

synergy[™]

 **fairford**

Quick Start Guide SGY-401 to SGY-505



Redefining Motor Control

synergy™

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 original features of a soft start including internal bypass and lower 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 compressors, refrigerators, pump jacks, moulding machines and chillers can typically see savings of around 8-40% of total energy consumption when lightly loaded.

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

Enabling the Intelligent Energy Recovery System (iERS)

iERS can produce energy savings in suitable applications. However, the user should have an understanding of the application and load characteristic before enabling the feature.

Loads which exhibit frequent changes in motor torque may cause the synergy™ unit to switch rapidly between the iERS on state and the 'bypassed' state as the motor torque changes. If left unchecked, such switching may cause premature wear of the internal bypass components and may invalidate the warranty.

If the loaded / unloaded state changes more than 4 times per minute, iERS should not be enabled.

Applications that are typically well suited to the iERS feature include; Artificial Lift Pump Jacks, Injection Moulding Machines, Mixers, Saws, Rolling Mills, Grinders, Hydraulic Pumps, Crushers, Conveyors, Compressors and Vertical Transport applications.

If the user requires further support regarding the suitability of the application, he should seek support from Fairford Electronics Ltd or an Authorised Distributor before enabling the iERS function



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.



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.



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.

Caution Statements

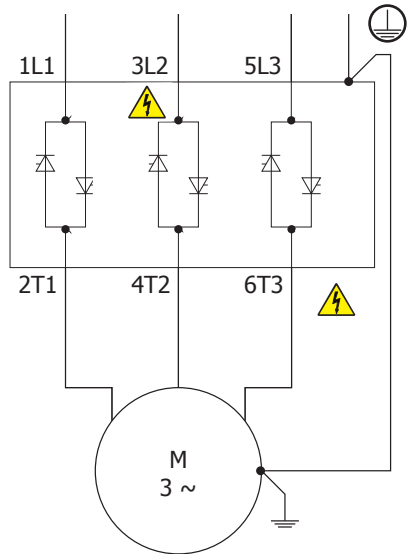
The examples and diagrams in this manual are included solely for illustrative purposes. The information contained in this manual is subject to change at any time and without prior notice. In no event will responsibility or liability be accepted for direct, indirect or consequential damages resulting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

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.



- 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.
- 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.
- It is the responsibility of the installer to provide suitable grounding and branch circuit protection in accordance with local electrical safety codes.
- 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.



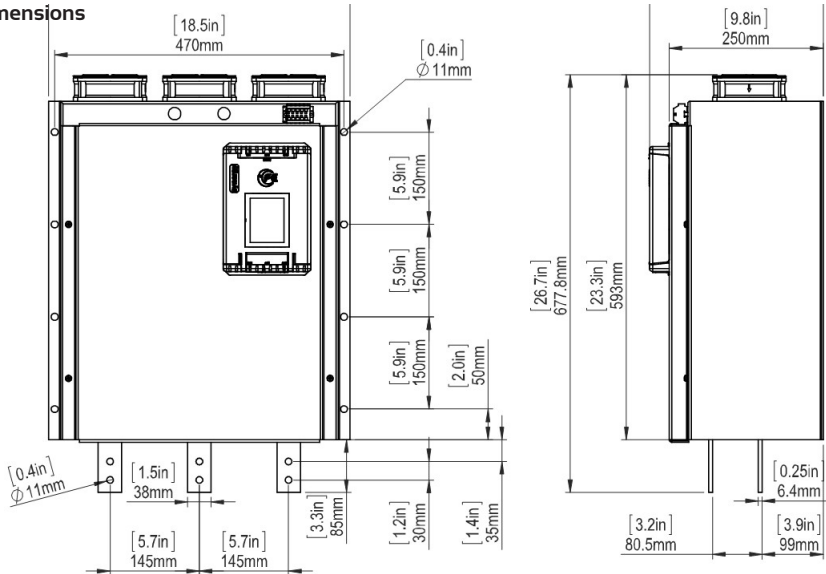
Environment - installation

synergy™

synergy™ SGY - 401 to SGY - 403

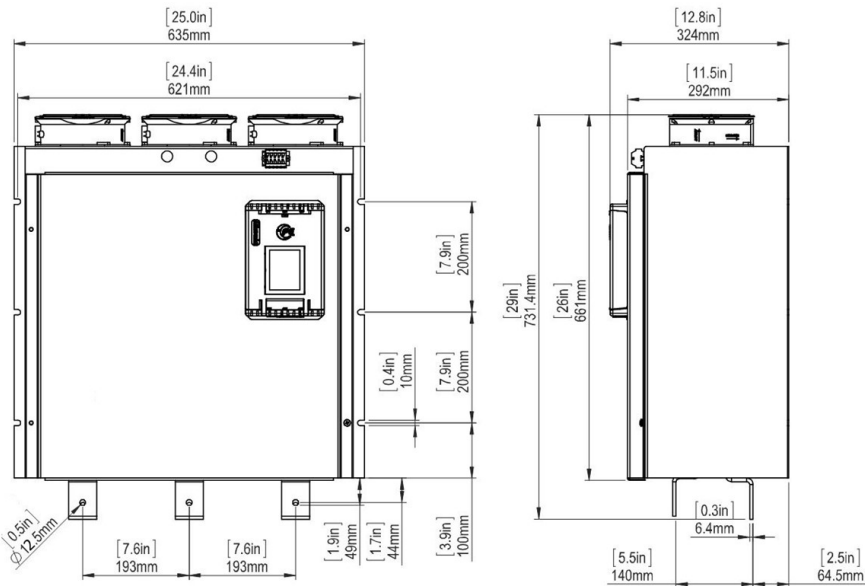
Weight = 65.00 kg (143.3lbs)

Dimensions



synergy™ SGY - 501 to SGY - 505

Weight = 72.0 kg (158.7lbs)





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.

Without external bypass, the maximum power dissipation occurs when energy saving.

Heat dissipated can be approximated with the formula:-

Watts (synergy™) = synergy™ current rating x 3

With external bypass installed, the formula becomes:-

Watts (synergy™) = 1/2 x synergy™ current rating x 3

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

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

(40°C for a fully rated synergy™)

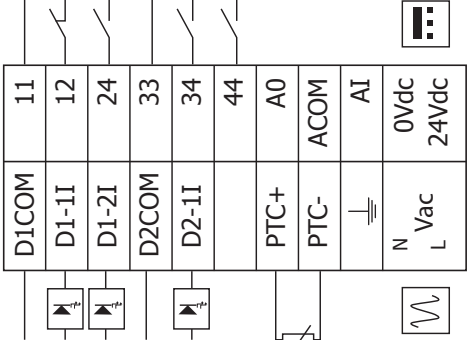
Tamb = Temperature of the air entering the enclosure (°C)

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

Wiring connection

	Required rating	Programmable	Default	Description	Default	Programmable	Required rating	
#1				Group 1 input common				
#1	SEE TABLE 1, U _C	yes	start/ stop	opto-coupled input			230Vac 1A AC15, 30Vdc 0.5A Resistive	
#1	SEE TABLE 1, U _C	yes	None	opto-coupled input			230Vac 1A AC15, 30Vdc 0.5A Resistive	
				group 2 input common				
	SEE TABLE 1, U _C	yes	reset	opto-coupled input			230Vac 1A AC15, 30Vdc 0.5A Resistive	
				not used				
	3 x PTC in series (130°C)		OFF	thermistor			230Vac 1A AC15, 30Vdc 0.5A Resistive	
	3 x PTC in series (130°C)		OFF	thermistor			230Vac 1A AC15, 30Vdc 0.5A Resistive	
				signal ground			0 to 10V 10mA / 4-20mA	
#3	SEE TABLE 1, U _S			control supply			0V	
#3	SEE TABLE 1, U _S			control supply			0 to 10V 10mA / 4-20mA	

Representative of terminal label. See TABLE 1, U_S for AC supply rating as marked on actual Synergy model.

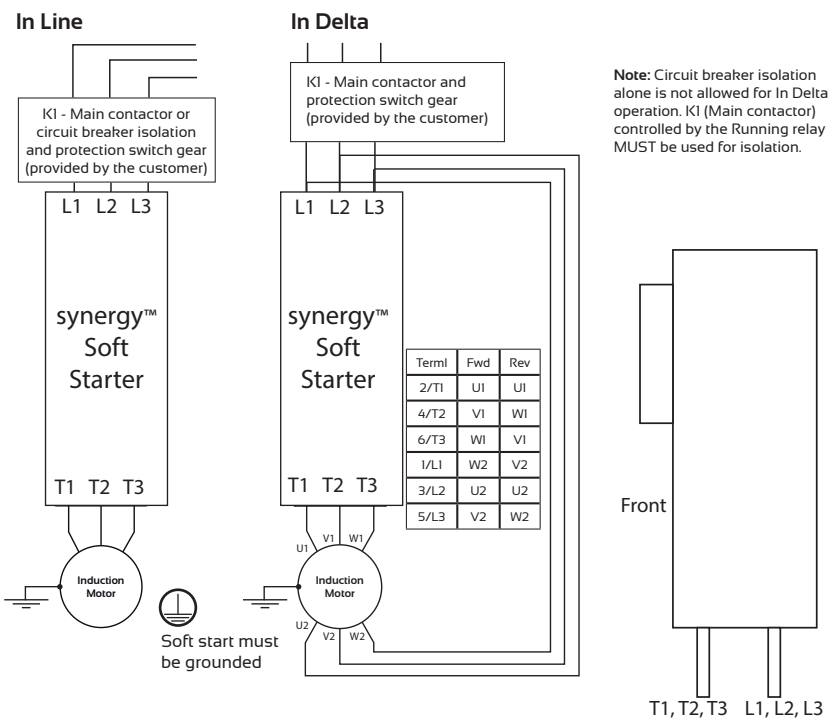


SGV-401 to SGV-505 Control Power Consumption 120W			
Table 1: Interface Control Voltages, 2 Amp supply (Continuous).			
Model No (e):	U _C (+10% -15%)	U _S (+10% -15%)	Notes
SGV-401-4-01 to SGV-505-4-01	110Vac or 230Vac or 24Vdc	110Vac or 230Vac or 24Vdc	The system can have either a 110/230Vac mains or 24Vdc input. NOT both.

*24Vdc Specification
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

Notes	
#1	The programmed digital input setting on D1COM, D1-1I, D1-2I must correspond to the voltage applied to these terminals to avoid risk of damage to the equipment.
#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.
#3	The control supply can be 110 to 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 one of these supply inputs to avoid risk of damage to the equipment.
#4	Refer to Synergy Programming Manual MAN-SGV-001 for factory default settings.

Wiring connection



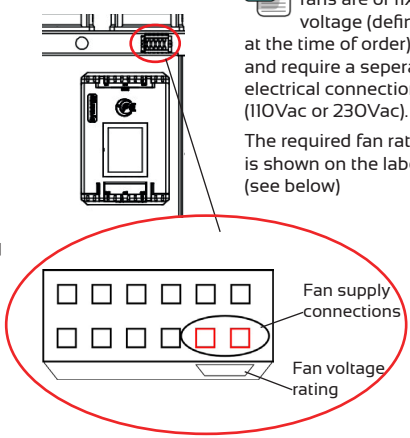
! For suitable short circuit protection devices (SCPD's) see short Circuit Protection in the Technical Information/ standards section of this guide.

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

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.

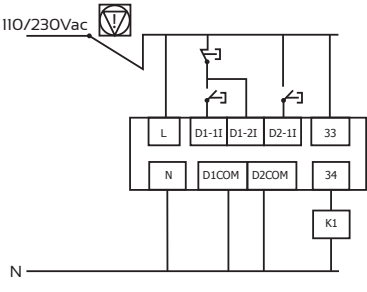
Fan Electrical Supply



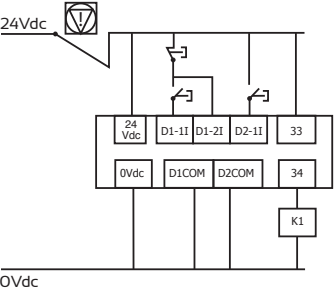
The cooling fans are of fixed voltage (defined at the time of order), and require a separate electrical connection (110Vac or 230Vac). The required fan rating is shown on the label (see below)

Wiring connection

3 Wire Control Diagram
110/230Vac control supply (U_s)
and digital input (U_c) programming.



3 wire Control Diagram 24Vdc control supply (U_s)
and digital input (U_c) programming.

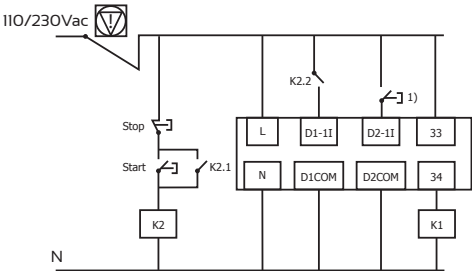


Digital input programming

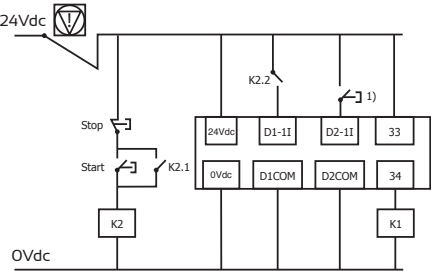
D1 - 1I = Start
D1 - 2I = Stop
D2 - 1I = Reset

	CAUTION
#1	REFER to TABLE 1 on page 6 for input control voltages. These recommended wiring diagrams are specifically where the control supply voltage (U_s) is identical to the control circuit voltage (U_c) and not to be supplied separately. Other wiring configurations must also be in accordance with existing local and national codes and regulations.
#2	Power factor correction capacitors must NOT be positioned between the soft start and the motor or there is a risk of damaging thyristors due to current peaks.

110/230Vac (U_s) and (U_c) user programmable control diagram



24Vdc (U_s) and (U_c) user programmable control diagram

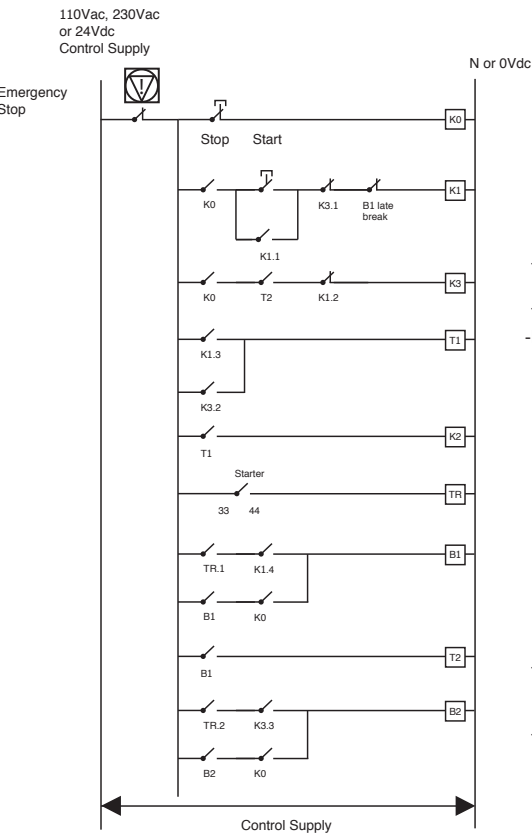
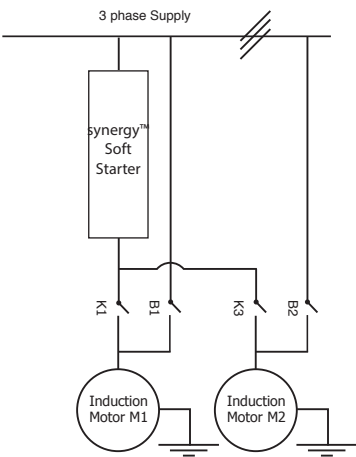
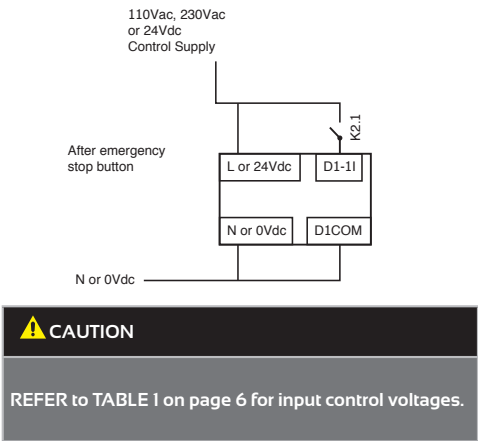


User programmable Inputs are fully programmable

D1 - 1I = High Start / Low Stop
D1 - 2I = None
D2 - 1I = 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 - 1I then select "Two wire control" in the control method menu.

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.

Set to 'Two wire control'

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.

The control logic can be continued for more motors.

The thermal capabilities of synergy™ should be considered.

Current Transformer Installation

synergy™

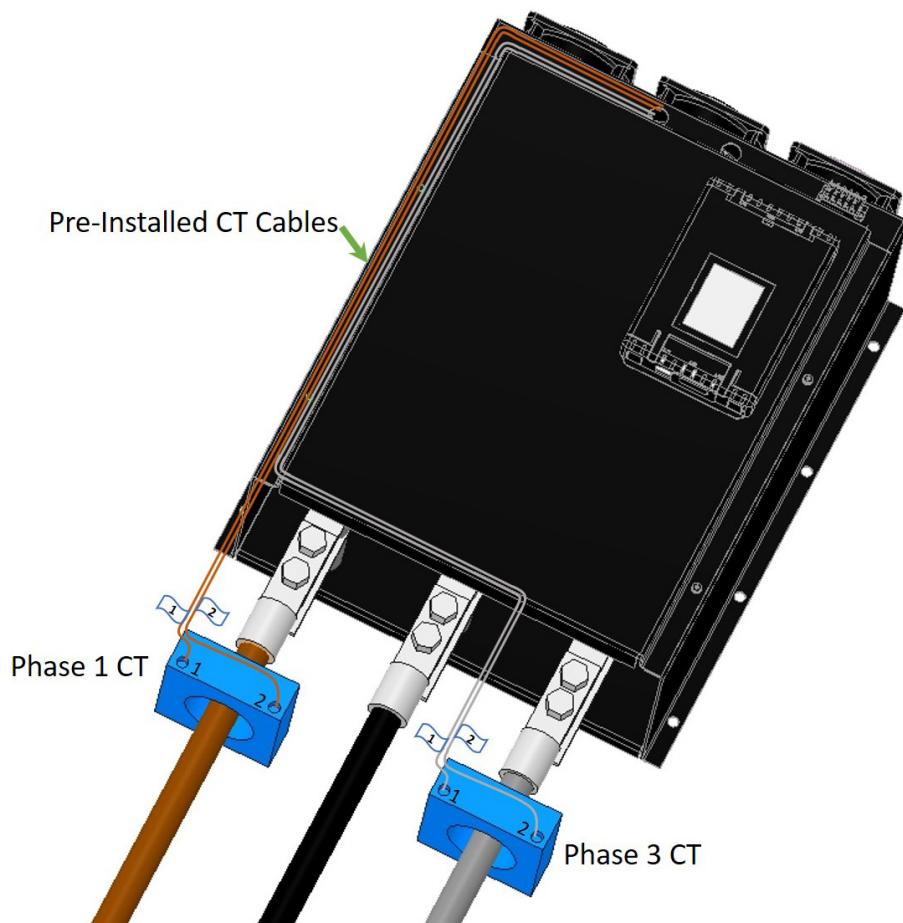
Current Transformers are supplied separately and must be fitted externally.

The unit has the current transformer (CT) cables pre-installed, colour coding corresponds to the phase wiring identification.

Attach the CT cables to the transformers adhering to the numbering scheme.



If the motor overload function is required when the unit is configured for external bypass operation, the current transformer must be placed outside the bypassed circuit.

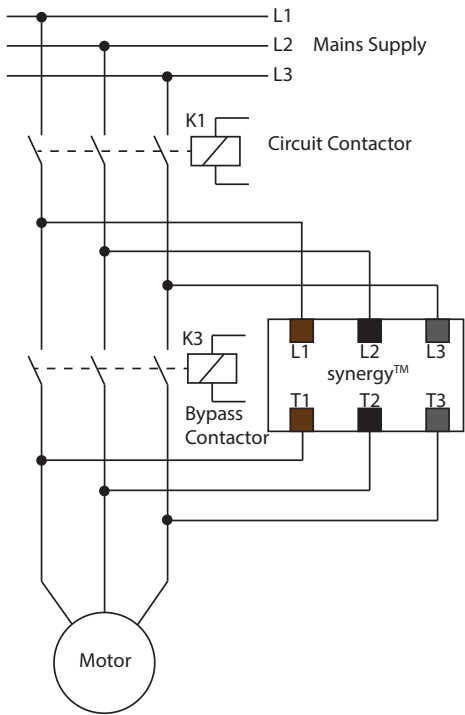


A separate, correctly rated AC53 bypass contactor may be used to provide thyristor bypass . The contactor must be connected in parallel with the synergy™ starter as shown in the diagrams below.

Soft-Starting and Soft-Stopping remain active as normal. At the completion of the starting ramp a bypass contactor is closed, effectively removing the thyristors from circuit, which in turn eliminates heating losses.

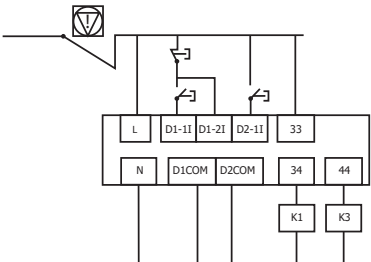
The contactor is controlled by a programmable relay set to 'End of Start' (terminal 44), ensuring that bypassing occurs only after completion of the start, and the motor terminal voltage is at supply voltage.

Power Circuit Diagram

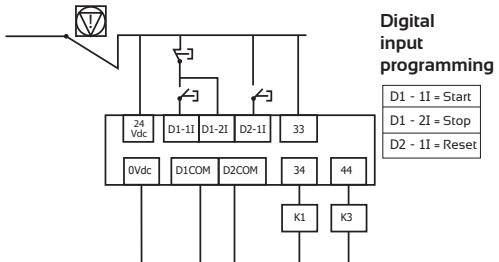


Control Circuit Diagrams

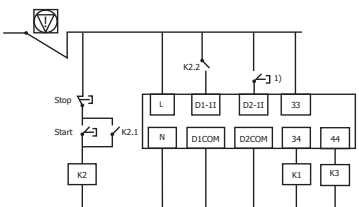
3 Wire Control Diagram 110/230Vac control supply (U_g) and digital input (U_c) programming. Bypass control



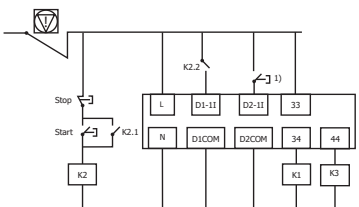
3 wire Control Diagram 24Vdc control supply (U_g) and digital input (U_c) programming. Bypass Control



24Vdc (U_g) and (U_c) user programmable control diagram. Bypass control



110/230Vac (U_g) and (U_c) user programmable control diagram. Bypass Control



CAUTION

REFER to TABLE I on page 6 for input control voltages.

1. Setup Wizard

Auto

Advanced

2. Select Your Application

Default

Heavy

Agitator

Compressor Centrifugal

Compressor Reciprocating

BACK

Up

Dn

NEXT

3. Select Your Application

Warning!

Selected Application Will Enable Trip Class 20

Ok

Centrifugal

Compressor Reciprocating

BACK

NEXT

4. Set Motor Current Rating

100%

+

+

17 A

-

-

BACK

NEXT

5. Select Control Method

Local Touch Screen

User Programmable

Two Wire Control

Three Wire Control

Modbus Network

BACK

NEXT

6. Select Digital Input Voltage

230V

110V

24V

BACK

NEXT

7. Auto Setup Summary

Motor Current: 17A

Application: Compressor

Control Logic: Local Touch Screen

Digital input Voltage: 24Vdc

Trip Class: 20

Save ?

BACK

No

Yes

8.

Stopped

OL = 0%

I = 0A

P = 0kW

BACK

HOME

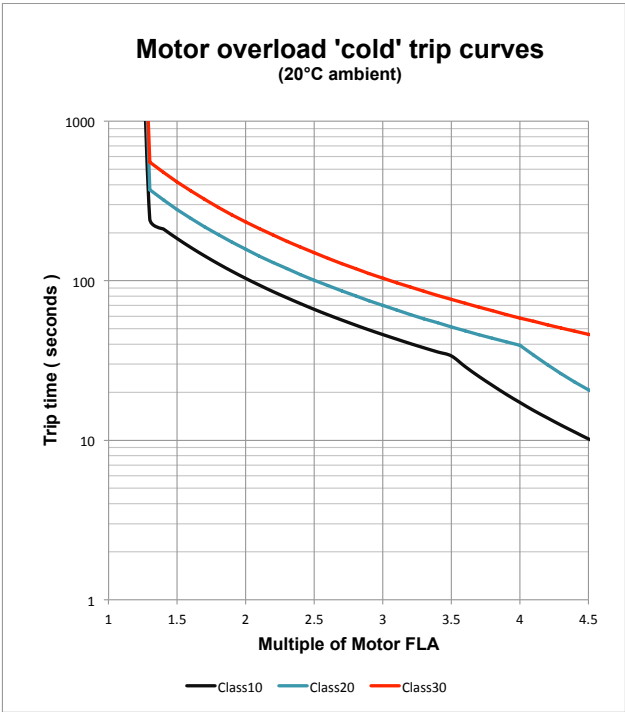
START

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⁾				Control supply U _s
		230V	400V		200V	208V	220- 240V	440- 480V	
SGY-401-4-XX	610	200	355	590	200	200	200	500	24Vdc or 110Vac or 230Vac
SGY-403-4-XX	722	220	400	722	250	250	300	600	
SGY-501-4-XX	850	280	500	840	300	300	350	700	
SGY-503-4-XX	960	315	560	960	300	350	400	800	
SGY-505-4-XX	1080	355	630	1080	350	400	450	900	

- 1) Rated operational powers in kW according to IEC 60072-1 (primary series) corresponding to IEC current rating.
- 2) Rated operational powers in HP used on Table 430.250 of the National Electrical Code, 2005® corresponding to FLA current rating.
- 3) The IEC, I_e rating will apply for EN 60947-4-2 max rating index 1080A: AC-53a: 3.5-17: 60-3
- 4) Ratings apply for a maximum surrounding air temperature of 40°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	200Vac to 480Vac	
Rated operational current	I _e	See Rating table	
Rating index		SGY-401 to SGY-505	Ie: AC-53a: 3.5-17: 60-3
Rated frequency		50 to 60Hz	
Rated duty		Uninterrupted	
Form designation		Form I	
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
		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 1 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, 2 Amp supply (continuous).	
Relay specification		AC-15 230Vac, 1A DC-13 30Vdc, 0.7A	
EMC Emission levels	EN 55011	Class A ①	
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	
Humidity		Max. 85% non-condensing, not exceeding 50% at 40°C	
① NOTICE: This product has been designed for environment A. Use of this product in environment B may cause unwanted electromagnetic disturbances, in which case the user may be required to take adequate mitigation measures.			

Standards



-20°C (-4°F) to 40°C (104°F). Above 40°C de-rate linearly by 4% of synergy™ le per °C to a maximum of 60°C (140°F).



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

Please note for higher temperatures (>60°C) and altitudes (>2000m) contact your supplier.

Short circuit protection

#1 Suitable for use in a circuit 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 with a maximum rating of ___Z2___ 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-201)			SGY 401	SGY 403	SGY 501	SGY 503	SGY 505
Rated operational current	I _e	A	610	722	850	960	1080
Rated conditional short circuit current	I _q	kA	30	30	42	42	42
Semiconductor fuse (class aR) #2	Type	A	Bussmann 170M5466 Siba 2067132.1000A		Bussmann 170M6467 Siba 2068132.1400A		
	Fuse rating	A	1000		1400		

Wire sizes and torques

Terminal		Models	Wire Size		Torque	
			mm²	AWG	Nm	lb-in
Main Terminals Copper busbar	2 x M10 bolt	SGY-401 to SGY-403	50 x 10	1.5in x 0.5in	14	123
	M12 bolt	SGY-501 to SGY-503	60 x 10	2.0in x 0.5in		
		SGY-505	80 x 10	2.5in x 0.5in		
Control terminals		All models	0.2-1.5	24-16	0.5	4.5
Protective Earth ¹⁾ Cu Only	M8 stud	SGY-401 to SGY-403	≥ 70	≥ 1/0	12	105
	M10 stud	SGY-501 to SGY-503	≥ 70	≥ 2/0		
		SGY-505	≥ 95	≥ 3/0		

1) Protective Earth wire size based on bonding conductor requirements of UL508 and UL508A and CSA C22. No.14

Notes

synergy™

[illegible]

Notes

synergy™[illegible]

Quick Start Guide

⚡ Electric current! Danger to life!

Only skilled or instructed persons may carry out the operations.

⚡ Lebensgefahr durch Strom!

Nur Elektrofachkräfte und elektrotechnisch unterwiesene Personen dürfen die im Folgenden beschriebenen Arbeiten ausführen.

⚡ Tension électrique dangereuse!

Seules les personnes qualifiées et averties doivent exécuter les travaux ci-après.

⚡ Corriente eléctrica! Peligro de muerte!

El trabajo a continuación descrito debe ser realizado por personas calificadas y advertidas.

⚡ Tensione elettrica: Pericolo di morte!

Solo persone abilitate e qualificate possono eseguire le operazioni di seguito riportate.

⚡ 触电危险!

只允许专业人员和受过专业训练的人员进行下列工作。

⚡ Электрический ток! Опасно для жизни!

Только специалисты или проинструктированные лица могут выполнять следующие операции.

⚡ Levensgevaar door elektrische stroom!

Uitsluitend deskundigen in elektriciteit en elektotechnisch geïnstrueerde personen is het toegestaan, de navolgend beschreven werkzaamheden uit te voeren.

⚡ Livsfare på grund af elektrisk strøm!

Kun uddannede el-installatører og personer der er instruerede i elektrotekniske arbejdsopgaver, må udføre de nedenfor anførte arbejder.

⚡ Προσοχή, κίνδυνος ηλεκτροπληξίας!

Οι εργασίες που αναφέρονται στη συνέχεια θα πρέπει να εκτελούνται μόνο από ηλεκτρολόγους και ηλεκροτεχνίτες.

⚡ Perigo de vida devido a corrente eléctrica!

Apenas electricistas e pessoas com formação electrotécnica podem executar os trabalhos que a seguir se descrevem.

⚡ Livsfara genom elektrisk ström!

Endast utbildade elektriker och personer som undervisats i elektroteknik får utföra de arbeten som beskrivs nedan.

⚡ Hengenvaarallinen jännitel!

Vain pätevät sähköasentajat ja opastusta saaneet henkilöt saavat suorittaa seuraavat työt.

⚡ Nebezpečí úrazu elektrickým proudem!

Níže uvedené práce smějí provádět pouze osoby s elektrotechnickým vzděláním.

⚡ Eluhohtlik! Elektrilöögihoht!

Järgnevalt kirjeldatud töid tohib teostada ainult elektriala spetsialist või elektrotehnillise instrueerimise läbinud personal.

⚡ Életveszély az elektromos áram révén!

Csak elektromos szakemberek és elektrotechnikában képzett személyek végezhetik el a következőkben leírt munkákat.

⚡ Elektriská stráva apdraud dzīvībai!

Tālāk aprakstītos darbus drīkst veikt tikai elektrospeciālisti un darbam ar elektrotehnikām iekārtām instruētās personas!

⚡ Pavojuos gyvybei dėl elektros srovės!

Tik elektrikai ir elektrotechnikos specialistai gali atlikti žemiau aprašytus darbus.

⚡ Poráženie prądem elektrycznym stanowi zagrożenie dla życia!

Opisane poniżej prace mogą przeprowadzać tylko wykwalifikowani elektrycy oraz osoby odpowiednio poinstruowane w zakresie elektrotechniki.

⚡ Življenjska nevarnost zaradi električnega toka!

Spodaj opisana dela smejo izvajati samo elektrostrokovnjaki in elektrotehnično poučene osebe.

⚡ Nebezpečnostv ohrozenia života elektrickým prúdom!

Práce, ktoré sú nižšie opísané, smú vykonávať iba elektroodborníci a osoby s elektrotechnickým vzdelaním.

⚡ Опасност за живота от электрически ток!

Операциите, описани в следващите раздели, могат да се извършват само от специалисти-електротехници и инструктиран електротехнически персонал.

⚡ Atentie! Pericol electric!

Toate lucrările descrise trebuie efectuate numai de personal de specialitate calificat și de persoane cu cunoștințe profunde în electrotehnică.