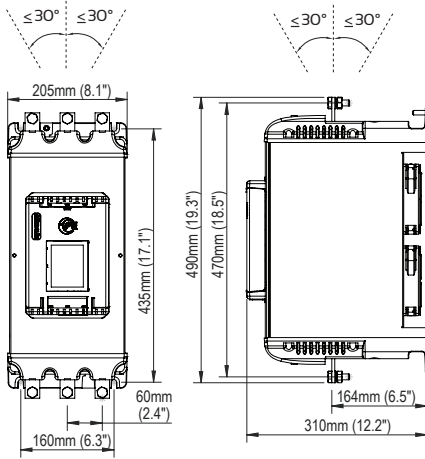


Environment - installation

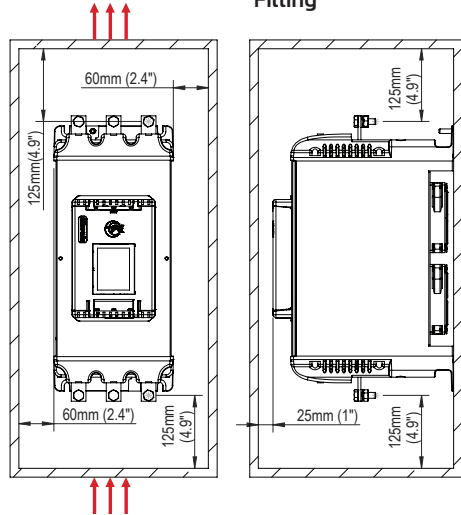
synergy™

synergy™ Size 3.

Dimensions



Fitting



Weight = 18 kg (39.7 lbs)



Enclosure Ventilation

When fitting synergy™ into a cabinet, ventilation must be provided if the heat output of the unit is greater than the cabinet will dissipate. Use the following formula to determine the fan requirement. An allowance has been incorporated into the formula so that the figure for Q is the air delivery in the fan suppliers data.

The maximum power dissipation occurs when energy saving.

Heat dissipated can be approximated with the formula:-

Watts (synergy™) = $\frac{1}{2}$ x synergy™ current rating x 3

Ventilation intérieure

Lorsque synergy™ est installé dans une armoire, il faut assurer sa ventilation, si la chaleur produite de l'unité est plus important que la capacité de dissipation de l'armoire. Utiliser la formule suivante pour déterminer la demande de ventilateur. Une tolérance a été incorporé dans la formule, ainsi la figure donnée dans Q est le débit d'air indiqué dans les données du fournisseur du ventilateur.

La puissance maximale de dissipation est atteint en mode économie d'énergie.

La chaleur dissipée peut être estimée par la formule suivante :

Watts (synergy™) = $\frac{1}{2}$ x courant nominal synergy™ x 3

$$Q = \frac{4 \times Wt}{(T_{\max} - T_{\text{amb}})}$$

Q = volume of air (cubic metres per hour-m³/h)

Wt = Heat produced by the unit and all other heat sources within the enclosure (Watts)

Tmax = Maximum permissible temperature within the enclosure
(50°C for a fully rated synergy™)

Tamb = Temperature of the air entering the enclosure (°C)

If you prefer to work in CFM, substitute °F for °C. Q is now in CFM

Q = quantité d'air (mètre cube par heure - m³/h)

Wt = Chaleur produite par l'unité et toutes autres sources de chaleur dans l'armoire (Watts)

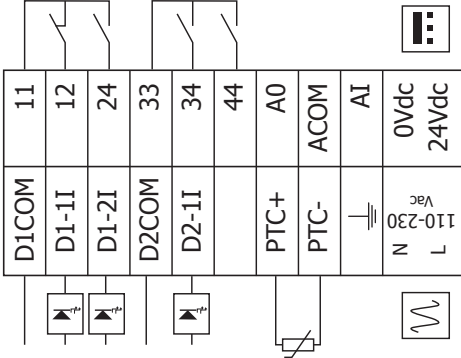
Tmax = Température maximale admissible dans l'armoire (50°C pour synergy™ en puissance maximale)

Tamb = Température de l'air entrant dans l'armoire (°C)

Pour calculer en CFM, remplacer °C par °F. Ainsi Q est en CFM.

Wiring connection

⚠	Required rating	Programmable	Default	Description
#1				Group input common
#1	24Vdc or 110Vac or 230Vdc +10% -15%	yes	start/stop	opto-coupled input
#1	24Vdc or 110Vac or 230Vdc +10% -15%	yes	None	opto-coupled input
#2				group 2 input common
#2	24Vdc or 110Vac or 230Vdc +10% -15%	yes	reset	opto-coupled input
				not used
	3 x PTC in series (50°C)		OFF	thermistors
	3 x PTC in series (50°C)		OFF	thermistors
				signal ground
#3	110Vac / 230Vac +10% -15%			control supply
#3	110Vac / 230Vac +10% -15%			control supply

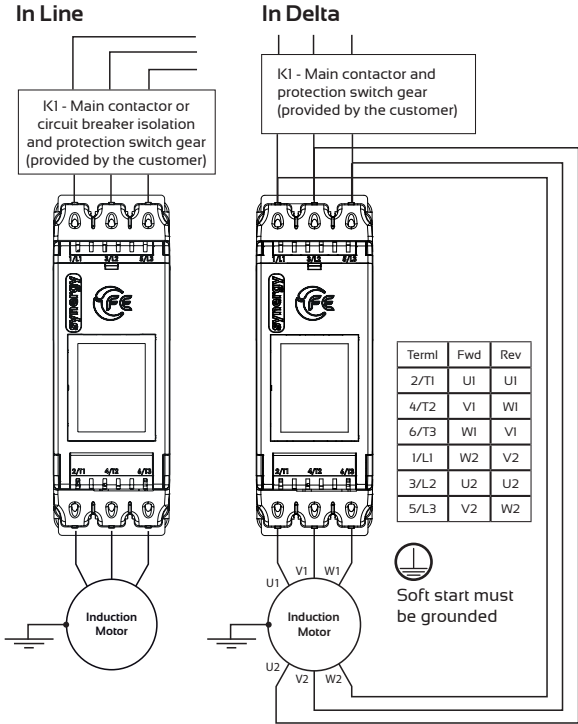


Description	Default	Programmable	Required rating	⚠
group relay common				
relay N/C	fault	yes	230Vac /A AC15, 30Vdc 0.5A Resistive	
relay N/O	fault	yes	230Vac /A AC15, 30Vdc 0.5A Resistive	
group 2 relay common				
relay N/O	running	yes	230Vac /A AC15, 30Vdc 0.5A Resistive	
relay N/O	end of start	yes	230Vac /A AC15, 30Vdc 0.5A Resistive	
analog output	0-10V	yes	0 to 10V /0mA / 4-20mA	
analog OV			OV	
analog input	0-10V	Yes	0 to 10V /0mA / 4-20mA	
OV input			OV	#3
24V input			24Vdc +10% -15%	#3

*24Vdc Specification

- 24Vdc 60W
- Residual ripple 100mV
- Spikes/switching Peaks 240mV
- Turn On/Off response
- No overshoot of V_{out}
- Overvoltage voltage protection output voltage must be clamped to <30Vdc

#1	The programmed digital input setting on D1COM, D1-2I must correspond to the voltage applied to these terminals to avoid risk of damage to the equipment. <i>Afin d'éviter d'endommager l'équipement, le réglage de l'entrée numérique programmé sur D1COM, D1-2I doit correspondre à la tension appliquée à ces bornes.</i>
#2	The programmed digital input setting on D2COM, D2-1I must correspond to the voltage applied to these terminals to avoid risk of damage to the equipment. <i>Afin d'éviter d'endommager l'équipement, le réglage de l'entrée numérique programmé sur D2COM, D2-1I doit correspondre à la tension appliquée à ces bornes.</i>
#3	The control supply can be 110 or 230Vac applied to the N, L terminals or 24Vdc applied to the 0Vdc, 24V input terminals. The correct voltage as specified must only be applied to pins of these supply inputs to avoid risk of damage to the equipment. <i>L'alimentation contrôlée peut être 110 ou 230 Vca, appliquée aux bornes N et L, ou 24 Vdc, appliquée aux bornes d'entrée de 0 Vdc, 24 V. Afin d'éviter d'endommager l'équipement, la tension appropriée selon les indications ne doit être appliquée qu'à une entrée d'alimentation.</i>



! **In Delta**
 For this configuration applying the equation.
 $synergy^{TM} I_e = I_e (moteur) / \sqrt{3}$

Allows lower current rating synergy™ than the motor.

When In Delta configuration is used a line contactor controlled by synergy™ **MUST** be used with the In Delta Firing Mode selected in the advanced menu.

! **En Delta**
 Pour cette configuration, appliquer l'équation.
 suivante : $synergy^{TM} I_e = I_e (moteur) / \sqrt{3}$

Cela permet le courant nominal inférieure de synergy™ par rapport au moteur.

Lorsque En Delta configuration est utilisée, **IL FAUT** utiliser un sectionneur principal contrôlé par synergy™. En Delta mode de fonctionnement, sélectionné dans le menu avancé.

! For suitable short circuit protection devices (SCPD's) see short Circuit Protection in the Technical Information/ standards section of this guide.

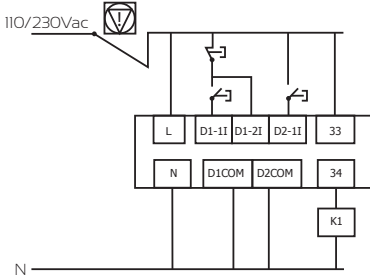
Pour un dispositif de protection approprié contre le court-circuit, voir la protection contre le court-circuit dans la section « Informations techniques/normes » du présent guide.

! For wire size and torque requirements see Technical Information/ standards section of this guide.

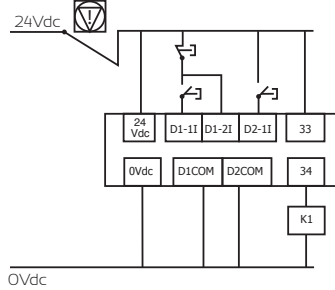
Pour les dimensions de câble et les besoins en couple, voir la section « Informations techniques/normes » du présent guide.

Wiring connection

3 Wire Control Diagram
110/230Vac control supply
and digital input programming



24Vdc control supply and digital input programming



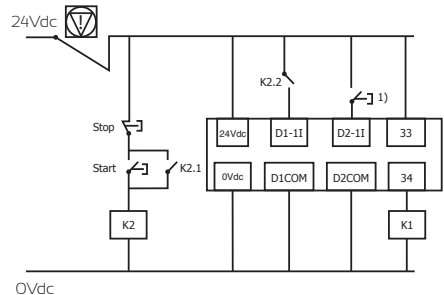
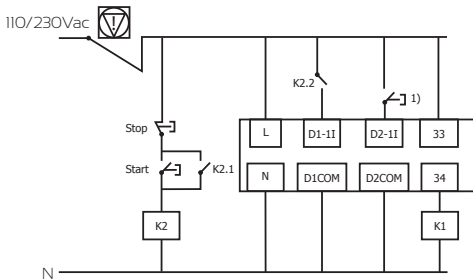
Digital input programming

D1 - II = Start
D1 - 2I = Stop
D2 - II = Reset

⚠ Power factor correction capacitors must **not** be positioned between the soft start and the motor or there is a risk of damaging the thyristors due to current peaks.

*Les condensateurs d'amélioration du facteur de puissance **ne** doivent pas être montés entre le démarreur progressif et le moteur, parce que les pointes de courant risquent à endommager les thyristors.*

User Programmable Control Diagram



User programmable Inputs are fully programmable

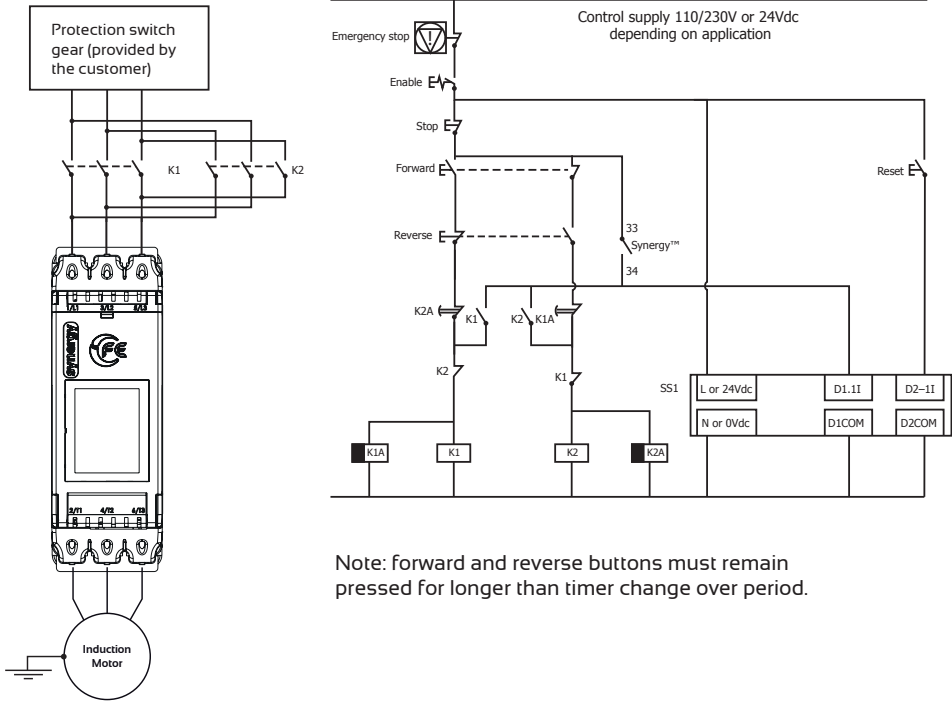
D1 - II = High Start / Low Stop
D1 - 2I = None
D2 - II = High Reset

1) Optional high reset. If this reset is required ensure "User Programmable" is selected in the control method menu found in the Digital Inputs menu. If you would prefer the reset to work by removing and reapplying the Start Signal on D1 - II then select "Two wire control" in the control method menu.

Soft start motor Reversing circuit



Below is a soft start reversing circuit without soft stop, it shows the main components required. You must follow your local wiring and electrical regulations when constructing this circuit.

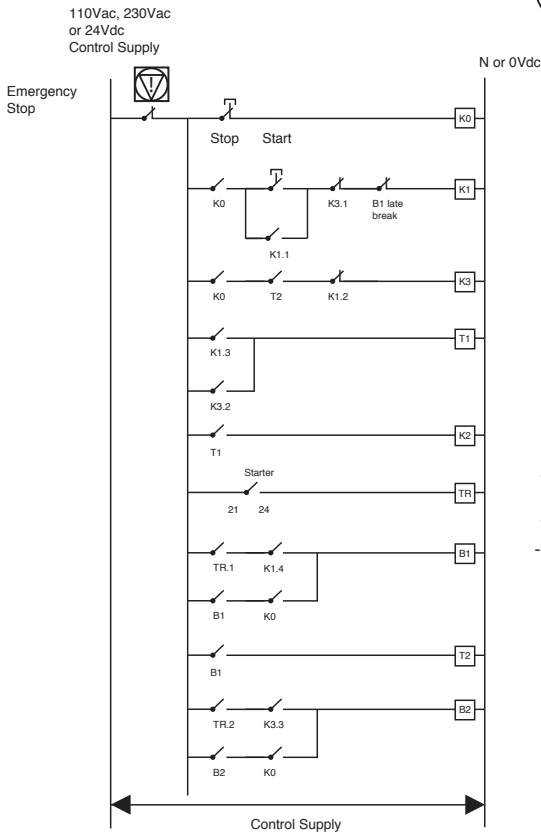
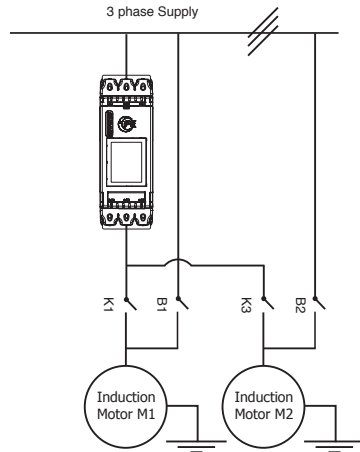
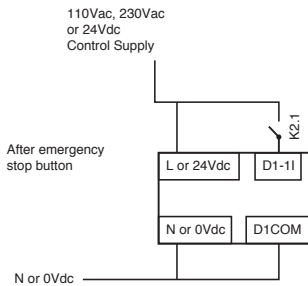


Note: forward and reverse buttons must remain pressed for longer than timer change over period.

Item	Description
K1, K2	AC3 rated forward/reverse contactors
K1A, K1B	1 second drop out delay timers
SS1	Synergy™ soft start

These are the major components of the system. Local wiring regulations should be observed. Note the use of timers to ensure that a reversed voltage is not applied to the starter/motor before the motor field has had some chance to die away.

Sequential Soft Start diagram



Notes

Soft Starter must have stop time set to 0
 T1 Time between K1 or K3 closing and the starter being energised - 0.5 sec minimum.
 T2 Time between B1 closing and K3 closing
 -Dependant on application - 0.5 sec minimum

Emergency stop switch cuts off control supply and drops out starter and motors.
 Stop switch drops control supply from Contactors and timers stopping both motors.
 Start switch initiates softstart then bypass of motor 1 immediately followed by softstart then bypass of motor 2.

Soft Starter must be rated for combined starting duty.

1. Setup Wizard

2. Select Your Application

3. Select Your Application

4. Set Motor Current Rating

5. Select Control Method

6. Select Digital Input Voltage

7. Auto Setup Summary

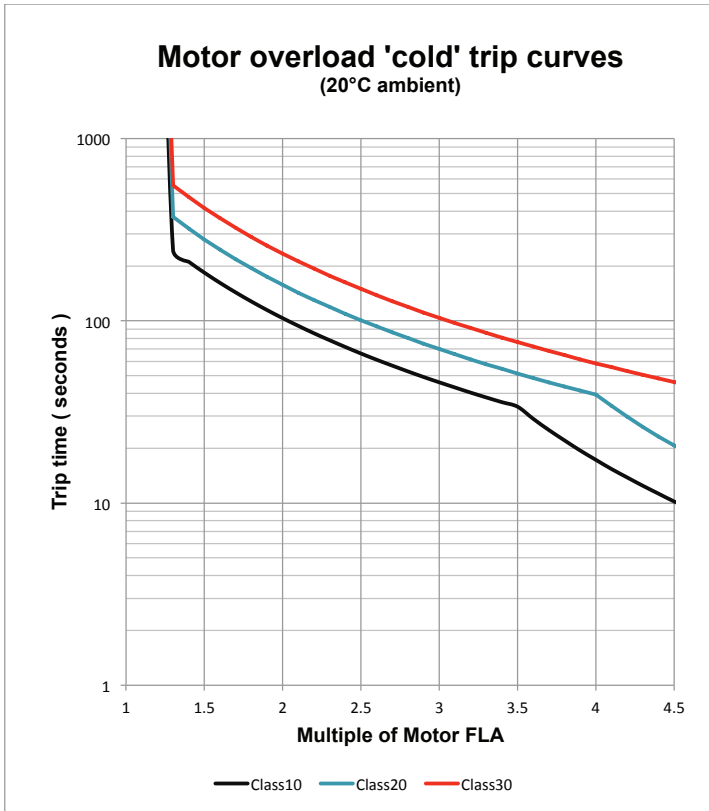
8. Final screen with circuit diagram and START button

Please note; Only appears if application with a trip class higher than 10 is selected

Rating table

Type	IEC, I _e A ³⁾	kW ¹⁾		UL, FLA A ⁴⁾	Hp ²⁾				U _s
		230V	400V		200V	208V	220-240V	440-480V	
SGY-101-4-01	17	4	7.5	17	3	5	5	10	24Vdc or 110Vac or 230Vac
SGY-103-4-01	22	5.5	11	21	5	5	5	15	
SGY-105-4-01	29	7.5	15	27	7.5	7.5	10	20	
SGY-107-4-01	35	7.5	18.5	34	10	10	10	25	
SGY-109-4-01	41	11	22	40	10	10	10	30	
SGY-111-4-01	55	15	30	52	15	15	15	40	
SGY-113-4-01	66	18.5	37	65	20	20	20	50	
SGY-115-4-01	80	22	45	77	25	25	30	60	
SGY-117-4-01	100	30	55	96	30	30	30	75	
SGY-201-4-01	132	37	75	124	40	40	50	100	
SGY-203-4-01	160	45	90	156	50	50	60	125	
SGY-205-4-01	195	55	110	180	60	60	75	150	
SGY-301-4-01	242	75	132	242	75	75	75	200	
SGY-303-4-01	302	90	160	302	100	100	100	250	
SGY-305-4-01	361	110	200	361	125	125	150	300	
SGY-307-4-02	430	132	250	414	150	150	150	350	110Vac
SGY-309-4-02	500	150	280	477	150	150	150	400	
SGY-307-4-03	430	132	250	414	150	150	150	350	230Vac
SGY-309-4-03	500	150	280	477	150	150	150	400	

- 1) Rated operational powers in kW according to IEC 60072-1 (primary series) corresponding to IEC current rating.
- 2) Rated operational powers in hp according to UL508 corresponding to FLA current rating.
- 3) The IEC, I_e rating will apply for EN 60947-4-2 max rating index 195A: AC-53a: 3.5-17: 90-5 and 500A: AC-53a: 3.5-17: 90-3.
- 4) The UL, FLA rating applies for a maximum surrounding air temperature of 50°C.



* Please note: When the overload has tripped there is a forced cooling time to allow the overload to recover before the next start.

Rated operational voltages	U_e	230Vac to 480Vac	
Rated operational current	I_e	See model ratings table below	
Rating index		SGY-101 to SGY-205	Ie: AC-53a: 3.5-17: 90-5
		SGY-301 to SGY-309	Ie: AC-53a: 3.5-17: 90-3
Rated frequency		50 to 60Hz	
Rated duty		Uninterrupted	
Form designation		Form I Internally bypassed	
Rated insulation voltage	U_i	480V	
Rated impulse withstand voltage	U_{imp}	Main circuit	4kV
		Control supply circuit	2.5kV
IP code		Main circuit	IPOO (IP 20 optional)
		Supply and control circuit	IP 20
Pollution degree		2	
Rated conditional short-circuit current and type of co-ordination with associated short circuit protective device (SCPD).		Type I co-ordination. See short circuit protection table for rated conditional short-circuit current and required current rating and characteristics of the associated SCPD	
Rated control circuit voltage (programmable)	U_c	24Vdc, 110Vac or 230Vac	Protect with 4A UL Listed fuse
Rated control supply voltage	U_s	See Rating table	
Relay specification		AC-15 230Vac, 1A DC-13 30Vdc, 0.7A	
EMC Emission levels	EN 55011	Class A	
EMC Immunity levels	IEC 61000-4-2	8kV/air discharge or 4kV/contact discharge	
	IEC 61000-4-3	10 V/m	
	IEC 61000-4-4	2kV/5kHz (main power and ports)	
		1kV/5kHz (signal ports)	
	IEC 61000-4-5	2kV line-to-ground 1kV line-to-line	
	IEC 61000-4-6	10V	
IEC 61000-4-11	0% U_e for 0.5 cycle 0% U_e for 1 cycle 40% U_e for 10/12 cycles 70% U_e for 25/30 cycles 80% U_e for 250/300 cycles		

Standards



-20°C (-4°F) to 50°C (122°F) above 50°C de-rate linearly by 4% of synergy™ Ie per °C to a maximum of 60°C (140°F).



Maximum altitude above sea level 1000m (3281ft) above 1000m de rate by 1% of synergy™ Ie per 100m (328ft) to a maximum altitude of 2000m (6562ft).

Please note for higher temperatures and altitudes contact your supplier.

Synergy™ models bearing the ETL listing mark are ETL UL508 and CSA C22.2 No.14 listed to US and Canadian safety standards respectively.

Short circuit protection

#1 Suitable for use in a circuit of delivering not more than ___Iq___ rms Symmetrical Amperes, 480 Volts maximum, when protected by Class J time delay fuses with a maximum rating of ___Z1___ or by a circuit breaker having an interrupting rating not less than ___Z2___ ms Symmetrical Amperes, 480 Volts maximum as in table below.

#2 Correctly selected semiconductor fuses can provide additional protection against damage to the synergy™ unit (this is sometimes referred to as type 2 co-ordination). These semiconductor fuses are recommended to provide this increased protection

Type designation (e.g. SGY-10I-4-0I)			SGY 10I	SGY 103	SGY 105	SGY 107	SGY 109	SGY 111	SGY 113	SGY 115	SGY 117
Rated operational current	I _e	A	17	22	29	35	41	55	66	80	100
Rated conditional short circuit current	I _q	kA	5	5	5	5	5	5	5	10	10
Class J time-delay fuse #1	Maximum rating Z ₁	A	30	40	50	60	70	100	125	150	175
UL Listed inverse-time delay-circuit breaker #1	Maximum rating Z ₂	A	60	60	60	60	60	150	150	250	300
Semiconductor fuse (class aR) #2	Type	Mersen 6,9 URD 30_ Bussmann 170M30_ Bussmann 170M31_ Bussmann 170M32_ SIBA 20 61_									
	Fuse Rating	A	100A	100A	160A	160A	160A	200A	200A	250A	315A

Short Circuit protection (continued).

Type designation (e.g. SGY-101-4-01)			SGY 201	SGY 203	SGY 205	SGY 301	SGY 303	SGY 305	SGY 307	SGY 309
Rated operational currents	I_e	A	132	160	195	242	302	361	430	500
Rated conditional short circuit current	I_q	kA	10	10	10	18	18	18	18	18
Class J time-delay fuse #1	Maximum rating Z_1	A	225	300	350	450	500	500	600	600
UL Listed inverse-time delay-circuit breaker #1	Maximum rating Z_2	A	350	450	500	700	800	1000	1000	1000
Semiconductor fuse (class aR) #2	Type	A	Mersen 6,9 URD 31__ Bussmann I7OM40__ Bussmann I7OM41__ Bussmann I7OM42__ SIBA 20 63__				Mersen 6,9 URD 33__ Bussmann I7OM60__ Bussmann I7OM61__ Bussmann I7OM62__ SIBA 20 63__			
	Fuse rating	A	400	550	550	700	800	900	1000	1100

Wire sizes and torques

Terminal		Models	Wire Size		Torque	
			mm ²	AWG	Nm	lb-in
Main Terminals Cu STR 75°C only	Terminal	SGY-101 to SGY-117	2.5 - 70	12 - 2/0	9	80
		SGY-201 to SGY-205	4 - 185	12-350MCM		
	M10 bolt	SGY-301 to SGY-305	2 x 95	2 x 2/0	14	123
		SGY-307 to SGY-309	2 x 150	2 x 350MCM		
Control terminals		All models	0.2-1.5	24-16	0.5	4.5
 Protective Earth ¹⁾ Cu Only	M6 stud	SGY-101	≥ 4	≥ 12	8	70
		SGY-103 to SGY-111	≥ 6	≥ 10		
		SGY-113 to SGY-117	≥ 10	≥ 8		
	M8 stud	SGY-201 to SGY-205	≥ 16	≥ 6	12	105
		SGY-301	≥ 25	≥ 4		
		SGY-303 to SGY-305	≥ 35	≥ 3		
		SGY-307 to SGY-309	≥ 35	≥ 2		
1) Protective Earth wire size based on bonding conductor requirements of UL508 and UL508A						