

Telemecanique

LH4

simple soft starting

April

99



Merlin Gerin

Modicon

Square D

Telemecanique

Schneider
 **Electric**



Why choose a Soft Start?

Traditional starting methods, whilst ideal for many applications, do have certain disadvantages.



Electrical problems, such as current peaks and voltage drop on starting, and the need for overly large power supplies to cater for start current demand.

Mechanical problems which result from torque surges and snatch on start-up, and lead to:

- Stretch, slip, premature wear and failure of drive belts
- Wear, noise and run-off of transmission chains
- Stress and fatigue on drive shafts which can eventually shear

Process problems arising from various combinations of the above, such as:

- Water hammer and fluid pressure surges in pumping systems
- Pressure fluctuations in compressed air systems
- Damage to delicate materials and packaging on process lines

A soft start will deal effectively with these disadvantages.

Why choose an LH4 Soft Start?

An LH4 Soft Start considerably reduces mechanical stress by eliminating sudden torque changes on starting (and stopping with LH4-N2). The result? Longer life for belts, chain and shaft drives, and smooth acceleration eliminating product damage during mechanical handling.

Using an LH4 Soft Start reduces current peaks and voltage drop during starting to a low level, prevents voltage spikes and avoids damage to

control equipment (contactors, overload relays, cable and short circuit protection) through overloading and overheating.

Compared to Star delta starting, LH4 installations are less complex, and only require a 3-wire motor.

All of these LH4 benefits combine to give the user maximum productivity, minimum downtime, and lower maintenance costs.

LH4 for new and existing applications

LH4 is easy to apply to new or existing installations. Wiring is straightforward, setting up is simplicity itself, and each unit has the smallest footprint in its class for any given rating.



Typical applications

LH4 Soft Starts are suitable for a wide variety of applications, such as:

- Mechanical handling systems, conveyors, transfer machines, swing tables, roller tables, hoists etc. in industry (eg: textiles and bottling plants), agriculture (eg: feed conveyors), and commercial applications such as baggage handling and goods lifts
- Compressors for refrigeration, air compression or liquid/gas compression in process industries
- Pumps for water pumping in public utilities such as swimming pools or fluid pumping in process industries
- Fans for extraction in buildings such as industrial ovens.

Principle of operation

The LH4 Soft Start energises the motor at low voltage and gradually increases this voltage up to the nominal value.

LH4-N2 Soft Start / Soft Stop units also provide a ramp down function by gradually reducing the voltage at switch off.

LH4 is a simple solid state device which varies the voltage applied to the three phase motor by the use of thyristors. Setting up is simple, one potentiometer sets the voltage ramp-up time, whilst a second sets the voltage level required by the motor applying sufficient initial torque to start the motor rotating immediately power is applied.

The design permits a single phase motor to be controlled, provided it is an asynchronous squirrel cage type.

No programming is required.





The LH4 range

LH4-N1 Soft Start



- 3 phase motor rating from 1.1kW to 11kW at 415V
- Single phase motor rating 0.75kW to 3kW
- DIN rail mounting or screw fixing
- Full speed LED
- Power-on LED
- Hinged, sealable cover over two set-up potentiometers - Acceleration time, and initial torque.

LH4-N2 Soft Start / Soft Stop



- 3 phase motor rating from 1.1kW to 11kW at 415V
- DIN rail mounting or screw fixing
- Full speed LED
- Power-on LED
- Hinged, sealable cover over three set-up potentiometers - Acceleration time, deceleration time and initial torque.

LH4-N2 High-Power Soft Start / Soft Stop



- 3 phase motor rating from 7.5kW to 45kW at 415V
- Surface mounting (screw fixing). Optional DIN rail mounting with adaptor up to 15kW
- Full speed LED
- Power-on LED
- Hinged, sealable cover over three set-up potentiometers - Acceleration time, deceleration time and initial torque.

Selection criteria

Selecting an LH4 Soft Start and associated items by motor rating

Motor full load current rather than kW rating is the key to selection of an LH4 Soft Start.

For three phase 415V motors, select an LH4 using the following procedure:

- 1 Establish full load current of the motor.
- 2 Select the LH4 Soft Start rated at or above the motor full load current (however the motor full load current must be at least 10% of the LH4 rated current).

Then select associated components as follows:

- 3 The **Contactor** should be selected in the usual way by referring to motor kW rating and full load current.
- 4 The **Thermal Overload Relay** should be selected on the basis of compatibility with the associated contactor range. The full load current of the motor should fall within the setting range of the thermal overload relay.
- 5 **Short Circuit Protection** should be selected from the tables on pages 6-7. Either a motor circuit breaker with motor protection characteristics or HRC fuses may be used.
- 6 A **Disconnect Switch**, (where required) should have an AC23 rating at least equal to the motor full load current.

Note:

- i LH4 is designed to operate 30 x 12 seconds per hour, with the starts equally distributed. Derating is necessary if this parameter will be exceeded. Contact your local customer support centre for further information.
- ii Single phase motors can be soft started using similar criteria. However, the motor must be of the asynchronous squirrel cage type.
- iii 2-speed and reversing motors can be controlled by LH4. Contact your local customer support centre for details.

Setting up

When wiring and testing of the installation is complete, the following procedure should be used to set up the LH4:

- 1 Set the acceleration time potentiometer fully clockwise.
- 2 Set the initial torque potentiometer fully clockwise.
- 3 Start the motor to prove the system.
- 4 If a shorter acceleration time is required, stop the motor, rotate the acceleration time potentiometer anti-clockwise, a little at a time, and then restart the motor. Continue with this procedure until the desired acceleration time is reached.
Note: LH4-N2 deceleration time is set up in the same way, using the deceleration time potentiometer. Soft stopping time cannot be less than freewheel stopping time.
- 5 Stop the motor, rotate the initial torque potentiometer anti-clockwise, a little at a time and restart the motor. Continue this procedure until the motor just fails to start (stalls) with the motor under the maximum load, which will be experienced in service. Stop the motor.
- 6 Rotate the initial torque potentiometer clockwise a little, and restart the motor, again under maximum load, checking there is no stall and confirming that the acceleration time is as required. (Adjust as per section 4 above if necessary).

LH4 set up is complete

Note:

If mechanical load on the motor fluctuates, run-up time will fluctuate also.
If initial torque setting is established when the motor is not under maximum load, stalling is likely to occur if a start is attempted when the motor is fully loaded.



Component selection

3 Phase 240V kW
3 Phase 415V kW
1 Phase 240V kW
Typical motor current A @ 415V
LH4 reference



GV MC Breaker reference



Vario disconnect reference Ω
Contactor reference #



Thermal overload relay reference
BS88 Fuse type



Manual control with GV Circuit breakers

Soft Start units to 11kW 415V (See schemes A1, B1 on page 10)

	0.37		0.98	LH4-N106...	GV2M06	V02
	0.55		1.5	LH4-N106...	GV2M06	V02
0.37	0.75		1.9	LH4-N106...	GV2M07	V02
	1.1		2.5	LH4-N106...	GV2M08	V02
0.75	1.5	0.37	3.5	LH4-N106...	GV2M08	V02
	2.2	0.55	5.0	LH4-N106...	GV2M10	V02
1.1	3.0	0.75	6.5	LH4-N106...	GV2M14	V02
	4.0		8.4	LH4-N112...	GV2M14	V01
2.2	5.5	1.5	11.0	LH4-N112...	GV2M16	V01
5.5	11.0	3.0	21.0	LH4-N125...	GV2M22	V1

Soft Start/Stop units to 45kW (See schemes A1, B1 on page 10)

	0.37		0.98	LH4-N206...	GV2M06	V02
	0.55		1.5	LH4-N206...	GV2M06	V02
0.37	0.75		1.9	LH4-N206...	GV2M07	V02
	1.1		2.5	LH4-N206...	GV2M08	V02
0.75	1.5	0.37	3.5	LH4-N206...	GV2M08	V02
	2.2	0.55	5.0	LH4-N206...	GV2M10	V02
1.1	3.0	0.75	6.5	LH4-N206...	GV2M14	V02
	4.0		8.4	LH4-N212...	GV2M14	V01
2.2	5.5	1.5	11.0	LH4-N212...	GV2M16	V01
5.5	11.0	3.0	21.0	LH4-N225...	GV2M22	V1
7.5	15.0		28.5	LH4-N230**	GV2M32	V2
11.0	22.0		42.0	LH4-N244**	GV3M63	V3
15.0	37.0		69.0	LH4-N272**	GV3M80	V5
22.0	45.0		81.0	LH4-N285**	GV7RE100	V6

Automatic control with contactor (Short circuit protection by circuit breaker or fuses)

Soft Start units to 11kW 415V (See schemes A2, B2, C4, D4, E4 on page 10)

	0.37		0.98	LH4-N106...	GV2LE06	V02	LC1K0610	LR2K0306	NIT6
	0.55		1.5	LH4-N106...	GV2LE06	V02	LC1K0610	LR2K0307	NIT10
0.37	0.75		1.9	LH4-N106...	GV2LE07	V02	LC1K0610	LR2K0308	NIT10
	1.1		2.5	LH4-N106...	GV2LE07	V02	LC1K0610	LR2K0308	NIT10
0.75	1.5	0.37	3.5	LH4-N106...	GV2LE08	V02	LC1K0610	LR2K0310	NIT16
	2.2	0.55	5.0	LH4-N106...	GV2LE10	V02	LC1K0610	LR2K0312	NIT16
1.1	3.0	0.75	6.5	LH4-N106...	GV2LE14	V02	LC1K0910	LR2K0314	NIT20
	4.0		8.4	LH4-N112...	GV2LE14	V01	LC1K0910	LR2K0316	NIT20
2.2	5.5	1.5	11.0	LH4-N112...	GV2LE16	V01	LC1D1210	LR2D1316	NIT20M25
5.5	11.0	3.0	21.0	LH4-N125...	GV2LE22	V1	LC1D2510	LR2D1322	TIA32M50

Note: Complete LH4 order reference as follows

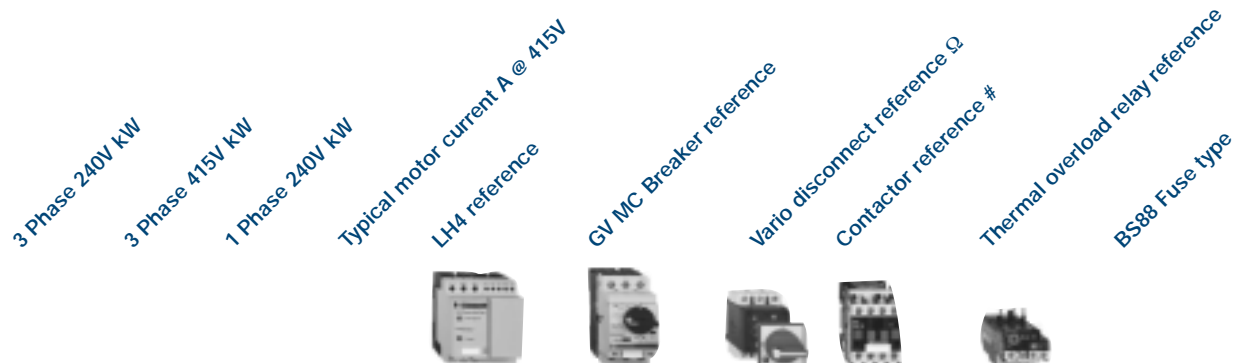
... 200-240v supply - LU7

380-415v supply - QN7

** 415v supply - LY7 - A separate control supply

110-115v 50 or 60Hz is required

Ω Complete Vario reference according to operator type required – see Power Control and Protection Catalogue (ICC 1565)



Soft Start/Stop units to 45kW (See schemes A2, B2, C4, D4, E4 on page 10)

	0.37		0.98	LH4-N206...	GV2LE06	V02	LC1K0610	LR2K0306	NIT6
	0.55		1.5	LH4-N206...	GV2LE06	V02	LC1K0610	LR2K0307	NIT10
0.37	0.75		1.9	LH4-N206...	GV2LE07	V02	LC1K0610	LR2K0308	NIT10
	1.1		2.5	LH4-N206...	GV2LE07	V02	LC1K0610	LR2K0308	NIT10
0.75	1.5	0.37	3.5	LH4-N206...	GV2LE08	V02	LC1K0610	LR2K0310	NIT16
	2.2	0.55	5.0	LH4-N206...	GV2LE10	V02	LC1K0610	LR2K0312	NIT16
1.1	3.0	0.75	6.5	LH4-N206...	GV2LE14	V02	LC1K0910	LR2K0314	NIT20
	4.0		8.4	LH4-N212...	GV2LE14	V01	LC1K0910	LR2K0316	NIT20
2.2	5.5	1.5	11.0	LH4-N212...	GV2L16	V01	LC1D1210	LR2D1316	NIT20M25
5.5	11.0	3.0	21.0	LH4-N225...	GV2L22	V1	LC1D2510	LR2D1322	TIA32M50
7.5	15.0		28.5	LH4-N230**	GV3LE32	V2	LC1D3210	LR2D2353	TIA32M63
11.0	22.0		42.0	LH4-N244**	NS80HMA50	V3	LC1D4011	LR2D3355	TIS63M80
15.0	37.0		69.0	LH4-N272**	NS80HMA80	V5	LC1D8011	LR2D3363	TCP100M125
22.0	45.0		81.0	LH4-N285**	NS100HMA100	V6	LC1D8011	LR2D3363	TCP100M125

Automatic control reversing (Short circuit protection by circuit breaker or fuses)

Soft Start units to 11kW 415V (See schemes C5, D5, E5 on page 10)

	0.37		0.98	LH4-N106...	GV2LE06	V02	+LC2K0601	LR2K0306	NIT6
	0.55		1.5	LH4-N106...	GV2LE06	V02	+LC2K0601	LR2K0307	NIT10
0.37	0.75		1.9	LH4-N106...	GV2LE07	V02	+LC2K0601	LR2K0308	NIT10
	1.1		2.5	LH4-N106...	GV2LE07	V02	+LC2K0601	LR2K0308	NIT10
0.75	1.5	0.37	3.5	LH4-N106...	GV2LE08	V02	+LC2K0601	LR2K0310	NIT16
	2.2	0.55	5.0	LH4-N106...	GV2LE10	V02	+LC2K0601	LR2K0312	NIT16
1.1	3.0	0.75	6.5	LH4-N106...	GV2LE14	V02	+LC2K0901	LR2K0314	NIT20
	4.0		8.4	LH4-N112...	GV2LE14	V01	+LC2K0901	LR2K0316	NIT20
2.2	5.5	1.5	11.0	LH4-N112...	GV2LE16	V01	+LC2D1201	LR2D1316	NIT20M25
5.5	11.0	3.0	21.0	LH4-N125...	GV2LE22	V1	+LC2D2501	LR2D1322	TIA32M50

Soft Start/Stop units to 45kW (See schemes C5, D5, E5 on page 10)

	0.37		0.98	LH4-N206...	GV2LE06	V02	+LC2K0601	LR2K0306	NIT6
	0.55		1.5	LH4-N206...	GV2LE06	V02	+LC2K0601	LR2K0307	NIT10
0.37	0.75		1.9	LH4-N206...	GV2LE07	V02	+LC2K0601	LR2K0308	NIT10
	1.1		2.5	LH4-N206...	GV2LE07	V02	+LC2K0601	LR2K0308	NIT10
0.75	1.5	0.37	3.5	LH4-N206...	GV2LE08	V02	+LC2K0601	LR2K0310	NIT16
	2.2	0.55	5.0	LH4-N206...	GV2LE10	V02	+LC2K0601	LR2K0312	NIT16
1.1	3.0	0.75	6.5	LH4-N206...	GV2LE10	V02	+LC2K0901	LR2K0314	NIT20
	4.0		8.4	LH4-N212...	GV2LE14	V01	+LC2K0901	LR2K0316	NIT20
2.2	5.5	1.5	11.0	LH4-N212...	GV2L16	V01	+LC2D1201	LR2D1316	NIT20M25
5.5	11.0	3.0	21.0	LH4-N225...	GV2L22	V1	+LC2D2501	LR2D1322	TIA32M50
7.5	15.0		28.5	LH4-N230**	GV2LE32	V2	+LC2D3201	LR2D2353	TIA32M63
11.0	22.0		42.0	LH4-N244**	NS80HMA50	V3	+LC2D4011	LR2D3355	TIS63M80
15.0	37.0		69.0	LH4-N272**	NS80HMA80	V5	+LC2D8011	LR2D3363	TCP100M125
22.0	45.0		81.0	LH4-N285**	NS100HMA100	V6	+LC2D8011	LR2D3363	TCP100M125

For complete contactor reference with coil suffix and auxiliary contact references – see Power Control and Protection Catalogue (ICC 1565) + Pre-assembled reversing contactor – Additional auxiliary contact attachments may be required depending on control circuit used

Frequently asked questions

Q1 Is it necessary to use a line contactor with an LH4?

A No, but a galvanic isolation device is required such as a Vario disconnect or GV Motor Circuit breaker.

Q2 Can LH4 soft start the motor in both directions of rotation?

A Yes, by connecting a reversing contactor in series with the LH4.

Q3 If so what precautions must be taken?

A It is necessary to insert a short time delay (of approximately 0.5 seconds) for the changeover from one direction to the other in order to deflux the motor and prevent connection in phase opposition. However as the voltage is reduced by the LH4, the current is also reduced.

Q4 Can the LH4 be used where starting times are longer than 5 seconds?

A Yes, if the motor is under abnormal load and if it was designed to start high inertia loads (see question 5).

Q5 Can the 11kW LH4 be used to start a small motor?

A Yes, as for contactors. But it is recommended not to go below 10% of the rating because the leakage currents of the thyristors would then be sufficient to drive the motor.

Q6 Can the LH4 be used with a generator set?

A The LH4 conforms to the electromagnetic compatibility standards (EMC) in particular:
IEC 60 801-2 level 3
IEC 60 801-3 level 3
IEC 60 801-4 level 4
IEC 60 801-5 level 3
It can therefore operate satisfactorily on supply systems which meet these standards.

Q7 Why isn't the starting torque potentiometer graduated in torque?

A This potentiometer is used to adjust the voltage level required at switch-on so that the motor starts immediately. For an asynchronous motor, torque is proportional to the square of the supply voltage. But each motor has a different starting torque at standstill, which is why it is not possible to graduate the potentiometer in torque.

Q8 Can the LH4 be used for applications requiring more than 40 starts per hour?

A Yes, LH4 is designed to operate 30 x 12 seconds per hour, with starts equally distributed. Providing the total of 360 seconds of equally distributed starting time per hour is not exceeded, derating is not necessary. Above this, the LH4 can be used but it must be derated.

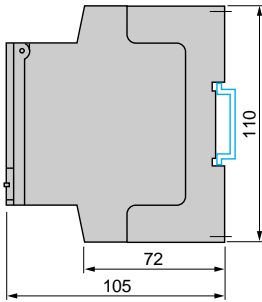
Q9 Can the LH4 be used to start a single-phase motor?

A Yes, providing it is an asynchronous squirrel cage motor, not a motor with a commutator. An LH4-N1 is adequate. The starter should be selected according to current and voltage (see page 5).

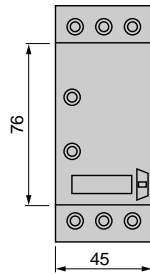


Dimensions and mounting

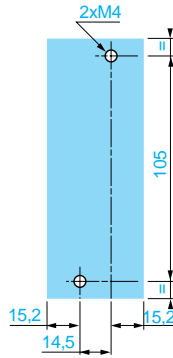
Side view - DIN rail mounting (35mm)
LH4-N106, LH4-N112, LH4-N125
LH4-N206, LH4-N212, LH4-N225



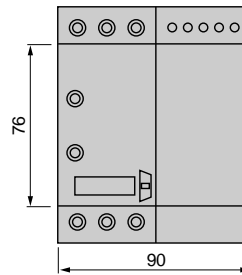
Front view
LH4-N106
LH4-N112
LH4-N125



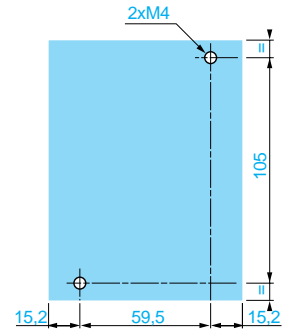
Panel mounting



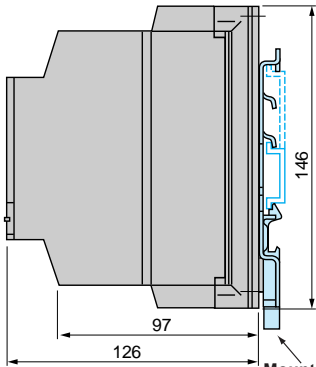
Front view
LH4-N206
LH4-N212
LH4-N225



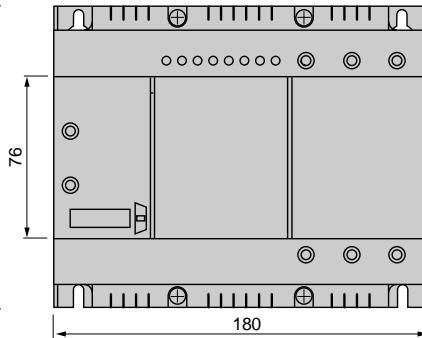
Panel mounting



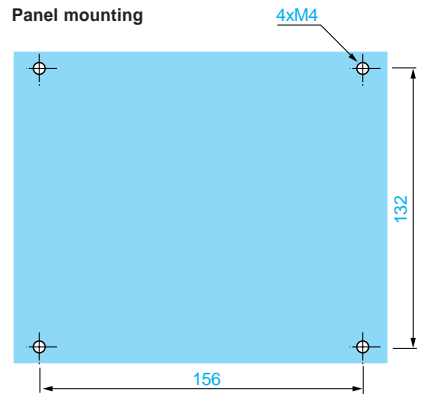
Side view - DIN rail mounting (35/70mm)
LH4-N230 and LH4-N244



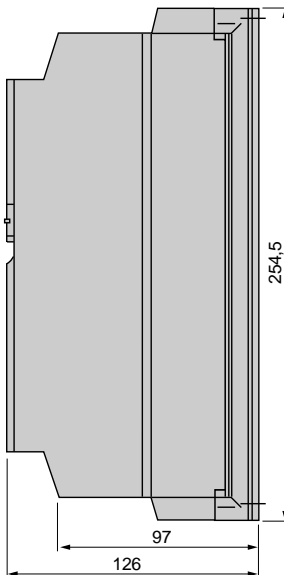
Front view



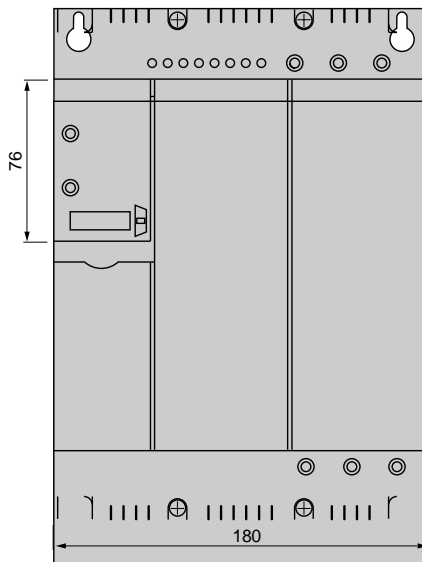
Panel mounting



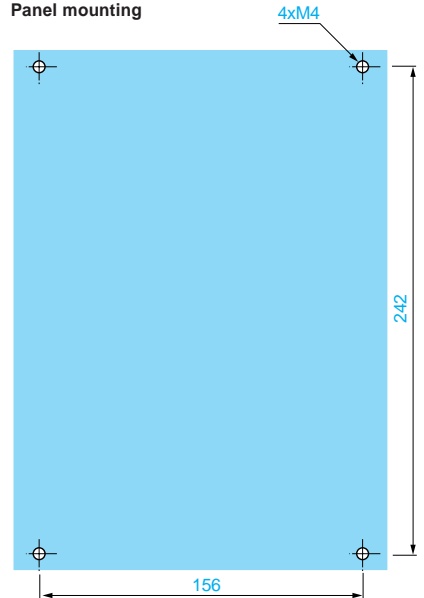
Side view
LH4-N272 and LH4-N285



Front view



Panel mounting



Power circuit wiring schemes

(1) Change -F1 to -F2 where fuses (scheme E) are used as the short circuit protective device

Short circuit protective device schemes

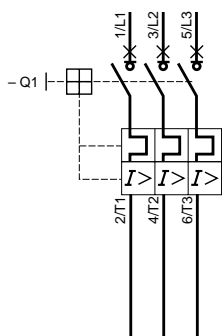
Motor circuit breaker
GV2-M, GV2-P
GV3, GV7

Switch-disconnector
V (Vario)
Motor circuit breaker
GV2-M, GV2-P
GV3, GV7

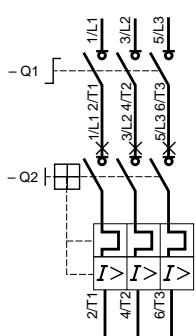
Motor circuit breaker
GV2-L, GV2-LE
NS80-MA, NS100-MA

Switch-disconnector
V (Vario)
Motor circuit breaker
GV2-L, GV2-LE
NS80-MA, NS100-MA

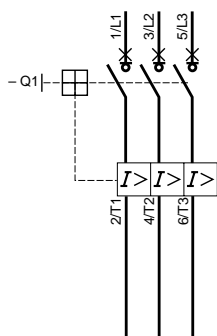
Switch-disconnector
V (Vario)
Fuse BS88



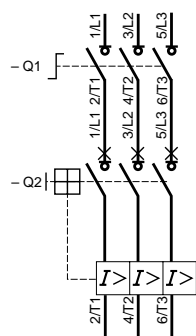
A



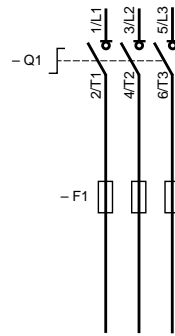
B



C

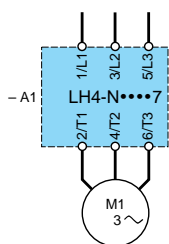


D



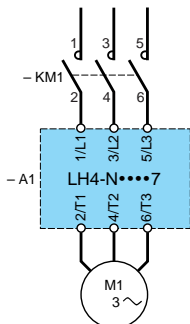
E

1



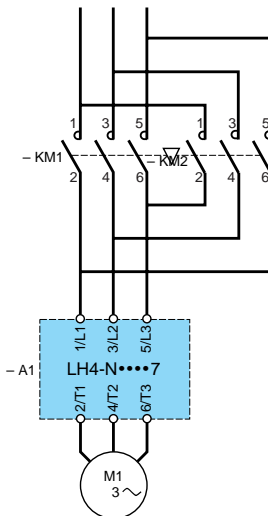
Soft start
LH4-N

2



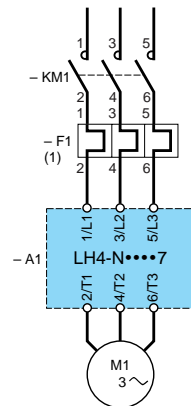
Power switching
LC1-D
Soft start
LH4-N

3



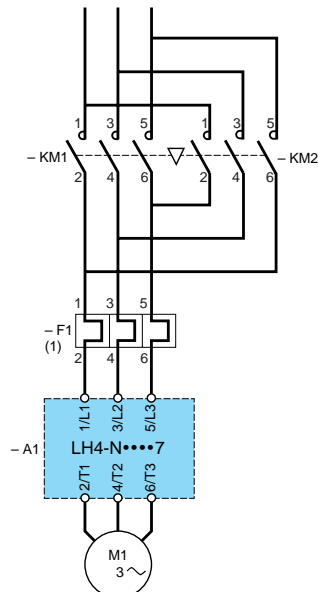
Power switching
LC2-D
Soft start
LH4-N

4



Power switching
LC1-D
Overload
LR1-D
Soft start
LH4-N

5



Power switching
LC2-D
Overload
LR1-D
Soft start
LH4-N

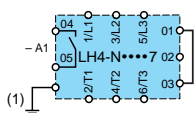
Power switching and soft start schemes

Control circuit wiring schemes

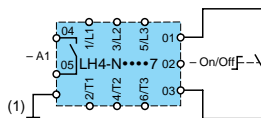
- (1) Earthing required for LH4-N230Q7 and above
- (2) Schemes B2 & D4 only
- (3) Schemes C4, D4 & E4 only
change F1 to F2 for scheme E4
- (4) Schemes B3 & D5 only
- (5) Schemes C5, D5 & E5 only
change F1 to F2 for scheme E5

LH4N206••7, 212••7, 225••7, 230Q7, 244Q7, 272Q7, 285Q7

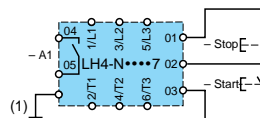
Manual control with
GV motor circuit breaker
without soft stopping
Schemes A1 & B1



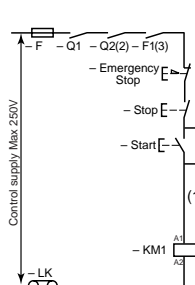
Automatic On/Off control with
GV motor circuit breaker
without soft stopping
Schemes A1 & B1



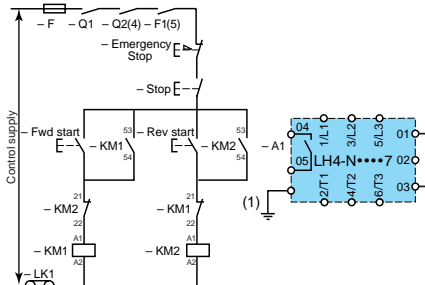
Automatic Start/Stop control with
GV motor circuit breaker
without soft stopping
Schemes A1 & B1



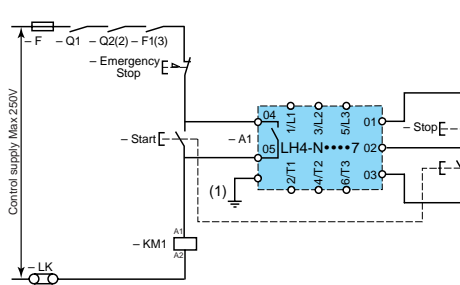
Automatic control with contactor
without soft stopping
Schemes A2, B2, C4, D4 & E4



Automatic control with reversing
contactor without soft stopping
Schemes A3, B3, C5, D5, & E5

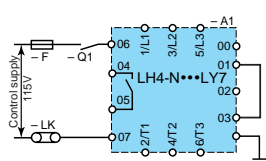


Automatic control with contactor
with soft stopping
Schemes A2, B2, C4, D4, & E4

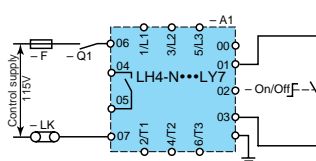


LH4N230LY7, 244LY7, 272LY7, 285LY7

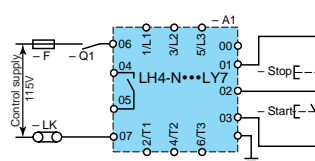
Manual control with
GV motor circuit breaker
without soft stopping
Schemes A1 & B1



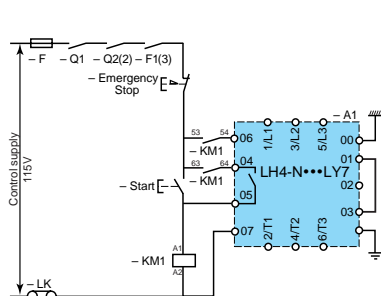
Automatic On/Off control with
GV motor circuit breaker
without soft stopping
Schemes A1 & B1



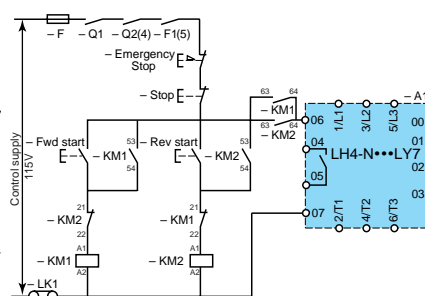
Automatic Start/Stop control with GV motor circuit breaker without soft stopping Schemes A1 & B1



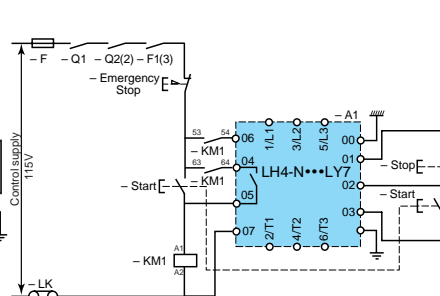
Automatic control with contactor
without soft stopping
Schemes A2, B2, C4, D4, & E4



Automatic control with reversing contactor without soft stopping Schemes A3, B3, C5, D5 & E5



Automatic control with contactor
with soft stopping
Schemes A2, B2, C4, D4, & E4



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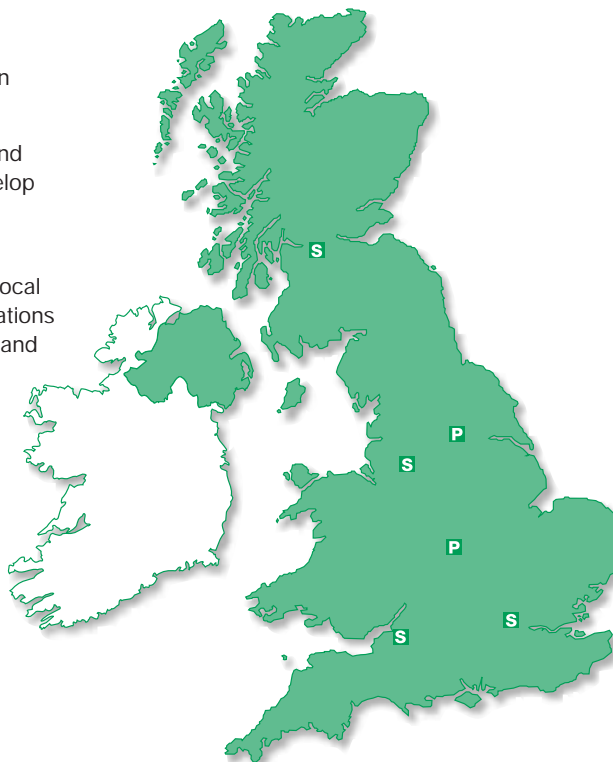
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Schneider - expertise in electrical distribution, industrial control and automation

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Modicon is a leading manufacturer and worldwide marketer of high technology programmable controllers (PLCs) and motion control systems used in industrial automation. Its international catalogue of products and services include PLCs, numerical controllers, specialised programming and software, fieldbus communication networks and interface terminals.

Square D is a total quality organisation and its business is to put electricity to work productively and effectively, protecting people, buildings and equipment. Its low voltage electrical distribution equipment, systems and services are used world wide in commercial applications.



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