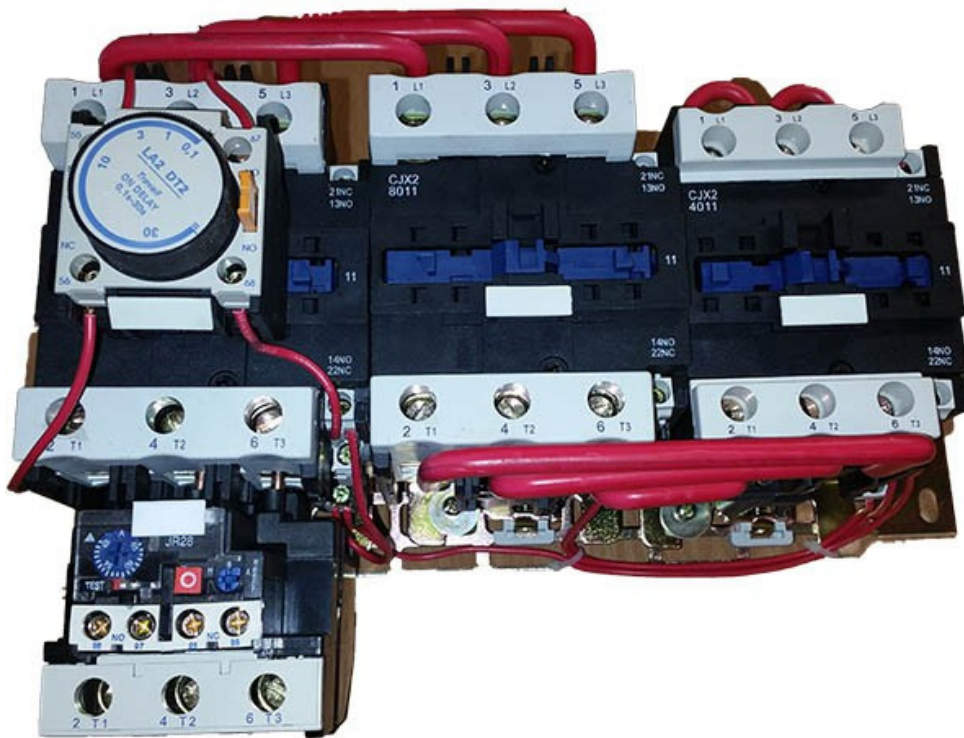


Open Chassis Star-Delta Starter User Guide

(7.5kW~90kW)



V2.0.3

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Revision V2.0.3

Safety Information

This chapter provides very important information so that you can use the **SDS Open Chassis Star-Delta Starter** safely, prevent injury or death, or damage to equipment. Please read this information thoroughly and make sure you observe all the safety information shown below and elsewhere in this manual. Please make this User Guide available for the end user.

Safety symbols



Danger: Danger of electrical shock which can cause injury or death, or damage to equipment



Warning: Potential hazard, other than electrical, that can cause physical injury or damage to equipment



Danger

- The SDS Open Chassis Star-Delta Starter should **ONLY** be installed, commissioned and maintained by qualified and competent personnel.
- The OC SDS must be installed to the latest IEE wiring regulations taking into account local regulations.
- Dangerous voltages are present when the input power supply is connected to the OC SDS. Before attempting any work on the OC SDS or motor, isolate and lock off the input power supply. Prove dead using a voltage tester. The voltage tester itself should be proved immediately before and after testing using a proving unit with a low power output.
- The OC SDS backplate must be connected to system ground using the earth terminals. The size of the earth conductor and earth loop impedance must comply with national and local electrical regulations.
- The SDS is a non-field repairable unit. Contact the supplier of the SDS.
- The mains supply and control supply to the OC SDS must be protected by suitable rated fuses/MCBs.



Warning

- All machinery, in which this OC SDS is used, within the European Union, must comply with directive 98/37/EC, Safety of Machinery.
- Do not install the OC SDS in an explosive environment.
- The motor must be used within the manufacturers guidelines.
- Do not allow conductive material to enter the components within the OC SDS, e.g. from drilling during installation.

Technical data

Trip Class 10

Model	kW rating	Input phase	Input voltage (VAC)	Max allowed motor current (A)	Motor current (A) (overload range) Trip Class 10	Overload range (A)	Typical Motor (A)
SDS075OC400V10	7.5	3	400	17	15.5 to 22	9 to 13	16
SDS110C400V10	11	3	400	22	20 to 31	12 to 18	20
SDS150C400V10	15	3	400	29	29 to 43	17 to 25	27
SDS185OC400V10	18.5	3	400	36	29 to 43	17 to 25	34
SDS220C400V10	22	3	400	44	39.5 to 55	23 to 32	41
SDS300C400V10	30	3	400	59	52 to 69	30 to 40	55

Trip Class 20

Model	kW rating	Input phase	Input voltage (VAC)	Max allowed motor current (A)	Motor current (A) (overload range) Trip Class 20	Overload range (A)	Typical Motor (A)
SDS075OC400V20	7.5	3	400	17	15.5 to 77	9 to 45	16
SDS110C400V20	11	3	400	22	15.5 to 77	9 to 45	20
SDS150C400V20	15	3	400	29	15.5 to 77	9 to 45	27
SDS185OC400V20	18.5	3	400	36	15.5 to 77	9 to 45	34
SDS220C400V20	22	3	400	44	15.5 to 77	9 to 45	41
SDS300C400V20	30	3	400	59	31 to 155	18 to 90	55
SDS370C400V20	37	3	400	75	31 to 155	18 to 90	72
SDS450C400V20	45	3	400	89	31 to 155	18 to 90	86
SDS550C400V20	55	3	400	108	31 to 155	18 to 90	98
SDS750C400V20	75	3	400	135	31 to 155	18 to 90	129
SDS900C400V20	90	3	400	170	103 to 206	60 to 120	158

NOTE: The thermal overload setting is set to minimum as default. It should be adjusted to suit the motor used.

To calculate the thermal overload setting = Actual motor nameplate current ÷ 1.7 x 1.1 (10% safety margin to prevent spurious tripping).

NOTE: Due to the large range of the thermal overloads on the Trip Class 20 star delta starters, please make sure the thermal overload is adjusted correctly to suit the motor.

NOTE: Starting the motor more than once every 10 minutes will alter the thermal overload tripping characteristic by heating the current sensing elements, making the overload trip more quickly for a given setting.

Approvals	CE approval	CE
Environment	Altitude	1000m rated 1000m ~ 3000m, 1% rated current de-rating per 100m above 1000m
	Operating Temperature	-10°C ~ +40°C
	Max. Humidity	≤90%RH, non-condensing
	Vibration	≤5.9m/s ² (0.6g)
	Storage Temperature	-40°C ~ +70°C
	Running Environment	Non-flammable, No corrosive gasses, no contamination with electrically conductive material
Supported Power Supply Systems		TT & TN
OC SDS Enclosure		IP20 (must be installed in an enclosure)
Supply frequency		50 to 60Hz
Supply voltage		3 phase 400VAC ±10%
*Contactor coil voltage		400VAC / 240VAC / 110VAC (+/-10%)

*Model dependant

OC SDS Dimensions

Model	Dimensions (H x W x D) Trip Class 10	Dimensions (H x W x D) Trip Class 20	Approx. Weight (kg)
SDS075OC400V	170 x 180 x 170	170 x 180 x 170	2.2
SDS110OC400V	170 x 180 x 170	170 x 180 x 170	2.2
SDS150OC400V	200 x 300 x 190	200 x 300 x 190	5
SDS185OC400V	200 x 300 x 190	200 x 300 x 190	5
SDS220OC400V	200 x 300 x 190	200 x 200 x 200	5
SDS300OC400V	200 x 320 x 200	200 x 320 x 200	5
SDS370OC400V		200 x 320 x 200	5
SDS450OC400V		200 x 320 x 200	5
SDS550OC400V		350 x 480 x 150	10
SDS750OC400V		350 x 480 x 150	10
SDS900OC400V		350 x 480 x 150	10

NOTE: The above dimensions are only approximate and do not take into account the size of the thermal overload on the trip class 20 star delta starters.

NOTE: The contactor sets between the Trip Class 10 and Trip Class 20 open chassis star delta starter may differ hence the physical size of the trip class 20 may be larger than the equivalent trip class 10 model.

NOTE: The open chassis star delta starters are supplied pre-wired on a back plate. The starting and stopping method will need wiring into the star delta starter. See *Control Connections & Operation* section of this User Guide for example connections.

NOTE: The thermal overload is fitted into the output of the main contactor on the Trip Class 10 product. The Trip Class 20 thermal overload is supplied as a separate module which will need to be mounted separately from the contactors and wired into the output of the main contactor.

SDS Trip Class

The MCW open chassis star delta starters are fitted with either a **Trip Class 10** thermal overload relay as which is suitable for the majority of light to medium industrial type load applications or a **Trip Class 20** thermal overload relay which is suitable for medium to heavy industrial loads.

The MCW star delta starter range is not suitable for applications that have a very heavy load on start that takes greater than 20s to start or very high inertia loads such as high inertia fans, centrifuges or loaded crushers.

Starting the MCW star delta starters more than once every 10 minutes will alter the thermal overload tripping characteristics making the overload trip more quickly for a given thermal overload current setting.

Trip Class Explained

At 600% of the maximum current rating of the motor the **Trip Class 10** unit will trip in 10 seconds or less, **Trip Class 20** will trip in 20 seconds or less, and **Trip Class 30** will trip in 30 seconds or less.

The class number indicates the thermal overload trip characteristics from cold state.

I_r = Current setting of overload relay. This should be the Full Load Current (FLC or FLA) shown on motor rating plate.

	$1.05 \times I_r$	$1.2 \times I_r$	$1.5 \times I_r$	$7.2 \times I_r$
	Time to trip from a cold start			
Trip Class 10	>2 hours	<2 hours	<4 minutes	2s< to <10s
Trip Class 20	>2 hours	<2 hours	<8 minutes	2s< to <20s
Trip Class 30	>2 hours	<2 hours	<12 minutes	2s< to <30s

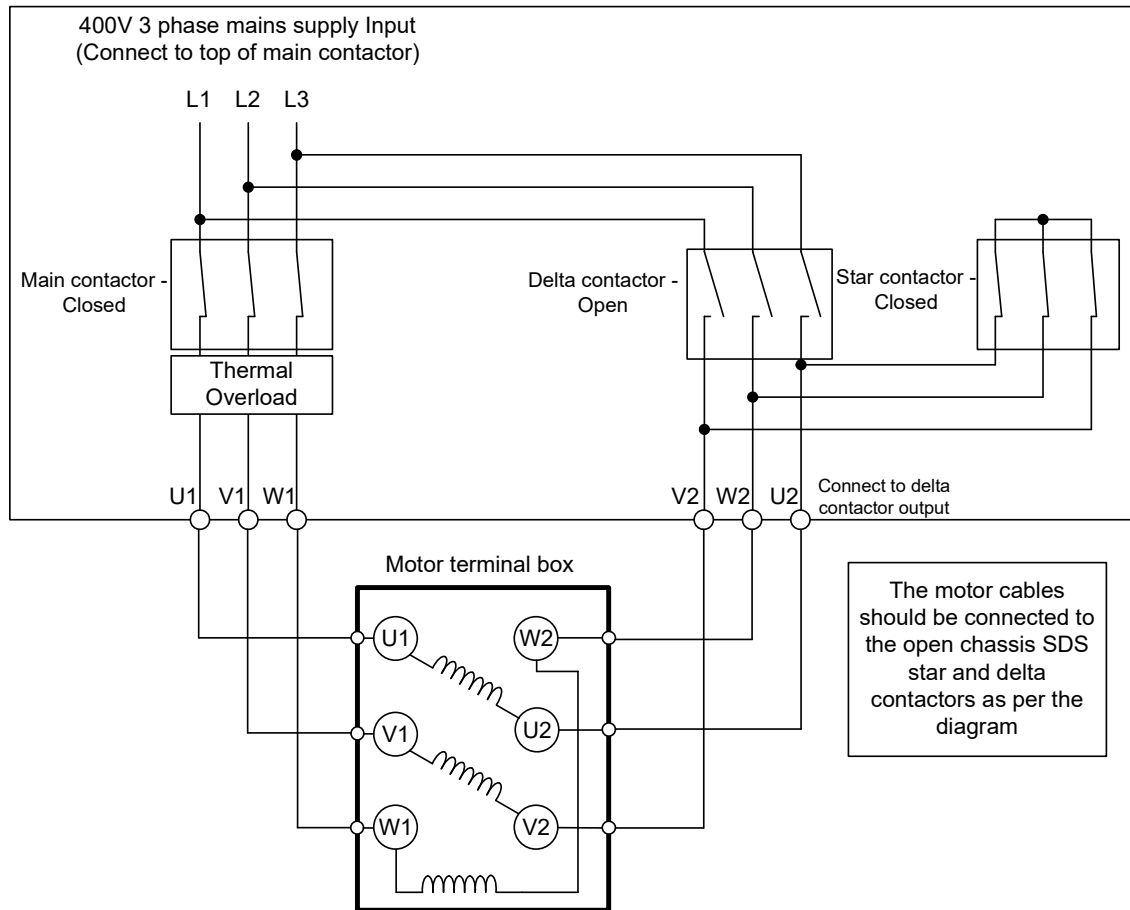
NOTE:

The open chassis star-delta starter can only be used with motors which have 400V delta and 690V star windings.

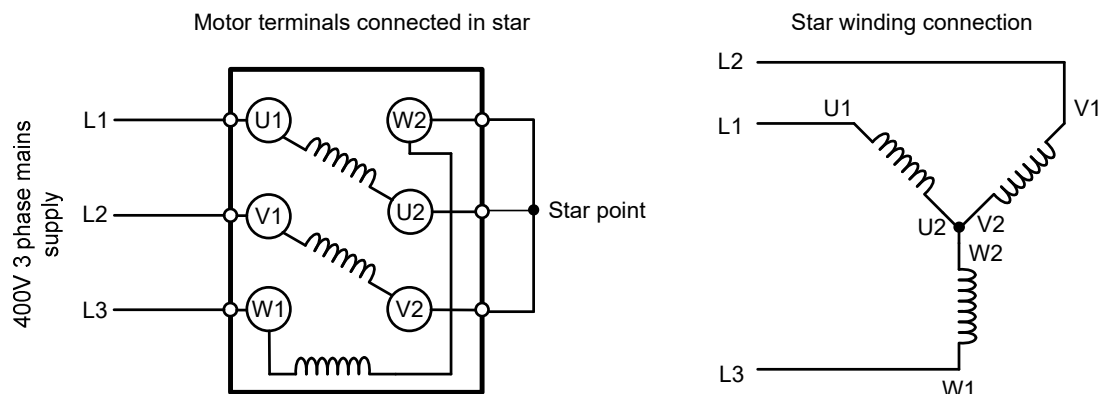
They cannot be used with motors that have 200V delta and 400V star windings.

Open Chassis SDS Circuit diagram with Main and Star contactors closed

This is equivalent to connecting the motor in the star 690V configuration. This is the start configuration for the motor. This configuration draws less current from the mains supply during starting then if the motor was started in the delta configuration. Please connect to the motor as per this top diagram.



Equivalent to -

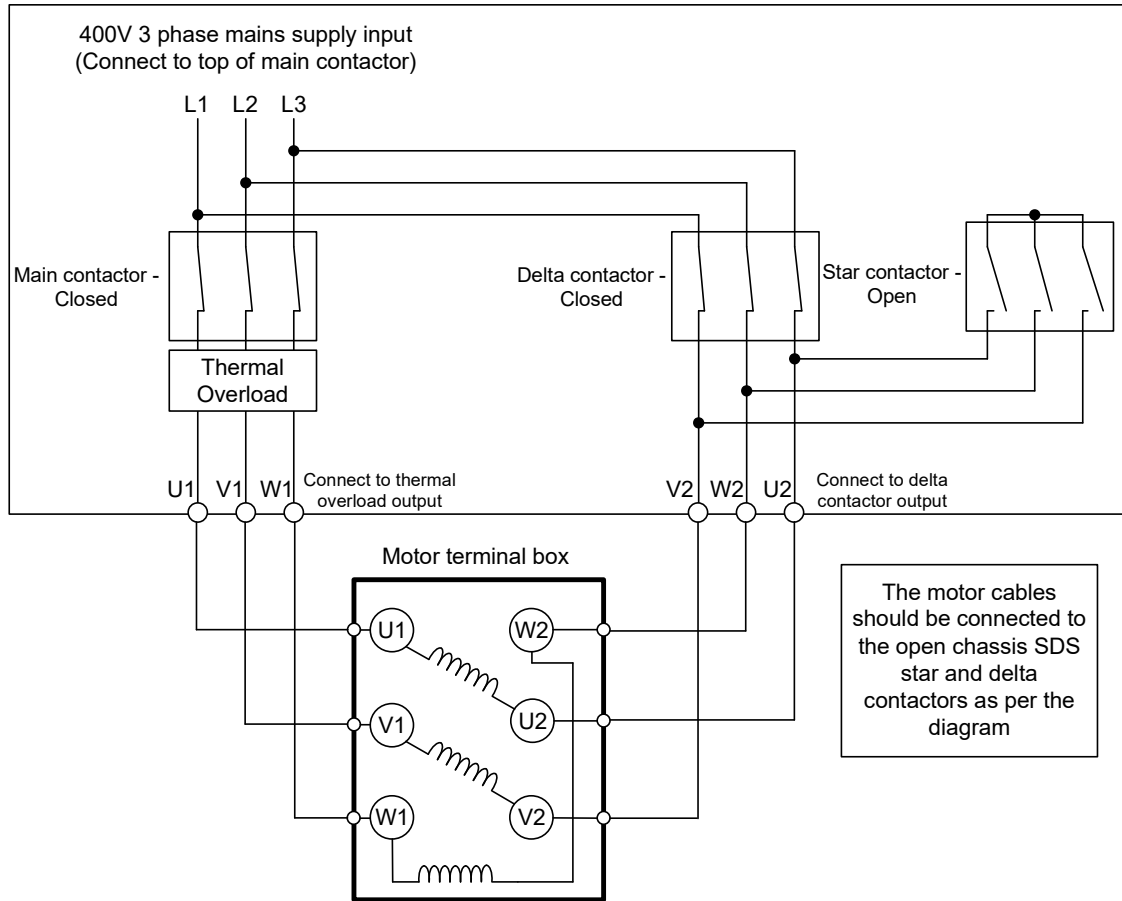


NOTE: The above 'Equivalent to' diagrams just give information on how the motor would be connected to a 3-phase supply if the motor was connected in the 'star' configuration

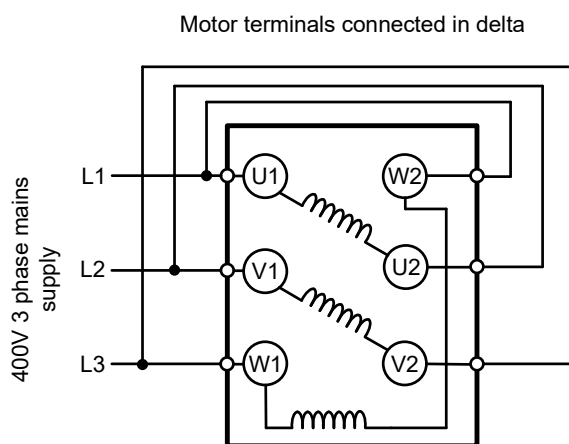
NOTE: Please remember to remove the shorting bars from the motor terminals as these are not required with a star-delta starter.

Open Chassis SDS Circuit diagram with Main and Delta contactors closed

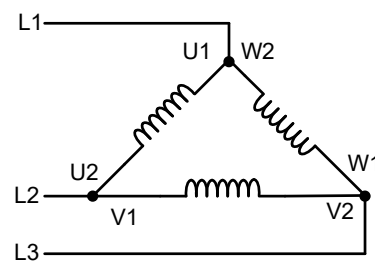
This is equivalent to connecting the motor in the delta 400V configuration. The delta connection is the running connection for the motor. Please connect to the motor as per this top diagram.



Equivalent to -



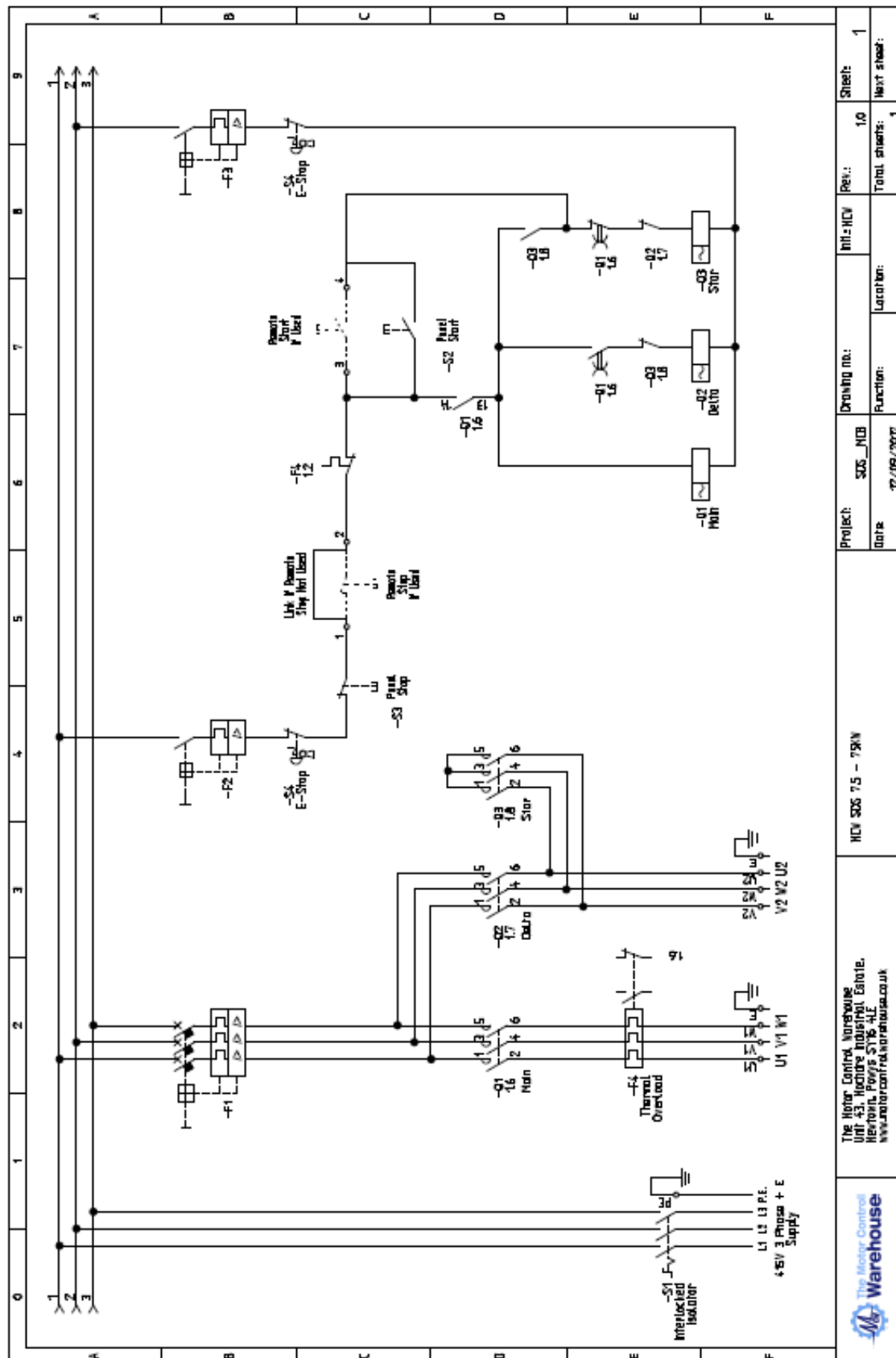
Delta winding connection



NOTE: The above 'Equivalent to' diagrams just give information on how the motor would be connected to a 3-phase supply if the motor was connected in the 'delta' configuration

NOTE: Please remember to remove the shorting bars from the motor terminals as these are not required with a star-delta starter.

Open Chassis SDS Circuit diagram Example (400VAC control)

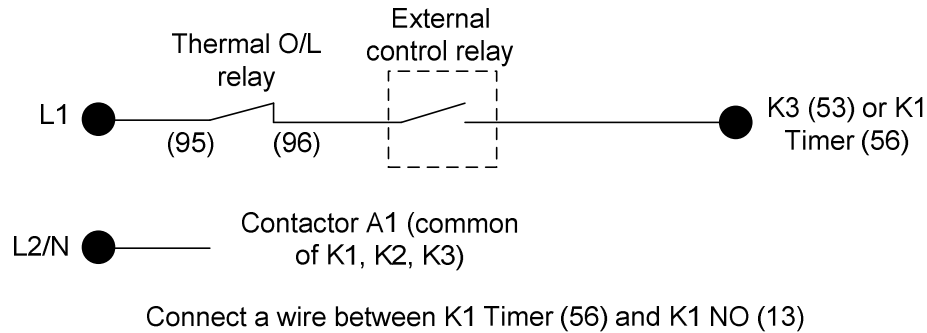


Control Connections

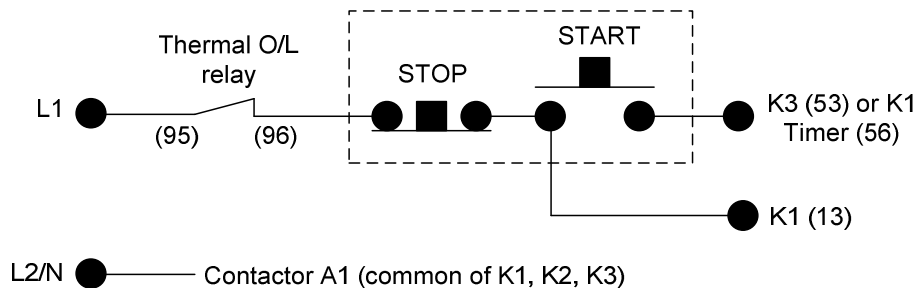
The following drawings give examples of how to connect volt free contacts, switches or push buttons to control the starting and stopping of the open chassis star delta starter.

Small Open Chassis Star-Delta Starter WITH Aux Contact Block on Contactor K3

- Controlled by an external normally open relay contact

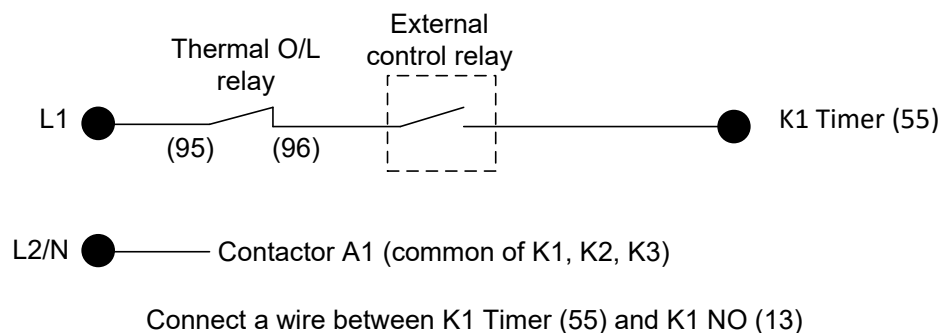


- Controlled by external Start/Stop buttons

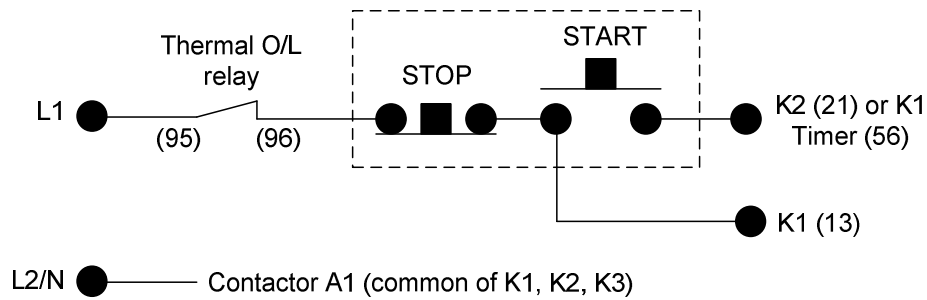


Large Open Chassis Star-Delta Starter WITHOUT Aux Contact Block on K3

- Controlled by an external normally open relay contact

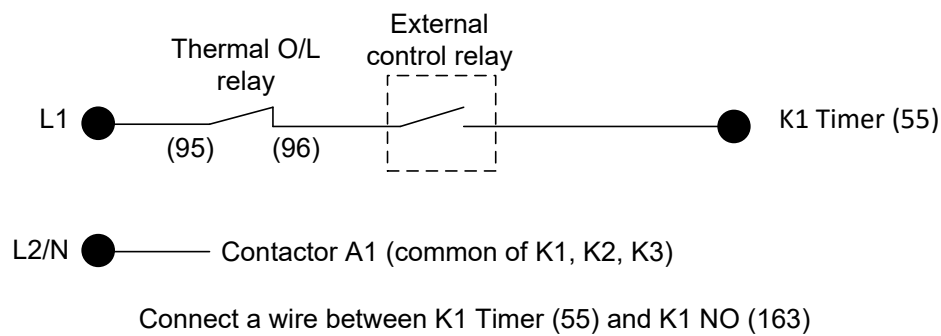


- Controlled by external Start/Stop buttons

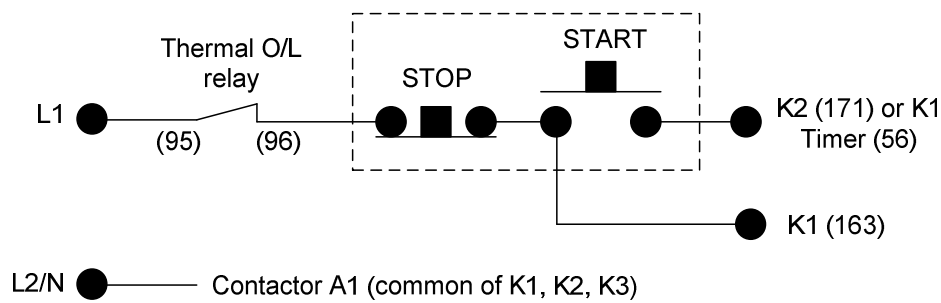


75kW & 90kW Open Chassis Star-Delta Starter

- Controlled by an external normally open relay contact



- Controlled by external Start/Stop buttons



Operation

When start button/switch is pressed on the star-delta contactors will initiate starting the motor.

The 'Main' and 'Star' contactors will pull in. The supply voltage (400VAC) is connected across the star connected motor. Because the motor is connected in star which is the 690V winding but with only 400V across it, the current the motor draws during starting will be reduced. After the time delay of the timer elapses, the 'Star' contactor will drop out and the 'Delta' contactor will pull in. Now the motor will be connected in its delta (running) winding with 400V across its windings.

Timer Setting

The timer setting is dependent on the driven load and inertia and can be determined as follows:

There are two basic ways of determining the correct point at which the timer should change the winding configuration from 'star' (starting mode) to 'delta' (running mode). Both methods determine the point at which the rotor has achieved its maximum speed in star, and therefore the point at which the starter should change to delta.

Current measurement method

Set the delta timer to its maximum setting. Put a clip-on ammeter on one of the lines FEEDING the starter. Set a stopwatch going when you press the start button. Watch the ammeter - it will peak immediately on start up, then the current will drop off as the load accelerates. As soon as the current steadies off, stop the watch. At this point (approximately 85% full load speed) the motor can achieve nothing more by remaining in star, and this is the latest point in time that delta changeover should be made.

Speed measurement method

Use a tachometer on the motor shaft (mechanical or optical) to measure motor speed. Set the delta timer to its maximum setting. Again, use a stop watch. Observe the Tacho. Acceleration characteristics will vary dependent on the driven load, but the speed will settle out at approx. 85% full load speed (this can usually be heard by the tone in the motor being constant). Stop the watch at this point. Set the timer to the time recorded on the stop watch.

NOTES

Date	Thermal Overload Setting

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Other Enclosed Products from Motor Control Warehouse

- **Enclosed Star Delta Starters**, three phase input from 7.5kW to 110kW. Rated for light to medium or medium to heavy industrial loads.

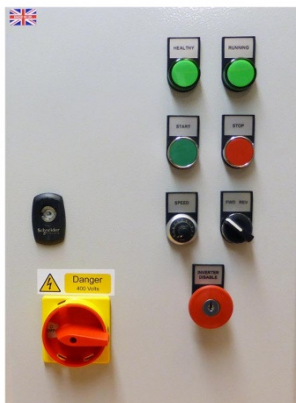


Features

IP65 Powder coated steel enclosure
Lockable panel door
Interlocked mains isolator
10kA MCBs or 80kA fuses on power
10kA MCBs on control
Tri rated cable
Motor outputs to terminals
Terminals for external stop/start Key
release E-Stop button
Adjustable changeover timer
Motor thermal overload relay (trip
class 10 or trip class 20)

Other Enclosed Products from Motor Control Warehouse

- **Enclosed Inverter Drives**, single phase input from 1.5kW to 4kW. Three phase input from 0.75kW to 37kW.



Features

IP54 powder coated steel enclosure
Interlocked mains isolator
10kA MCBs – power & control
Tri rated cable
Keyed Inverter Disable button
IP rated speed pot
Motor connections to terminals
Fwd/Rev switch
Stop/Start buttons
Indication lamps
Thermostat controlled cooling fans
HD700 industrial inverter

- **Enclosed Soft Starters**, from 7.5kW to 55kW, three phase input. All these products are rated at trip class 10 (medium industrial loads).



Features

IP65 Powder coated Steel enclosure
10kA MCBs – power & control
Interlocked mains isolator
Motor thermal overload relay
Internal bypass contactor
Stop/start pushbuttons
Keyed soft stop button
Running and healthy lamps
Customer terminals
24Vdc power supply
Tri rated cable
Fairford Electronics DFE Soft Start