WESTCAR S.R.L.
ELECTRONIC

CSV

Soft Starter

Instruction Manual

CE

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ATTENTION:

The starter is provided with the terminal for the connection of the protection conductor (⏚) .In order to avoid dangerous voltage on the cover of the equipment it is important to provide the connection with the appropriate section and color.

The starter, if not specified when the order was made, works with **380V Three-phase circuit** in normal service ad installation conditions.

The starter is designed with a nominal input current **In** and is not protected from overload. Thermic protections for both the starter and the engine need to be provided. In order to achieve a correct protection for short circuit extra-fast-fuses need to be provided in the size indicated in the table at page 12.
The optional board **00-LCV** can limit the current maximum output value during the start to the value shown in the table at page 12.

The starter designation must be made by the customer and must be made on the grounds of the real current required to start.
The proper work of the starter is guaranteed only on new or overhauled motors guaranteed by the constructor and properly connected.

The starter is not designed to supply capacitive loads.
Possible **additional power factor rectified** must be placed **before the device.**

The starter are realised in conformity with the regulations in force about:

- Insulation distances
- Conformity of the materials used in the construction

The use of the product must be made in conformity with the harmonised European regulations and in particular the EN60439-1 (CEI 17-13-1) and EN 60204-1 (CEI 44-5).

During the installation, the use and the servicing, must be respected the regulations in force concerning labour accidents prevention and engine security. (DLgs. N° 626-19/09/94 and CEE regulation 99/382 with followed interpretations and modifications).

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SOFT STARTER CSV
INSTRUCTIONS MANUAL

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1.1 INTRODUCTION

CSV is a starter that use a circuit incorporating power semi-conductor phase control technology with a close loop control of the current, which allows a gradual start-up and slowing down of standard asynchronous motors.
This system allows:

- To adjust the acceleration deceleration time
- To set the start of motor steady running speed
- To set the maximum current absorbed during the start phase
- To limit the torque peak to the mechanical transmission

If it's necessary obtain a continuous speed control and not the only controlled start, it needs to be realised the speed retroaction. The converter is suitable to receive as retroaction signal the voltage of a dynamo tachimetric. In this case the speed control is not made acting on the frequency, but on the voltage, then the motor slide, and is therefore **squanderer.**
It's necessary verify that the starter designation would be proper for the used motor.
Before using the **CSV**, we advise you to read carefully this manual.

2.1 PARTS CHECK

Handle the **CSV** with care and avoid to force open.
Then check that:

- No parts would be damaged during the transport.
- The plate date would be the same as in your order.

If the received material is different from what you have ordered, please contact immediately our assistance offices.

3.1 INSTALLATION

Assemble the starter correctly by using the fixing holes; check that the ventilation pipes are not blocked and that there is enough space around the converter to allow a free circulation of the air.

Then, you have to take into account the following requirements:

- The room temperature (internal part of the casing) must be between **+5** e **+40 °C** and that the relative humidity less than **90%**.

  Avoid areas rich of metallic dust and corrosive gases.

- Avoid areas where there are strong vibration; eventually you can assemble the converter on anti-vibration supports (this option can be supplied on customer request).

4.1 OPERATOR'S PANEL

The starter panel, as seen from the operator, is shown by the fig. 4.1.1 on page 5.
It results divided in three sections:

- ADJUSTMENT SECTION
- WARNING SECTION
- PREDISPOSITION

The **adjustment section** consists of N. 5 potentiometers **P1 ÷ P4** having the following functions:

P1 = Acceleration ramp
Allows to vary the time period from the zero current motor to nominal current linear.
P2 = Initials start up current
Allows to set the initial current available from the starter.
P3 = Time ramp
Allows to set the starting and the stopping time.
P4 = Gain loop seed setting

The **warnings** consists of N. 4 led **DL1 ÷ DL4** which have the following functions:

DL1 = Breakout	Highlights problems within the supply or overheating of the converter
DL2 = Converter OK	Its lighting during the starter feeding indicates that the converter is properly connected and that there are no fault conditions. The *OK* function is available on the **OK** terminal.
DL3 = Gear	Shows the gear nedded
DL4 = Startup start	The engine has terminated the start

The predisposition section has both small bridges to be joined **(JP7, JP8, JP9, JP10,JP11)** in order to set special functions and nornal bridges **(JP3, JP4, JP5, JP6)** in order to set the calibration and personalization of the starter.

A) Calibration jumper:

jumper	function	default
JP3	open for current loop mode (option 00-LCV)	close
JP4	close for external and internal voltage loop mode	closed
JP5	close for direct reference without voltage control mode	open
JP6	close for internal voltage loop mode	closed

A) Small jumper:

jumper	function	default
JP7	close for start circuit internal power supply	closed
JP8	close to exclude voltage clamp (special function)	closed
JP9	close for 60Hz frequency line	open
JP10	open to perform controlled deceleration	closed
JP11 A JP11 B	close for normal mode - start/stop close for controlled acceleration	closed open

Note: don't close JP11A and JP11B simultaneously

Attention: The wrong position of the bridges might cause the failure of the starter

Function mode	JP3	JP4	JP5	JP6	JP7	JP8	JP9	JP10	JP11
Normal start with open V loop	X		X		X	X		X	A
Normal start with internal V loop	X	X		X	X	X		X	A
Normal start with external V loop	X	X			X	X		X	A
Acc/dec start with internal V loop	X	X		X	X	X			B
Normal start with current limit (LCV open loop)			X		X	X		X	A
Normal start with current limit mode and internal V loop		X		X	X	X		X	A

Fig. 4.1.1

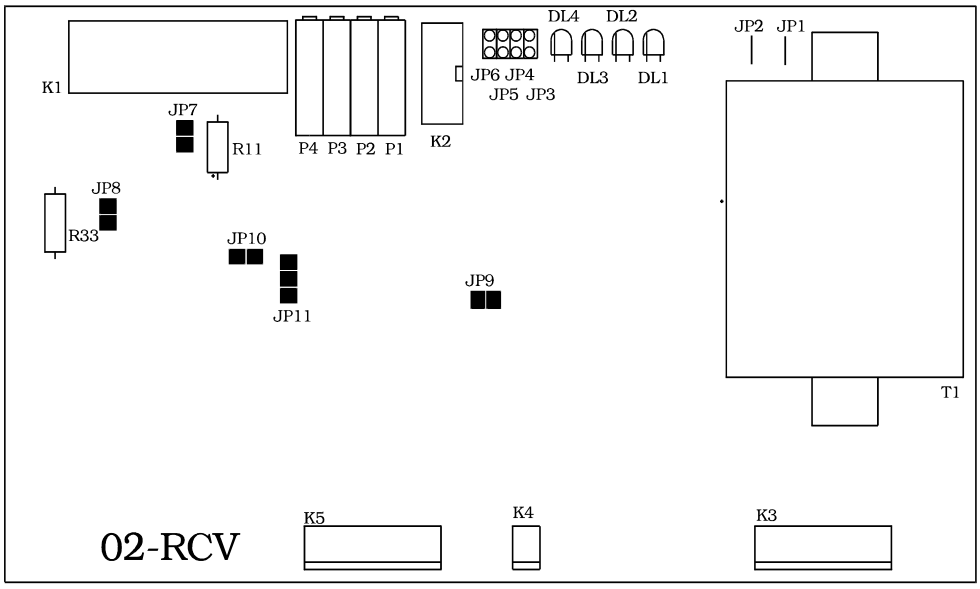
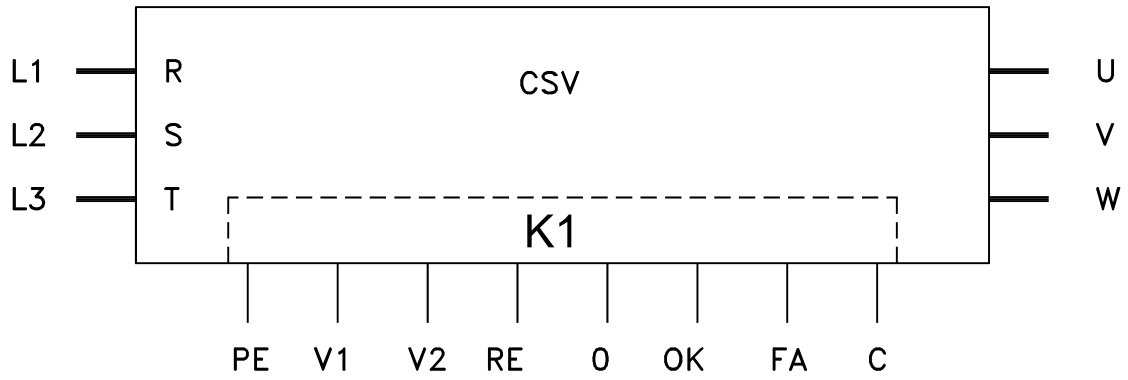


Fig. 4.2.1



4.2 OUTPUT INTERFACE

ABBREVIATION	DESCRIPTION	LEVELS
L1, L2, L3	Power supply	400V threephase 50/60 Hz
U, V, W	Motor output	0÷400V threephase partialized
Pe	Internal voltage reference	+24V CC 200 mA max
V1	Comando di marcia in versione standard	+24V 5 mA
V2	Comando di marcia in versione Acc/Dec	+24V 5 mA
Re	External reaction (Optional)	-100V CC 5 mA max
OK	Starter OK	Open coll. NO 1A 125V
FA	Starter stop	Open coll. NO 1A 125V
0	Common electronic circuit	0 VCC
C	Common contacts FA-OK	1A 250V 125 VA Max
K2	Pin strip option connectors protected	

5.1 CONNECTION

The fig. 5.1.1 on page 8 shows a typical layout connection of a soft starter.

Are necessary those considerations:

The power supply 380/400V 3 phases:

Connect to **L1, L2, L3** following the correct sequence of each phase, an incorrect phase sequence is indicate by a led (**DL5**) illumination; when the phase is correct the led will exaust. If during the starting the motor should rotate in the opposite direction, please invert the **U-V** connections.

Thermical protection:

The starter is not provided with any thermical protection. A thermic relè (RT) need to be provided before the starter in order to protect the starter itself and the engine as shown in Fig. 5.1.1. on page 8. For a good protection against short circuit it is necessary to provide axtra fast fuses of the indicated size on the table at page 12.

Start command:

It's made connecting the **V1 - Pe** terminals together by an N.O. contact of a power contactor **KM**.

Protection conductor (⏚):

The converter is provided with an anchorage for the connection of the protection conductor.
Please assure yourselves have made the connection properly.

Screening:

Normally it's not necessary; in case of control and warning circuits with connections cable longer than 10 meters, please use screened cables with the screen connected to earth on the converter side.

External warnings:

Are available on terminal (OPEN COLLECTOR output) two relays commands (24V / 500 ohm minimum) which warning the **'CONVERTER OK'** (**OK**) and **'START UP END'** (**AV**) conditions.

Options:

The converter is built with a expansion options like the limit of external current or ring of speed. The optional board is to be connected to **K2** connector.

5.2 NOTES

The rephrasing group is not to connect on the starter output; in case that the rephrasing group should be necessary, connect it before the starter, as shown by the fig. 5.1.1 on page 7. The rephrasing group must be made by a fixed condenser.

5.3 ARRANGING

Before the start is necessary to make some arrangements on the jumpers of the **RCV-01** boards depending on the chosen function. For the predisposition se page 5 – 6. It is reccomended to leave the settings in the original position if special functions are not requested.

5.4 STARTING UP PROCEDURE

5.4.1 Starting up

After the check of the proper starter connection and of the system isolation, perform the following operations:

- Check the bridges are in the needed position
- Disconnect the motor from the starter - power the **L1-L2-L3** terminals; the led **DL2** must light up (if **DL1** is lighted swop **L1-L2**)
- Operate the start up by shorting the **V1 - PE** connection together: The led **DL3** must light up and after a while **DL4** must light up as signal of startup ended.
- Operate the stop by opening the **V1 - PE** contact. Reconnect the motor and set the potentiometers **P1 - P2 - P3** to 'zero' (anticlowise rotation).
- Operate the start up command and rotate **P2** clockwise till the motor starts to turn; adjust then **P3** so that the motor starts up in desire way and time
- Repeat the start in order to optimize the operation
- If it would be necessary use a suitable starting boost to overcome the possible initial static frictions, perform as follows:
  Start with the starter in the stop condition, set the **P1, P2, P3** potentiometers to 'zero'.
  Operate the start up and adjust **P2** till the motor starts to turn slowly. Operate now the stop command and turn **P1** as **P2**; reset then **P2** to 'zero'.
  Operate the the start up and check if the booster (**P1**) is able to overcome the initial static friction; if necessary re-adjust (by decreasing if the start is too violent or increasing if not enough). Set then **P2** to keep the system in slow rotation and **P3** to make the the motor start in desire way and time.
  To increase the starting period is enough rotate clockwise the **P3** potentiometer.

6.1 NOTES FOR THE STARTER SETTING UP

A) If the motor to be started has mechanical transmissions with rather high plays, it would be necessary to set the starting current (**P2**) to a lower value and leave **P1** to 'zero'; mechanical kick are so avoidable.

B) If rapid deceleration is required, **P3** would be set to a rather high value, because it's necessary to supply a lot of current to the motor. If it was not enough, increase also **P2**, keeping in mind what explained at point A.

C) If a very slow acceleration is required, set **P3** to a very high value (long acceleration time).

For a better understanding of the effects of the potentiometer on the engine see Fig. 6.1.1. at page 7.

Fig. 6.1.1

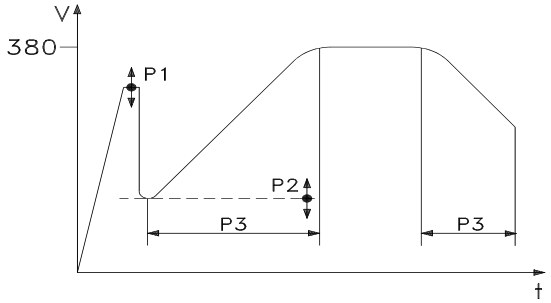
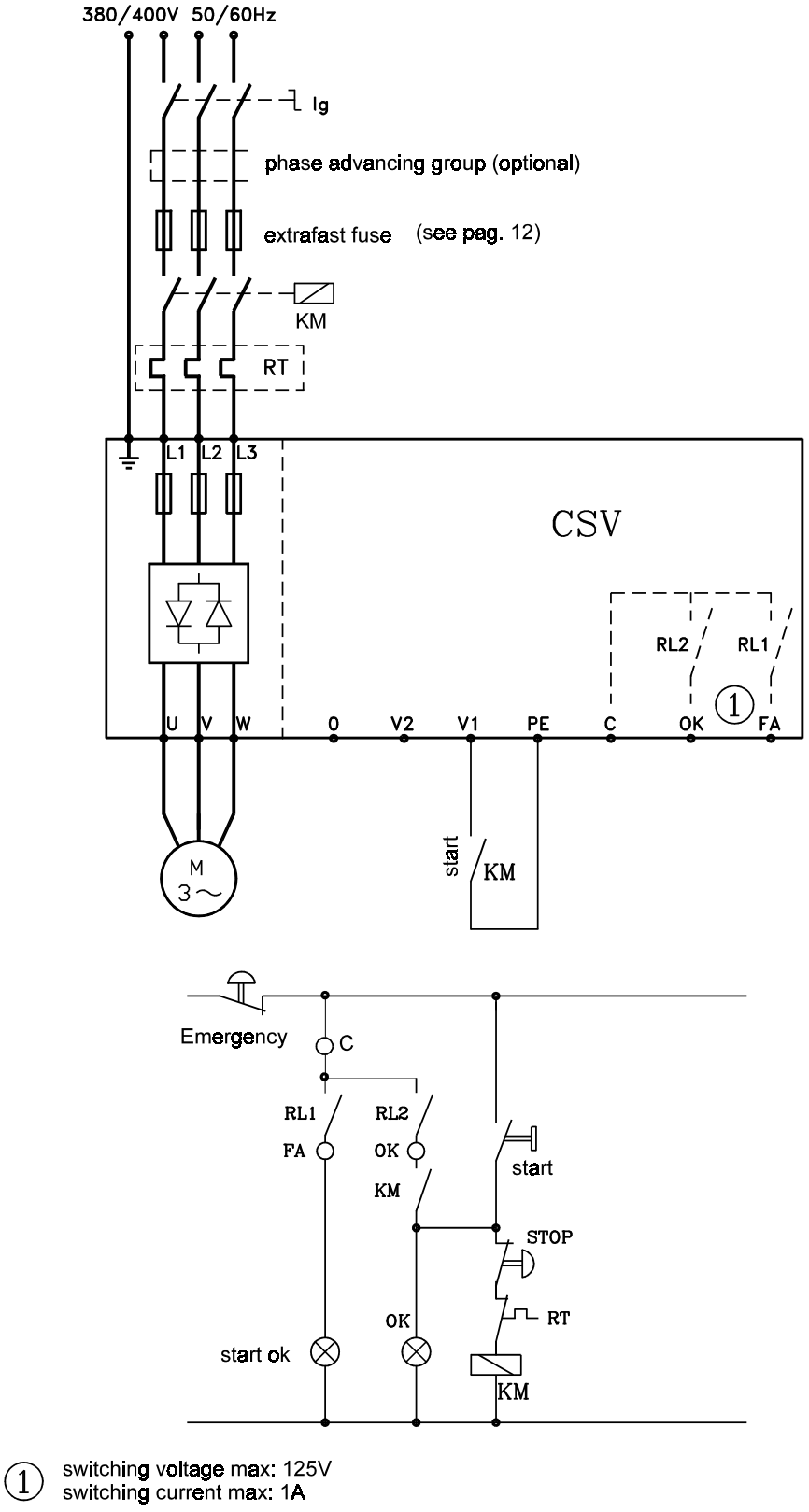


Fig. 5.1.1 Functioning on controlled startup



1 switching voltage max: 125V
switching current max: 1A

7.1 TROUBLE SHOOTING

PROBLEM	CONDITION	SUGGESTED CORRECTION
The engine doesn't turn Not absorbs current	The start led is not lighed up (**DL3**)	Check the command **V1-Pe**
The engine doesn't turn And not absorbs current	The converter led is off (**DL1**)	Probably missing of power supply. Thermic protection inside The converter. Failure on control board
The motor turns and by increasing the absorb current doesn't reach the max running speed(**LCV version**)	The required torque is higher than the one available	Check the T max Use the CSV of bigger size

8.1 OPERATING THE STARTER

8.1.1 FLOWCHART

The flowchart of the soft starter **CSV** is shown by figure 8.1.1 on page 10 .
Here are pointed out the following main blocks:

1 Power groupe
It consists of SCR control, RC filter units and units of overvoltage thyistor suppressors. The power bridge consists of 6 thyristors, connected together in antiparallel, which allow in this way the whole control of the start up/ speed decrease.

2 Transformers and power supply unit
It receives the alternating voltage supply; then, after reducing it through three single phases transformers and rectifiing it, using two bridges rectified, it supplies the following DC voltage:
± 24V, not-regulated voltage for triggering circuits, internal and external relays supply.
± 15V, regulated voltage for regulation and control circuit supply.
The unit is protected by fuses.

3 Control circuit and protections
It represents the supervisor system of all sizes and the control system of the correct command and interlock system.
In particular it controls:

- Correct phase sequence
- Presence of all the supply phases
- Status of the protection devices into the starter
- Possible not enough voltage supply
- Start up/ stop sequence correct
- Start up completed
- Control of the signal coming from thermal option

The overload control is made by an electronic thermal sensor adjusted during the testing stage.

4 Booster circuit
This circuit receives the start up command (contact **Pe - MA** closed) and changes this command into a pulse with duration of about 500mS which sends to a voltage reference circuit (practically it's a shunt); this allows to obtain an adequate amount of start up torque to overcome possible static frictions.
The value during the start up can be adjusted by using the potentiometer **P1**.

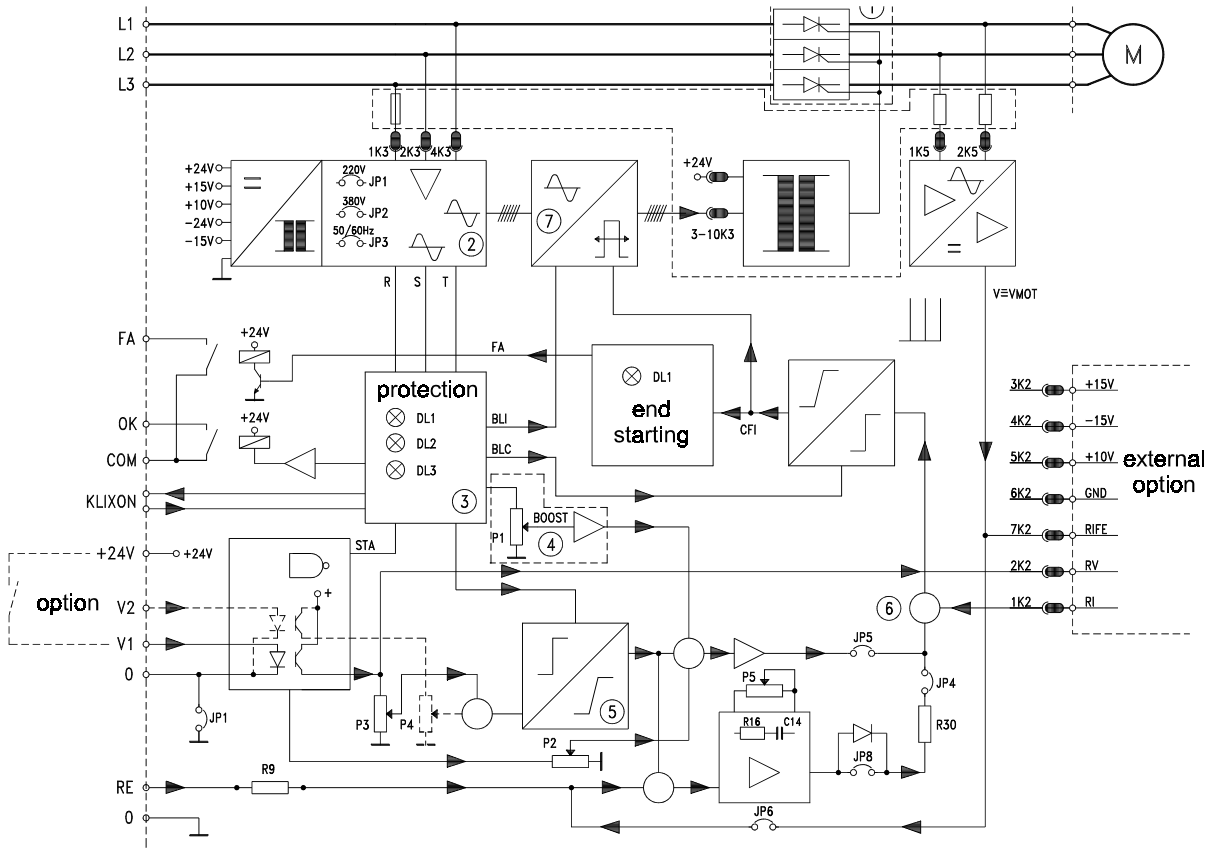
5 Ramps Circuit
Pratically it is an integrated circuit, whose charge and discharge are controlled by the potentiometer **P3** when the start command is on V1. By adjusting the potentiometer you can reduce the starting time.

6 Current ring amplifier circuit
The current control signal is comparated with the motor current one, and limitated into its maximum amount.
The fault that there is between the nominal current and the motor one is amplified and send to the next circuit to make the pulse maker command (CFI).

7 Phaseshifter pulse amplifier circuit

The **CFI** is applied to this circuit that provide to the production of the SRC command pulses. Those are sent as a train of pulses (a first pulse of a quite high value and a series of other one of reduced value) to the primary of a transformer, which secondary is connected the thyristor gate; in this way an electrical isolation is obtainable between the control and power circuits.

Fig. 8.1.1



9.1 THECHNICAL SPECIFICATIONS

POWER SUPPLY:

- SUPPLY	380/400V	|	
		|	Different voltage on demand
- FREQUENCY	50/60Hz	|	

LOADS AND ADJUSTMENTS :

- Nominal output current:	In
- Maximum output current:	See selection table at page 12 (OPZION)
- Start up Boost:	0 ÷ 50% V max settable
- Acceleration/Deceleration ramp:	4 ÷ 40 sec. settable

PROTECTIONS:

- Wrong input phases sequence
- Overvoltages
- Overheating

LED WARNINGS:

- Starter ready
- Starter at work
- Starter broken
- Start up end

EXTERNAL SIGNALS:

- Output contact relay: 1A 125 V
- Starter ready
- Start up end

DISSIPATION:

- Into the power circuit: $P = N^{(1)} \times I^{(2)} \times \Delta V^{(3)}$
- Into the control circuit: Pmax = 15W

(1) N = Phases number = 3
(2) I = Phase current (effective value)
(3) ΔV = equivalent voltage drop (usually 1.2V)

- Maximum allowed starting:
  15 per hour with a 2 minutes pause between one starting and the other

AMBIENTAL CONDITIONS:

- Storage temperature: -10 / +70°C
- Work temperature**:** + 5 / +40°C

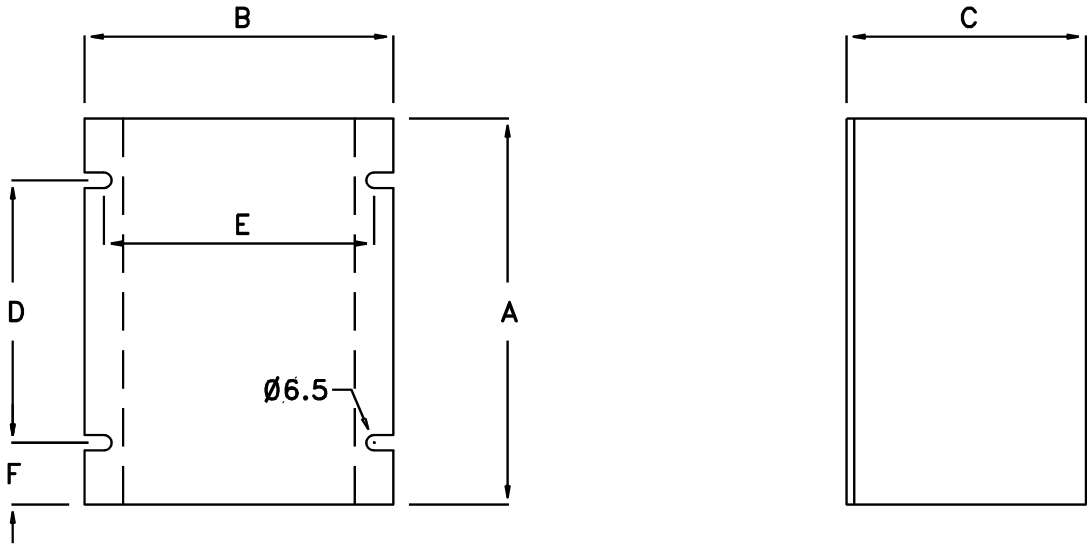
The starter is able to provide the nominal value up to 50 °C into the screen; higher than this temperature is necessary a decreasing of the performances equal to the 2% for every temperature increasing °C degree. Maximum temperature 55 °C.

- Relative humidity: 90% without condensing
- Altitude**:** 1000 mt. above sea level

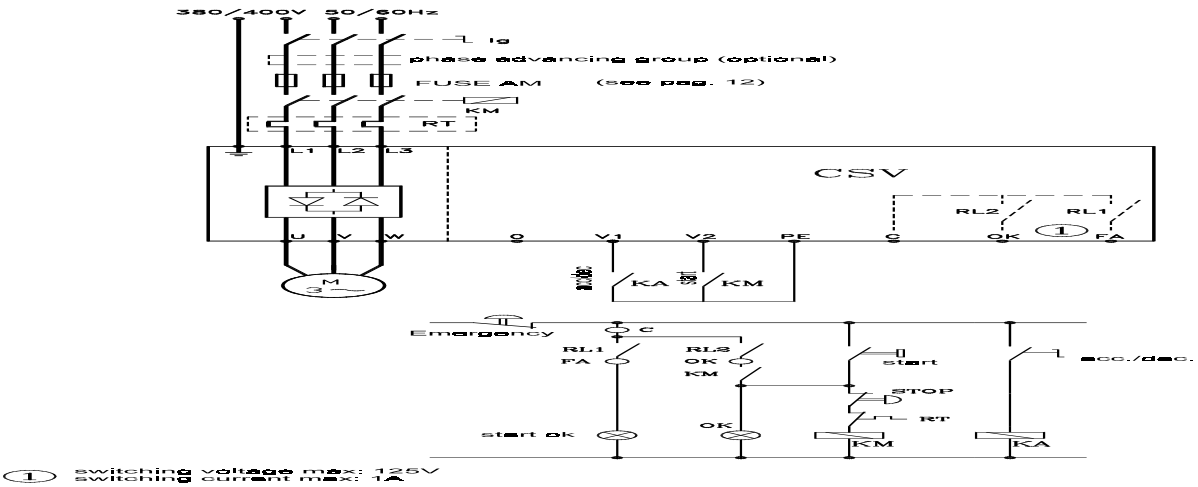
PROTECTION DEGREES:

- 20 frontal (IP20 total optional)

9.2 INITIALS FOR THE ORDER AND DIMENSIONS



DIM(mm)		A	B	C	D	E	F	weight
size	1	200	183	170	150	168	25	4
	2	200	233	170	150	218	25	6
	3	200	233	200	150	218	25	8
	4	260	233	200	210	218	25	10

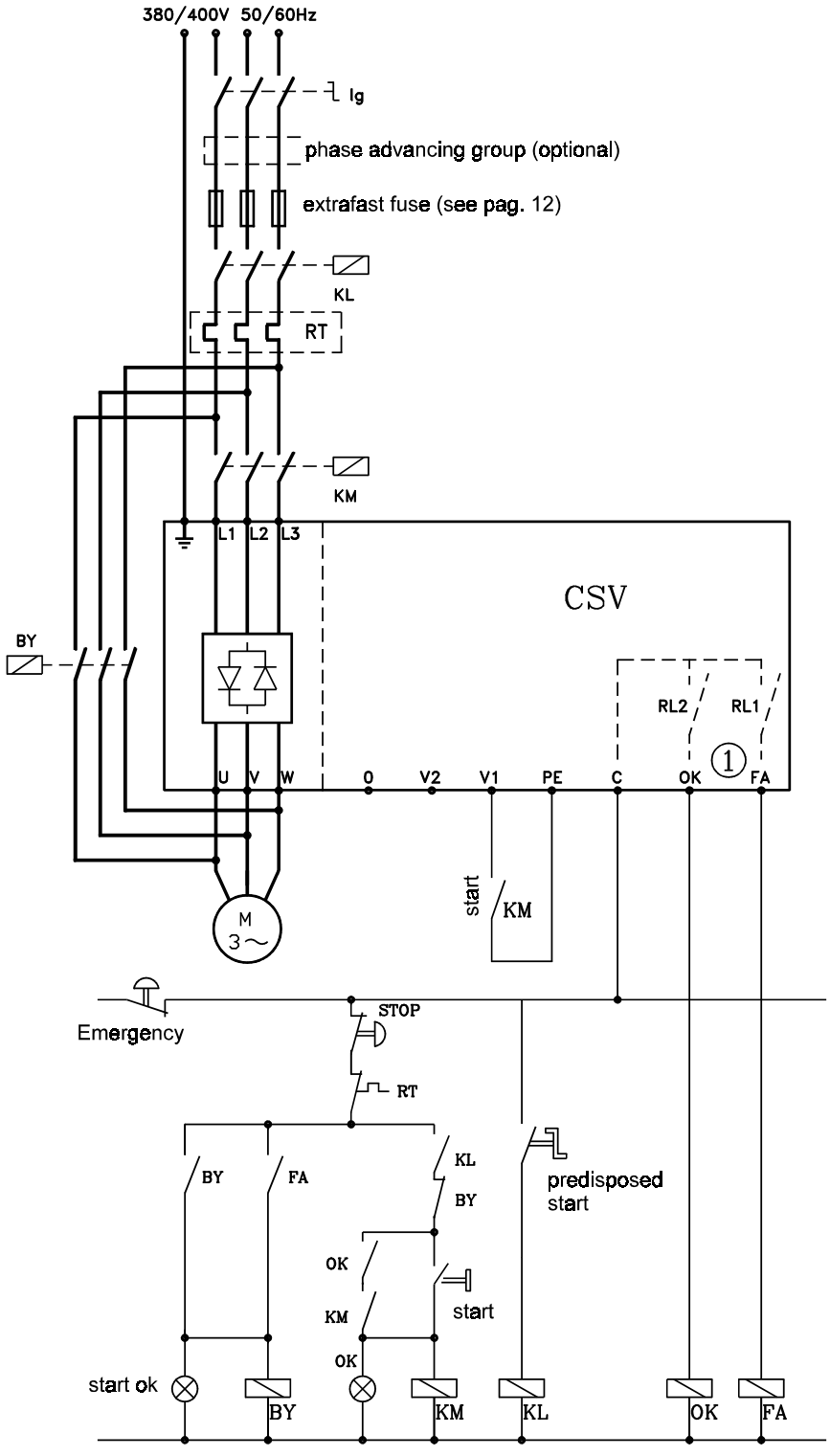


10 OPTIONS AND SPECIAL FUNCTIONS

10.1 By-pass Plan

If the starter is working just a few times a day might be useful to use a by-pass contactor that helps saving electricity when the starter is switched on. Fig. 10.1.1. shows the tipical connection scheme:

Fig. 10.1.1



1 switching voltage max: 125V
switching current max: 1A

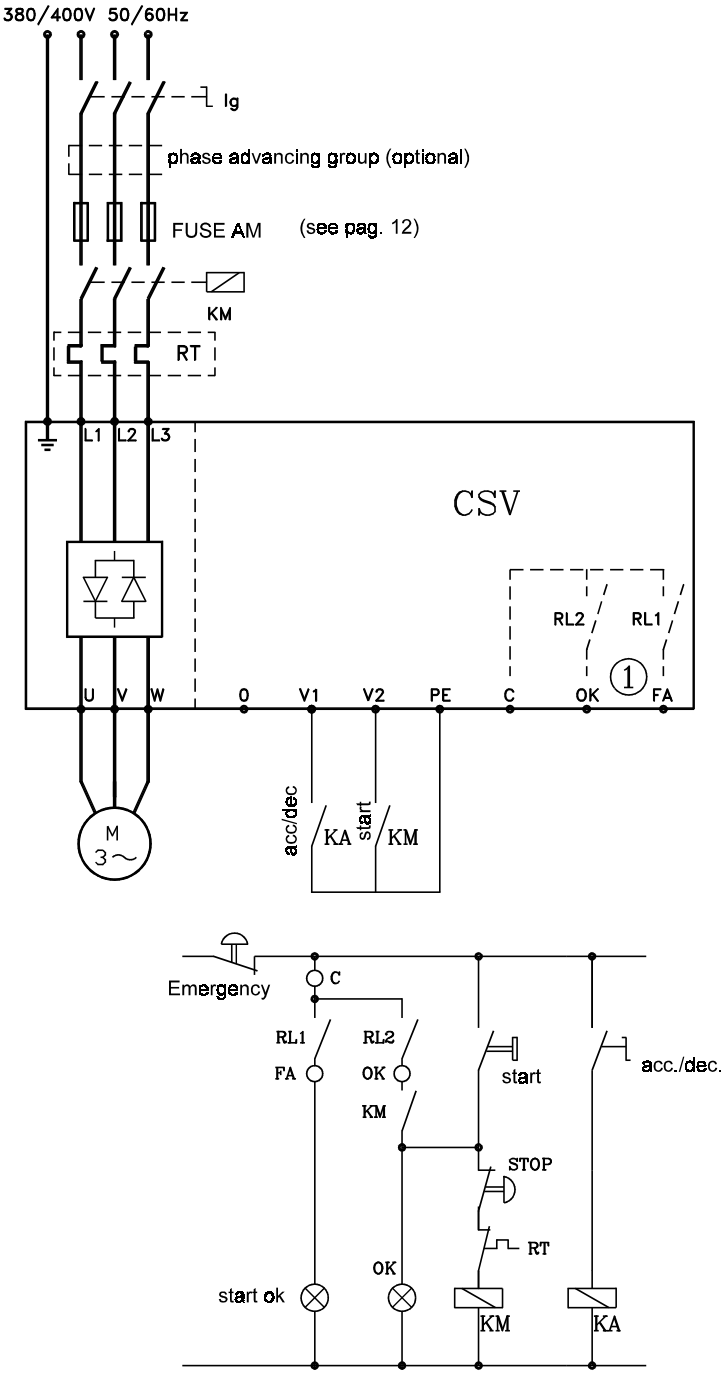
10.2 OPERATING WITH CONTROLLED ACCELERATION\DECELERATION

Set the following short bridges on the **02-RCV** board (to localize the bridgessee Fig. 4.1.1 page 5):

JP10 OPEN
JP11 POSITION **B**

If V1 is closed the engine accelerates, if V1 is open decelerates.
The running set on V2 must be mantained for both acceleration and deceleration.
See fif.10.2.1. at page 14 for standard connection.

Fig. 10.2.1



1 switching voltage max: 125V
switching current max: 1A

10.3 OPERATING WITH FEEDBACK OF EXTERNAL LCV LINE

Set the following small bridges on **02-RCV** board (to locate the small bridges see Fig. 4.1.1 page 5):

JP3	OPEN
JP4	CLOSED
JP6	CLOSED

Insert the cable for connection of **00-LCV** board into **K2** connector of **02-RCV** board.
On LCV board make the passages of TA (N° spyrals) indicated on table 10.3.1. at page 15, they are function of necessary I max. Set the small bridges on **02-RCV** board for maximum output.
Connect following the scheme shown on Fig.10.3.2. at page 16.
For the settings: proceed as for normal version by regulating the **02-RCV** board:
P1 for boost current
P2 for detached current
P3 for ramp time
P4 for gain loop speed

Tab. 10.3.1

00-LCV Tarature settings

Number of coils	max current JP1 closed	max current JP1 open
1	250	200
2	125	100
3	85	65
4	60	50
5	50	40
coils must be in the same direction for both TA		
Nota: 300Amax with 01-LCV. for max output current see pag.12		

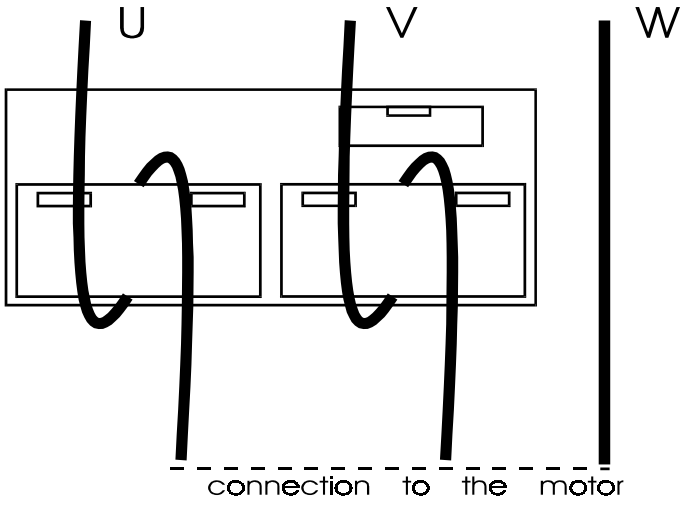
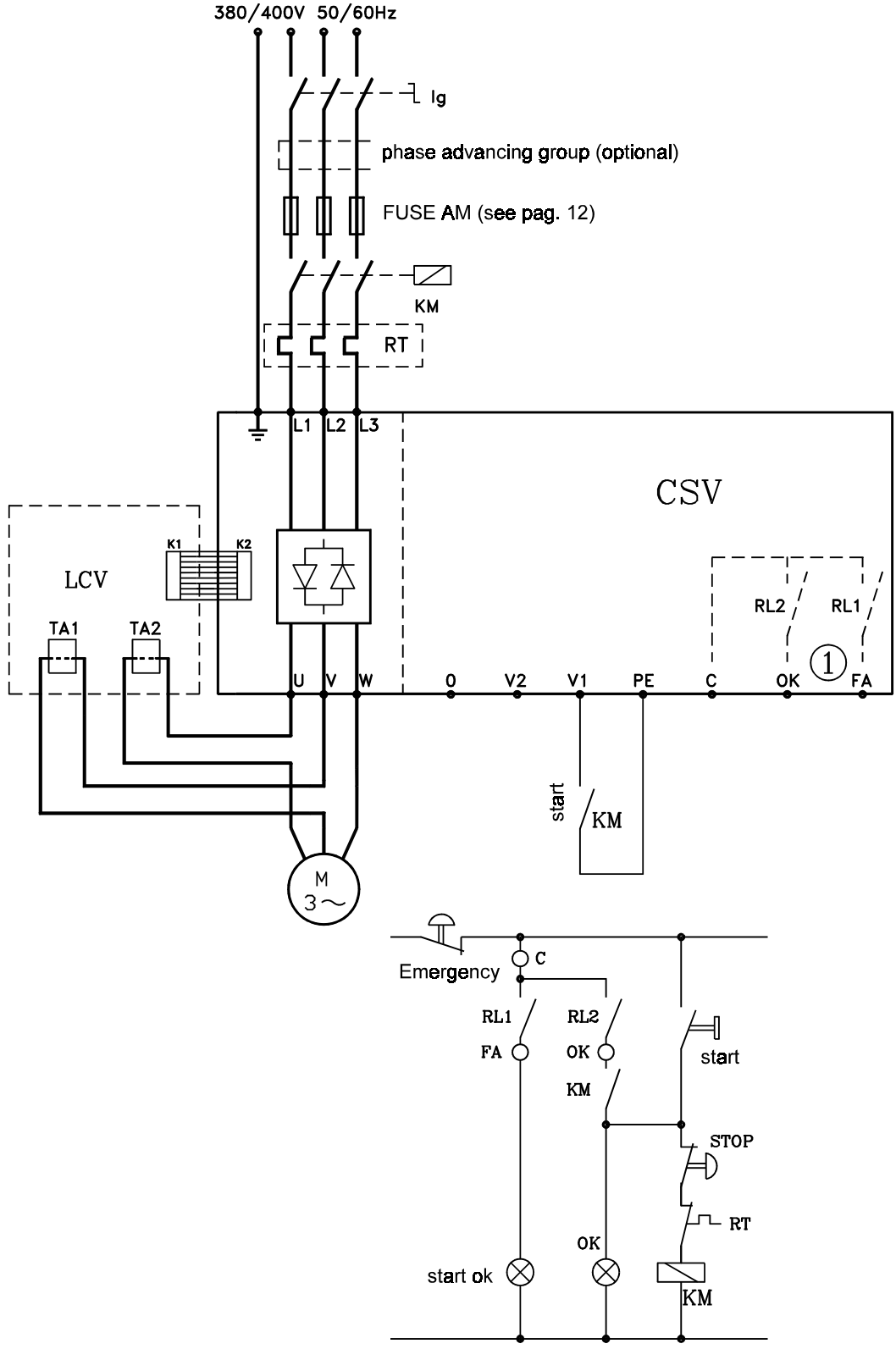


Fig. 10.3.2



1 switching voltage max: 125V
switching current max: 1A