Digital electronic soft starter
NOVADEM S3

instruction manual

DIGITAL ELECTRONIC SOFT STARTER
NOVADEM S3

CE

NT 67006-100B - Ed. 03 November 04

AOIP INSTRUMENTATION

CE

Déclaration d'incorporation et de conformité

Declaration of incorporation and conformity

Nom du fabricant : AOIP
Manufacturer's name :
Adresse du fabricant : Z.I. de Saint-Guénault - Rue Maryse Bastié
Manufacturer's address : BP 182 - 91006 EVRY CEDEX - FRANCE

Déclare que le produit
Declares, that the product

Désignation : Démarreur électronique NOVADEM S3
Designation : *Electronic starter, NOVADEM S3*
Référence/*Model number* : NS XX-XXXX
Date : 29.04.98

- a été conçu pour une utilisation dans un ensemble soumis à l'application de la directive 89/392/CEE sous réserve que son incorporation soit effectuée en respectant les consignes spécifiées dans la notice de montage et d'utilisation et les documents annexes.
- a été fabriqué conformément aux spécifications techniques du produit et sous tous ses aspects, est conforme aux normes et réglementations en vigueur s'y rapportant et en particulier à la :

Compatibilité électromagnétique
Immunité :
- Conduite : EN 61000-4-4, niveau 3
- D.E.S : EN 61000-4-2, niveau 3
- Rayonnée : EN 61000-4-3, niveau 3
  EN 61000-4-6, niveau 2
- Onde de choc : EN 61000-4-5 :
  1,5 kV entre phases
  3 kV entre phase et terre
- Creux de tension, microcoupures : EN 61000-4-11

Emission :
- Conduite : EN 55022, CA puissance, classe A
  CA contrôle, classe B
- Rayonnée : EN 55022, classe B

Sécurité machine
Suivant EN 60204-1.

Sécurité électrique
- Puissance : CEI 60947-4-2
- Contrôle : EN 61010-1

Le produit nommé ci-dessus est conforme aux prescriptions de la directive européenne basse tension 73/23/CEE et à la directive CEM 89/336/CEE amendées par 93/68/CEE.

- *has been designed to be used in a device complying with the requirements of the directive 89/392/EEC on condition its assembling is performed according to the recommendations given in the instruction manual and the accompanying documents.*
- *has been manufactured according to the technical specifications of the product and conforms in all respects to the relevant standards and regulations in force and especially to :*

Electromagnetic compatibility
Immunity:
- *Conducted: EN 61000-4-4, level 3*
- *E.S.D: EN 61000-4-2, level 3*
- *Radiated: EN 61000-4-3, level 3*
  EN 61000-4-6, level 2
- *Surge voltage: EN 61000-4-5 :*
  1,5 kV between phases
  3 kV between phase and ground
- *Voltage dips, short interruptions: EN 61000-4-11*

Emission:
- *Conducted: EN 55022, CA power line, class A*
  CA control line, class B
- *Radiated: EN 55022, class B*

Machine safety
According to EN 60204-1.

Electrical safety
- *Power line: IEC 60947-4-2*
- *Control line: EN 61010-1*

The product herewith complies with the requirements of the low voltage directive 73/23/EEC and the EMC directive 89/336/EEC amended by 93/68/EEC.

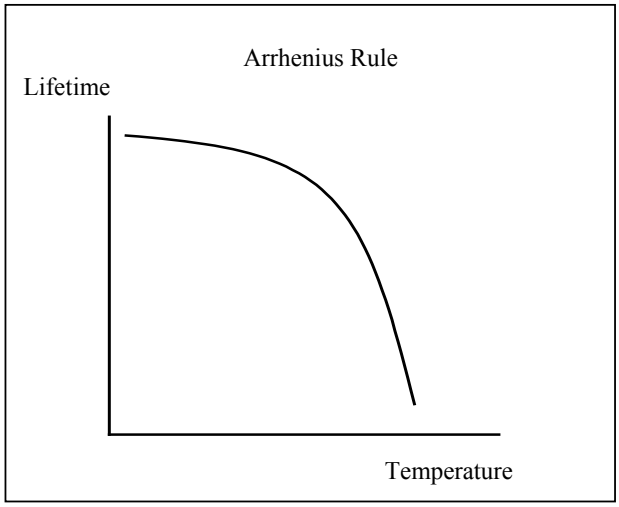
R. SOUCEK
Directeur Assurance Qualité
Quality Assurance Manager

Electronic Drive Repairs and Preventative Maintenance

We are able to offer full back up and support for all drive systems, whether new or many years old.
We have workshop facilities to repair and test any electronic drive. We also have engineers based in our northwest repair centre, who are able to visit any site in the UK, to carry our diagnostics, or to carry out preventative maintenance.

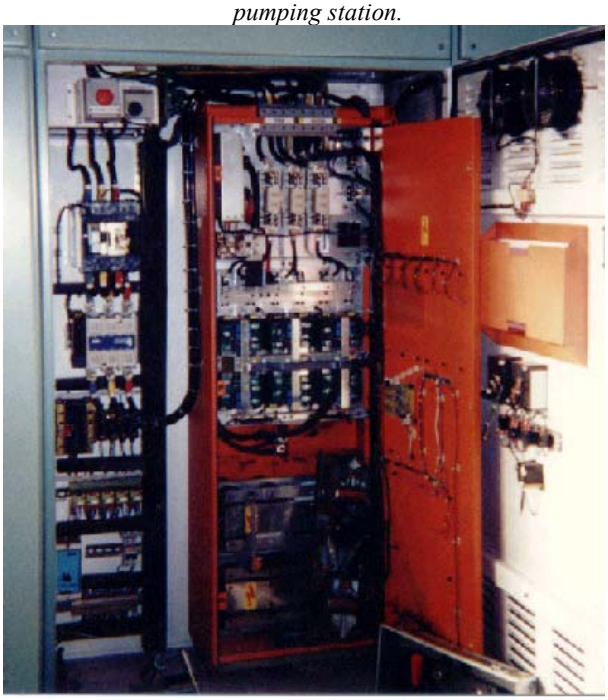
Returning a faulty controllers to manufacturers can be time consuming and therefore costly.
Very often, this is how we can help by offering cost effective repairs with a quicker turn around time.
One source for the repair of any make of drive, and a source of replacements.

As there are very few moving parts in electronic motor controls many people believe it is not necessary or not possible to carry out any preventative maintenance/service. However this is not the case!!
The biggest problems are caused by heat, therefore it is essential to keep cooling fans running in their optimum condition and to keep the airways clear.
Also other components deteriorate with age especially those with a liquid or gel electrolyte which slowly dries out.
From equipment and component manufactures data the typical useful life of some of these components is 5 years. The lifetime is affected by six main factors, the prime factor is heat. These components follow the 'Arrhenius' rule in which the lifetime is reduced by half when the temperature is increased by 10°C. This characteristic dominates the useful lifetime of all electronic motor controls and is a primary factor in deciding a maintenance schedule.



Electronic motor controls do not just suddenly fail, they gradually deteriorate over time therefore it is essential to carry out preventive maintenance in order to avoid a catastrophic failure. The power side of a motor controller rarely fails on its own. Failure of the power side is often due to incorrect firing due to the firing control deteriorating and causing avoidable damage and additional cost, not only financial but also down time. Therefore at the first signs of tripping with no external cause the controller should be serviced with out delay before further damage is caused.

Service being carried out at a regional water company pumping station.



Service and repair at glance:- Electronic drives can be sent into our dedicated workshop. Or engineers are able to visit your sites to carry out service work or to identify an optimum service schedule.

WORKSHOP REPAIRS:
*Fast Turnaround Times
*6 Months Warranty
*Free Estimates
*Extensive Testing (Simulation of application)
*Repair to Component Level Including Surface Mount
*Courier Next Day Delivery

FIELD SERVICE:
*Breakdown Service:
*Same day response if required
*Planned Maintenance
*Installation and commissioning

Contact:-

Power Drive Services Ltd.
Unit 1, Victoria St. Ind. Est.
Leigh,
WN7 5SE

Tel 01942 260 206
Fax 01942 260 525
www.inverter.co.uk

How to use this manual?

To save time and ensure correct operation of the NOVADEM S3, it is suggested that the following chapters be read:

Operation 1: Commissioning and Fast Programming
See chapters 2, 3 and 4.

Operation 2 : Processing
See chapte 5.

Operation 3: Using the serial link
See chapter 6.

Operation 4: Maintenance and troubleshooting
See chapter 7.

If you wish to program the NOVADEM S3 using the extended mode (F01 to F40) or just adjust parameters of the macroprograms or use special functions, refer to chapter 5

1. OVERVIEW

1.1 Introduction

The digital electronic soft starter is designed to control the starting and stopping of three phase squirrel cage motors (up to 690 V). It offers many functions for control and protection of the motor and driven machine, as well as a user interface.

1.2 NOVADEM S3 description

1.2.1 Presentation

It is composed of two main parts:

- The power section assures control of the power supply to the motor. This comprises three pairs of thyristors connected in series with the motor phases, heat sinks, mechanical devices and sensors.

- The digital electronic card realises the control of the thyristors, galvanic isolation, control functions and communications. The structure of the card, designed around a powerful microprocessor, permits the support of the functions of calculation, programming and communications of the highest order.

1.3 Instructions before use

1.3.1 Unpacking

The NOVADEM S3 is mechanically and electrically checked before dispatch. Every precaution has been taken to ensure that it reaches the user undamaged.
Nevertheless, it is advisable to carry out a quick check for any damage that may have occurred in transit. If any such damage is found, it should be reported to the shipper.

1.3.2 Return

If the unit is to be returned, the original packaging should be used and a note explaining as clearly as possible the reasons for returning it should be included.

1.4 NOVADEM S3 functions

Type	Function/Option/Remarks
Starting the motor	Constant current. Current feedback. Voltage ramp. Constant acceleration with feedback signal. Boost.
Stopping	Freewheel stop. Soft stop. Deceleration for pumps. Braking with contactor.
Protection	Thyristors. Heat sink overtemperature. Momentary supply failure. Supply available. Motor overload. Motor underload. Thermal. Phase imbalance. Phase rotation upstream of starter. PTC thermistor.
Control functions	Automatic restart. Restart on the fly. Bypass at end of start. Energy saving. Limit the number of starts. Anticondensation of motor. Antirotation. Multi-parameters. Variation of slip on resistive cage motors. Delta cabling. Start counter.
User interface	Phases of operation. Fault analysis. Terminal/screen.
Communication	RS 232. PC data entry (Option LOGIDEM). PC/PLC communication. Remote control display. Link MODBUS® RS 485 (MODBUS interface card). Link FIP (FIPCOM interface card). 4-20 mA analogue output (Option MUL).

1.4.1 Starting functions

1.4.1.1 Selection of starting type (F03)

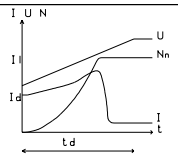
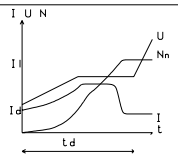
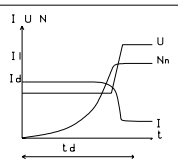
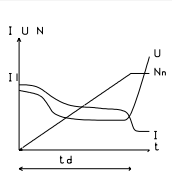
- Starting type: without current limit (Ramp 1)
  The voltage applied to the motor is ramped up linearly. The voltage at the start of the ramp is determined by the setting of the pedestal current (or breakaway current). There is no current limit.

- Starting type: with current limit (Ramp 2)
  The voltage applied to the motor is ramped up linearly. The voltage at the start of the ramp is determined by the setting of the pedestal current (or breakaway current). The current is limited by the setting of the limitation current.

- Starting type: constant current
  The current is constant during run-up until the motor is seen to have been started.

- Starting type: constant acceleration
  The run up to speed is determined by a linear ramp. This function requires a speed feedback signal to be connected to terminal block TB1. The limitation of current together with duration of ramp are adjustable.

- Starting type: borehole pump (borehole pumps on friable soil)
  The run up to speed is achieved by the internal closed loop control of the power factor (cos φ) of the motor, this provides a long and progressive gentle acceleration (designed to start borehole pumps).

TYPE	CHARACTERISTIC	PROGRAMMING
RAMP 1		Function 03: type of starting n°1 Id : starting Current td : ramp time setting
RAMP 2		Function 03: type of starting n°2 Id : starting Current IL : current limitation td : ramp time setting
CONSTANT CURRENT		Function 03: type of starting n°3 Min(Id,IL): starting Current td : ramp time setting
SPEED CONTROL		Function 03: type of starting n°4 Il : current limitation td : speed ramp time setting

1.4.1.2 Boost (F05)

The boost function provides an increased torque upon commencement of starting. This is achieved with a high initial current having a ramp decaying or with a programmed level of constant current for the duration of the boost time. At the end of the boost period, the starter returns to the normal starting characteristics.

1.4.1.3 Starting calibration

The starter automatically limits the maximum permissible starting time as a function of the starter rating and the chosen starting type (F03): it defines the operating zone of the NOVADEM S3. The higher the selected starting current, the shorter the authorised maximum run up time.
NOTE: This time can be verified in function F20.

1.4.1.4 End of start relay (F02)

The output of the programmable relay "CKL" or "RL", which is mounted on the control card, provides a "top of ramp" signal which indicates the end of starting. This may be used to operate a bypass contactor (see wiring diagram, paragraph 3.3.7). This signal is provided by a volt free contact (closed = end of start).

1.4.2 Stop functions

1.4.2.1 Selection of stop type (F04)

- Freewheel stop
  When this stop is initiated, the NOVADEM S3 no longer supplies power to the motor which is permitted to run to a freewheel stop.

- Soft stop
  After a stop command, the voltage to the motor is reduced in accordance with the programmed decelerating ramp. This function requires a start/stop signal which is independent of the line contactor (see wiring diagram, paragraph 3.3.10).
  NOTE Application: allows initiation of controlled decelerating.

- Braking with contactor
  Upon stopping, the braking contactor (normally controlled by one of the programmable relays "CKL" or "RL") shorts phases 2/T1 and 4/T2 of the motor together and a DC current is injected (see wiring diagram, paragraph 3.3.6). The average braking torque CFN is in the region of 0.25 Cn for a maximum braking current.

1.4.2.2 Emergency stop

An emergency stop may be initiated by the input EL1 on the control card (F02). It can also operate as an "external fault" such that the starter will stop immediately. The emergency stop causes the relay FT to open, changing to emergency stop fault and the motor coasts to a stop.

1.4.3 Sequences and internal protections

1.4.3.1 Start/Stop modes

NOVADEM S3 uses various modes of Start/Stop:

- Control by contactor
  In this case, the opening and closing of the contactor starts and freewheel stops the motor (see wiring diagram, paragraph 3.3.4).

- Independent control
  Start/Stop commands are sent to NOVADEM S3 independently of the line contactor (see wiring diagram, paragraph 3.3.4). This type of command allows controlled decelerating (soft stop or braking). The supply is maintained until the end of the stop ramp.

- 3-wire control
  The Start/Stop signal is provided by a 3-wire system (see function F02) by using inputs MA and EL0 (see wiring diagram, paragraph 3.3.5). In this mode, the NOVADEM S3 controls the line contactor.

- Control without start order
  The NOVADEM S3 is switched on as soon as the power voltage is detected on the starter input (see function F29).

1.4.3.2 Supply monitoring

The NOVADEM S3, during stop and operation, monitors the presence of the supply to the phases on the input of the starter:

When stopped, the display shows: "Phases not present" for loss of one or more phases, "Ready to start" if all the phases are present and the starter connected.

Upon starting, "Phase loss fault" will show for loss of one phase. When running, "Brownout fault" will be displayed if a supply failure longer than the programmed time occurs (see function F12).

The automatic restart function will allow the starter to restart the equipment after a momentary supply failure (see function F12).

When voltage interruptions are present on both power and control supplies:

- Below 100 ms, the NOVADEM S3 is not affected.
- Between 100 ms and 150 ms (depending upon the state of charge on the control card), the control supply is maintained such that a power fault can be detected: an automatic restart procedure can be activated (F12).
- Above 150 ms, the control card supply is lost. When the voltage returns, if the start signal is maintained but the automatic restart function is not activated, the NOVADEM S3 will trip on "Start command fault".

When the supply to control card is secure:

- The starter always keeps control of the power supply monitoring. The duration of the momentary supply failure can be altered (F12) to make it less sensitive to power interruptions on the network. When the automatic restart function is activated, the contactor is held by the relay contact FT.

⚠ If the automatic restart is activated, the user must take all the necessary precautions concerning the personnel protection. Especially, access to the machine should be prohibited as long as the circuit breaker upstream the starter is not opened and locked.

1.4.3.3 Heat sink temperature

The starter is protected by a thermostat mounted on the heat sink which operates when the heat sink temperature exceeds 85°C.

⚠ The message "Phases not present" signals loss of at least one phase on the starter terminals, two phases may be present on the starter. Before any intervention, make sure that there is no voltage present on the starter using a multimeter.

1.4.3.4 Thyristor status

The starter continuously monitors the status of the thyristors.

- Thyristor short circuit test
  The thyristors are tested upon stopping as soon as the voltage is present on the starter input. If one or more thyristors are short-circuited when starting is attempted, the starter displays "Thyr. short cir. flt".

- Thyristor open circuit test
  With each firing signal, the card verifies the firing of the thyristors. If a thyristor fails to fire correctly for longer than 100 ms (programmable), "Thyr. firing fault" is displayed.

1.4.3.5 Current transformer (CT) cabling test

When starting is attempted, the NOVADEM S3 verifies that the current feedback is present. If not, the NOVADEM S3 trips to "CT loss fault".

1.4.3.6 Fault reset

Resetting after a fault may be carried out by operating the RESET key or remotely by closing 9-10 on terminal rail TB1, or using the serial link.

1.4.4 Monitoring and protection Motor/Machine

1.4.4.1 Motor underload (F06)

When NOVADEM S3 detects a permanent underload for 2 seconds, it activates the "Motor underload flt". The level of underload is adjustable between 0 % and 99% FLC. During the period of underload, the display shows "Motor underloaded".
The function is inhibited in starting phase, energy saving and controlled stop phase.

1.4.4.2 Overload and electronic thermal protection (F07)

When the NOVADEM S3 has reached the overload level, the display shows "Overload". The thermal protection checks the value of overload and activates "Motor overload fault" after a time determined by the overload level and the thermal integration level of the motor (protection I^2t).

NOTE: An "Overload" alarm contact remains available when the function is programmed (see function F02). In this case, the contact closes when integration starts.

1.4.4.3 Locked rotor

When the current has exceeded 5 x FLC for longer than 3 seconds, the starter activates "Locked rotor fault". By default, this protection is not active during starting.

1.4.4.4 Imbalance of phases

By measuring the motor current in two phases, it is possible to detect serious phase imbalances (greater than 20 % of the motor full load current). During the detection of an imbalance, the display shows "Phases out of balance".
If the imbalance persists for longer than 10 s, the display shows "Phase imbalance flt".
This function is inhibited during starting and when energy optimisation is in operation.

1.4.4.5 Monitoring by PTC thermistor or hypsotherm contact (see function F28)

It is possible to achieve further thermal protection of the motor by either of the following options:

1. By connection to the NOVADEM S3 the PTC thermistor probe(s). The level of tripping and resetting, as well as the mode of operation are programmable.

2. By connecting to the programmable input EL1 from function F 02 (emergency stop) a normally closed contact of a hypsotherm relay.

1.5 Options

- Remote keypad
  A remote keypad display option is available with 3 m cable for mounting on the face of the enclosure.

- Multi-function card
  4/20mA isolated output.
  Input for pulse generator (speed measurement).
  Two additional programmable logic outputs.

- Logidem
  This software provides processing and supervision of the starter. It will operate with a PC® via the serial link on the control card. It permits:
  - The complete control of the starter (programming the functions, possibility of saving the information to files, tele-parametering).
  - The supervision of the operation (starter/motor/machine) together with the possibility of displaying curves and saving the values.
  - A maintenance tool.

- MODBUS® card
  This interface card provides the facility to program and control the starter using the MODBUS® protocol. The connection to the MODBUS® network is performed via an isolated RS 485. The card is supplied with a cable for connection to the NOVADEM S3 together with PC® software for evaluation and installation.

NOTE: With each of these options, a specific instruction manual is supplied attached.

PC®: IBM Corp. registered trademark.
MODBUS®: GOULD MODICON registered trademark.

2.MODELS AND SPECIFICATIONS

2.1 NOVADEM S3 specification sheet

(according to IEC Publication 947-4-2)

Identification	
Designation	Digital electronic soft starter NOVADEM S3.
Model	See table, paragraph 2.2.
Manufacturer	
Standard	IEC Publication 947-4-2.

Main specifications	
Rated operational voltages Ue	230 V/400 V/500 V or 690 V.
Rated operational currents Ie depending on usage	See tables, paragraphs 2.4 and 2.5.
Duty	Uninterrupted.
Rated frequency	50 Hz/60 Hz.
Form	1.

Environmental conditions	
Operating temperature	- 5°C to + 40°C.
Altitude	< 1000 m.
Humidity	95 % without condensation.
Degree of pollution	2.
Electrical	Category III.

Safety and installation	
Rated insulation voltage Ui	415 Vac or 690 V.
Rated impulse withstand voltage	4 kV.
IP code	IP 00.
Short-circuit specifications	Protection by fuses. See tables, paragraph 2.8.

Command auxiliary circuits (card and fans)	
Supply voltage Us	230 Vac, 50/60 Hz. 115 Vac, 50/60 Hz (option). 48 Vdc (option).
Operation limits	90 % to 110 % Us (230 V or 115 V). 85 % to 115 % Us (48 V).
Power supply	See table, paragraph 2.7.
Command logic inputs	Volt free contact (10 mA).
Relay output contact	250 Vac, 12 A, AC1.

Overload relay specifications	
Type	Overload thermal relay, 2 poles. Not compensated for temperature.
Current setting	See table, paragraph 2.6.
Trip class	Programmable from 10A to 30A.
Time/current characteristics	According to curve supplied in the manual.
Maximum current	5 In.

EMC	
Emission Power supply conducted RF Control supply conducted RF Radiated	 Class A (EN 55022). Class B (EN 55022). Class B (EN 55022).
Immunity Electrostatic discharge RF electromagnetic field Fast transients Surges Voltage dips	 EN 61000-4-2. 8 kV, performance criterion 1. EN 61000-4-3. 10 V/m, performance criterion 1. EN 61000-4-4 Level 3, performance criterion 1. EN 61000-4-5. Category III, performance criterion 1. EN 61000-4-11. 5 s, performance criterion 3.

2.2 Models and dimensions

220 V/240 V	380 V/415 V	500 V	660 V/690 V	Dimension (mm) L x H x D	Weight (kg)
NS21-25	NS41-25	NS51-25		200 x 370 x 182	8.5
NS21-55	NS41-55	NS51-55		200 x 370 x 182	8.5
NS21-90	NS41-90	NS51-90		200 x 370 x 182	8.5
NS22-90	NS42-90	NS52-90		200 x 370 x 255	10
NS22-91	NS42-91	NS52-91		200 x 370 x 255	10
NS22-132	NS42-132	NS52-132		200 x 370 x 255	10
NS22-160	NS42-160	NS52-160		200 x 370 x 255	10
NS23-250	NS43-250	NS53-250	NS63-250	200 x 470 x 265	15
NS23-251	NS43-251	NS53-251		200 x 470 x 265	15
NS23-300	NS43-300	NS53-300	NS63-300	200 x 470 x 265	15
NS24-300	NS44-300	NS54-300	NS64-300	454 x 675 x 285	44
NS24-500	NS44-500	NS54-500		454 x 675 x 285	44
NS24-600	NS44-600	NS54-600		454 x 675 x 285	44
NS25-760	NS45-760	NS55-760	NS65-760	454 x 675 x 285	49
NS25-1200	NS45-1200	NS55-1200	NS65-1200	454 x 675 x 285	49
NS25-1500	NS45-1500	NS55-1500	NS65-1500	454 x 675 x 285	49
NS26-1200	NS46-1200	NS56-1200	NS66-1200	409 x 1 030 x 390	85
NS27-1200	NS47-1200	NS57-1200	NS67-1200	530 x 1 340 x 420	165
NS27-1800	NS47-1800	NS57-1800	NS67-1800	530 x 1 340 x 420	165
NS27-2300	NS47-2300	NS57-2300	NS67-2300	530 x 1 340 x 420	165

2.3 Utilisation category

(according to IEC Publication 747-4-2)

Utilisation category	Starting current	Starting period	Running factor	Number of cycle	OFF time
AC53a: 3-20 :99-10	3 Ie	20 s	99 %	10	-
AC53a :4-40 :99-10	4 Ie	40 s	99 %	10	-
AC53b :3-20 :500	3 Ie	20 s	-	-	500 s

For the other NOVADEM S3 utilisation modes, please contact AOIP.

2.4 Nominal current depending on usage for 230 V, 400 V, 500 V three phase voltages

	Rated nominal current Ie		
Model of NOVADEM S3	Usage 4 x Ie AC53a : 4-40 : 99-10	Usage 3 x Ie AC53a : 3-20 : 99-10	Short circuit 3 x Ie AC53b : 3-20 : 500
NS x1-25	16 A	23 A	37 A
NS x1-55	23 A	37 A	44 A
NS x1-90	30 A	44 A	59 A
NS x2-90	37 A	59 A	78 A
NS x2-91	44 A	72 A	87 A
NS x2-132	59 A	87 A	110 A
NS x2-160	87 A	106 A	130 A
NS x3-250	106 A	144 A	173 A
NS x3-251	121 A	173 A	210 A
NS x3-300	144 A	210 A	251 A
NS x4-300	173 A	251 A	302 A
NS x4-500	210 A	302 A	400 A
NS x4-600	302 A	376 A	560 A
NS x5-760	376 A	468 A	680 A
NS x5-1200	468 A	615 A	816 A
NS x5-1500	514 A	705 A	915 A
NS x6-1200	514 A	668 A	915 A
NS x7-1200	615 A	741 A	1 158 A
NS x7-1800	741 A	915 A	1 500 A
NS x7-2300	914 A	1 158 A	1 800 A

2.5 Nominal current depending on usage for 690 V three phase voltage

	Rated nominal current Ie		
Model of NOVADEM S3	Usage 4 x Ie AC53a : 4-40 : 99-10	Usage 3 x Ie AC53a : 3-20 : 99-10	Short circuit 3 x Ie AC53b : 3-20 : 500
NS 63-250	96 A	121 A	164 A
NS 63-300	121 A	164 A	190 A
NS 64-300	164 A	239 A	280 A
NS 64-500	239 A	322 A	401 A
NS 65-760	322 A	401 A	527 A
NS 65-1200	401 A	527 A	729 A
NS 65-1500	450 A	630 A	915 A
NS 66-1200	450 A	583 A	820 A
NS 67-1200	600 A	729 A	915 A
NS 67-1800	729 A	915 A	1 500 A
NS 67-2300	914 A	1 158 A	1 800 A

2.6 Adjustment ranges

NS model	Adjustment range of nominal current (Inom)	Max current (Imax)	n°
NS x1-25	11 to 37 A	117 A	1
NS x1-55	11 to 44 A	185 A	2
NS x1-90	11 to 59 A	236 A	3
NS x2-90	29 to 78 A	300 A	4
NS x2-91	29 to 87 A	360 A	5
NS x2-132	29 to 110 A	472 A	6
NS x2-160	29 to 130 A	590 A	7
NS x3-250	46 to 173 A	708 A	8
NS x3-251	46 to 210 A	708 A	9
NS x3-300	46 to 251 A	758 A	10
NS x4-300	94 to 302 A	1 159 A	11
NS x4-500	94 to 400 A	1 414 A	12
NS x4-600	94 to 560 A	1 886 A	13
NS x5-760	176 to 680 A	2 367 A	14
NS x5-1200	176 to 816 A	2 946 A	16
NS x5-1500	176 to 915 A	3 200 A	17
NS x6-1200	176 to 915 A	3 200 A	18
NS x7-1200	352 to 1 158 A	3 525 A	19
NS x7-1800	352 to 1 500 A	4 700 A	20
NS x7-2300	352 to 1 800 A	5 800 A	21

2.7 Consumption of NOVADEM S3 auxiliary circuits

	230 V~/115 V~ supply			48 V= supply		
Model	Card	Fans	Total	Card	Fans	Total
NS x1-25 NS x1-55 NS x1-90	10 VA	-	10 VA	10 W	-	10 W
NS x2-90 NS x2-91 NS x2-132 NS x2-162	10 VA	40 VA	50 VA	10 W	14 W	24 W
NS x3-250 NS x3-251 NS x3-300	10 VA	90 VA	100 VA	10 W	20 W	30 W
NS x4-300 NS x4-500 NS x4-600	10 VA	130 VA	140 VA	10 W	②	②
NS x5-760 NS x5-1200 NS x5-1500	10 VA	270 VA	280 VA	10 W	②	②
NS x6-1200	10 VA	290 VA①	300 VA①	10 W	②	②
NS x7-1200 NS x7-1800 NS x7-2300	10 VA	490 VA①	500 VA①	10 W	②	②

① There is no option available to supply the card and fans with 115 V~.
② There is no option available to supply the fans with 48 V-.

2.8 Protection of the NOVADEM S3 against short-circuits

The user must **define** and **set in place** his (her) own protection in accordance with the IEC Publication 60947-4-2.

The following tables give information on the protection co-ordination against short-circuits of type 2 according to IEC Publication 60947-4-2, and show the references of FERRAZ fuses.

NOVADEM S3 up to and including 500 V

Model	Imax ① (A)	I^2t thyristor ② (kA^2S)	Isc bar ④ (kA)	Type 2 Co-ordination ③ FERRAZ fuse
NS x1-25	117	8,5	2,3	6.6 URD 30 TTF 00063
NS x1-55	185	8,5	2,3	
NS x1-90	236	8,5	2,3	
NS x2-90	300	135	5,7	6.6 URD 30 TTF 350
NS x2-91	360	135	5,7	
NS x2-132	472	135	5,7	
NS x2-162	590	135	5,7	
NS x3-250	708	300	12,8	6.6 URD 31 TTF 550
NS x3-251	708	300	12,8	
NS x3-300	758	300	12,8	
NS x4-300	1 159	320	41	6.6 URD 32 TTF 630
NS x4-500	1 414	320	41	
NS x4-600	1 886	320	41	
NS x5-760	2 367	840	51	6.6 URD 33 TTF 0900
NS x5-1200	2 946	3 000	51	6.6 URD 33 TTF 1400
NS x5-1500	3 200	3 125	51	6.6 URD 33 TTF 1400
NS x6-1200	3 200	3 000	65	6.6 URD 33 TTF 1400
NS x7-1200	3 525	3 000	128	6.6 URD 33 TTF 1400
NS x7-1800	4 700	5 000	128	6.6 URD 232 TTF 2000
NS x7-2300	5 800	12 000	128	6.6 URD 233 TTF 2800

NOVADEM S3 690 V

Model	Imax ① (A)	I^2T thyristor ② (kA^2S)	Isc bar ④ (kA)	Type 2 co-ordination ③ FERRAZ fuse
NS 63-250	708	80	12,8	6.6 URD 31 TTF 315
NS 63-300	758	281	12,8	6.6 URD 30 TTF 350
NS 64-300	1 159	100	41	6.6 URD 32 TTF 400
NS 64-500	1 414	228	41	6.6 URD 32 TTF 550
NS 65-760	2 367	845	51	6.6 URD 32 TTF 800
NS 65-1200	2 946	2 880	51	6.6 URD 33 TTF 900
NS 65-1500	3 200	2 645	51	6.6 URD 33 TTF 900
NS 66-1200	3 200	3 125	65	6.6 URD 233 TTF 1400
NS 67-1200	3 525	3 125	128	6.6 URD 233 TTF 1600
NS 67-1800	4 700	3 640	128	6.6 URD 233 TTF 1800
NS 67-2300	5 800	3 640	128	6.6 URD 233 TTF 1800

① Max rms current. Reaction period of the thermal relay of the NOVADEM S3 over this maximum current is 3 seconds.

② I^2t of thyristor needed to select the adequate fuse (see note 3).

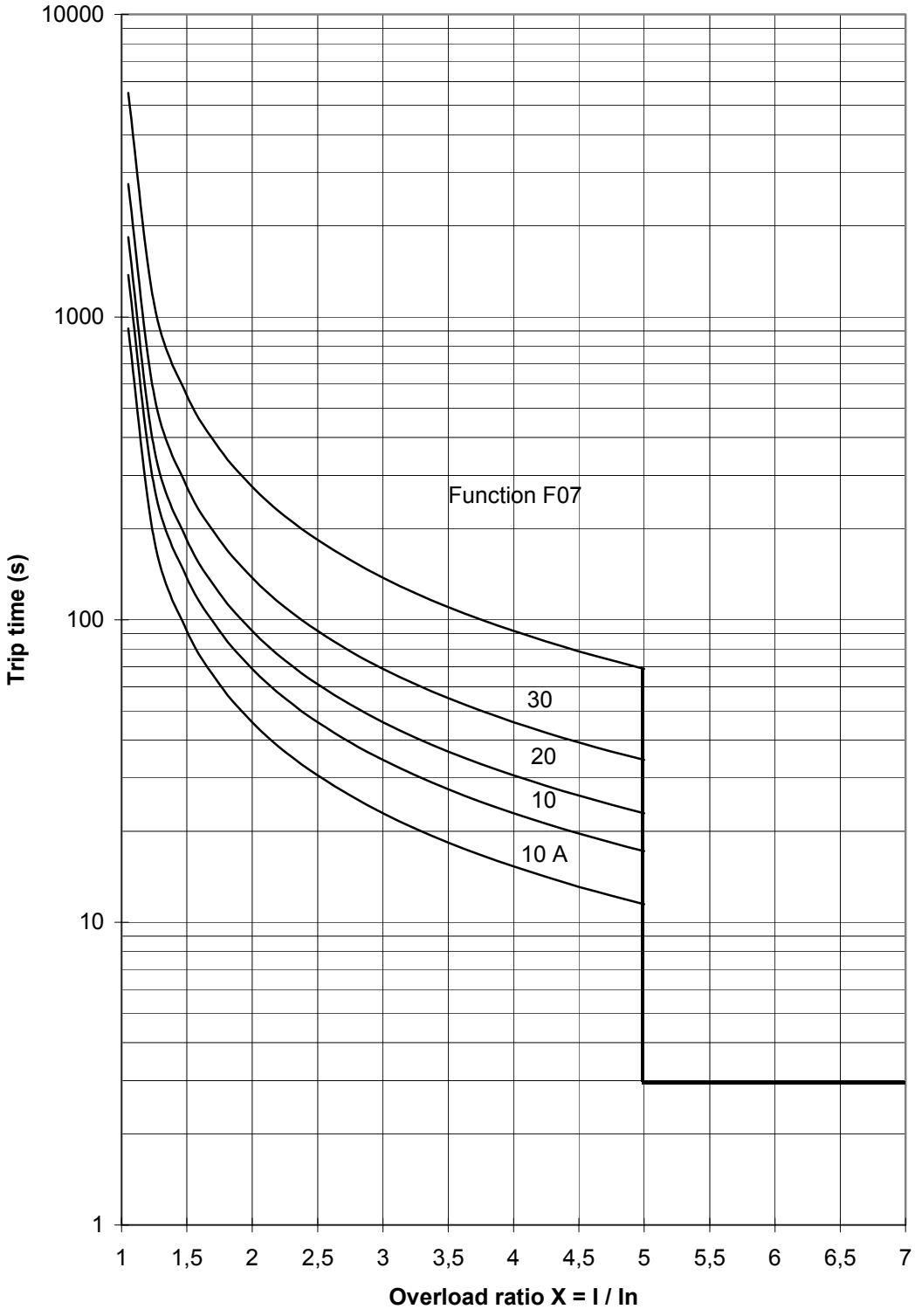
③ In order to provide total protection for the NOVADEM S3 against short-circuits on the motor side (type 2 co-ordination), it is advisable to install high-speed fuses upstream of the NOVADEM S3. These fuses are intended to protect the thyristors of the NOVADEM S3 and should be rated as follows:

- Service voltage > supply voltage.
- I^2t of fuse should be in the order of 0.8 x I^2t thyristor.
- Fuse rms. current > motor rms. current.
- Conservative rapidity index (usually RI = 5).

④ Short-circuit rms current for a temperature rise below 100°C on the bus bars and to withstand to electrodynamic constraints generated over fixing and supports.

2.9 Thermal relay

TRIP CURVE FROM THE NOVADEM S3
THERMAL RELAY (cold state)



3.INSTALLATION ET BRANCHEMENTS

3.1 Preliminaries

Installation and connections must be performed with the power down (control and power cards) and executed by qualified personnel by following the electrical safety rules.

3.1.1 Protection of personnel

The NOVADEM S3, in standard version, comes in an IP 00 chassis. Up to the size 3 (model Nx3-300), the heat sink (connected to the chassis) must be connected to the ground. On the other models (Nx4-300 to Nx7-2300), the heat sinks are set to the power phase potential and only the chassis is to be connected to the ground using the ground terminal provided to this effect. In all cases, the power bus bars 1/L1, 3/L2, 5/L3, 2/T1, 4/T2 and 6/T3, accessible to the operator, are live when power is present. Consequently, installing the NOVADEM S3 should take account of the following rules:

- Connection should be performed with the unit switched off (control and power).
- The NOVADEM S3 should be mounted in a secure room with regulated access or in an enclosure according to NF C 15100 standard.
- The NOVADEM S3 should be programmed when there is no power voltage present.
- Precautions should be taken to prevent access to the power connections (1/L1, 3/L2, 5/L3, 2/T1, 4/T2, 6/T3) when programming the keypad unit (with power switched on).
- The NOVADEM S3 includes automatic functions which can be programmed by the operator (such as automatic restart F12) and it is therefore necessary to observe the safe working of the machine. Moreover, it is **imperative** to prohibit access to the machine unless the isolator or circuit breaker upstream of the starter is locked in the open position.

3.1.2 Protection of starter

3.1.2.1 Power

a) Confirm, from the starter rating plate, that the mains voltage matches that of the starter.

b) Ensure that the motor is neither short circuited nor subjected to an earth fault.

c) In the event that power factor correction capacitors are to be utilised, these must be installed upstream of the starter (supply side, connection terminals 1/L1, 3/L2, 5/L3 from the starter, and not placed between the NOVADEM S3 (connection terminals 2/T1, 4/T2, 6/T3 from the starter) and the motor.

d) Precautions should be taken when using the NOVADEM S3 on certain non-standard motors (E.g.: two speed DAHLANDER motors). Consult AOIP in order to ensure the correct method of installation of NOVADEM S3.

3.1.2.2 Control card

a) Make sure that the power supply voltage of the control card (230 V~, 115 V~ or 48 Vdc) is the one indicated on a label located close to the TB9 connection terminal of the control supply.

b) Power cables from the card should be isolated from the power cables.

c) Separate control cables (connection terminal on TB1 and TB2 card) from power cables.

3.1.3 EMC

The EMC characteristics are given in paragraph 2.1. These characteristics are guaranteed on condition that the cabling instructions given in this manual are observed.

Conducted emission: this product has been designed to Class A (industrial environment) for conducted radio frequency on the power line. Using the product in a domestic environment may cause radio interference, in which case, the user may wish to employ additional methods of attenuation. The AOIP technical department can always advise the user about the choice and the use of these methods.

3.1.4 Environmental conditions

a) IP code
The NOVADEM S3 is declared IP 00.
It must be mounted in a secure room or in an enclosure.

b) Temperature
The maximum room temperature for the NOVADEM S3 is 40°C. If this value is exceeded, derate the operating nominal current of the NOVADEM S3 by 1.2 % per degree above to a maximum of 55°C.

c) Altitude
The NOVADEM S3 should be used at altitude below 1 000 m. Above, please consult AOIP.

d) Electrical
The unit is designed to operate in an electrical environment, Category III, pollution 2.

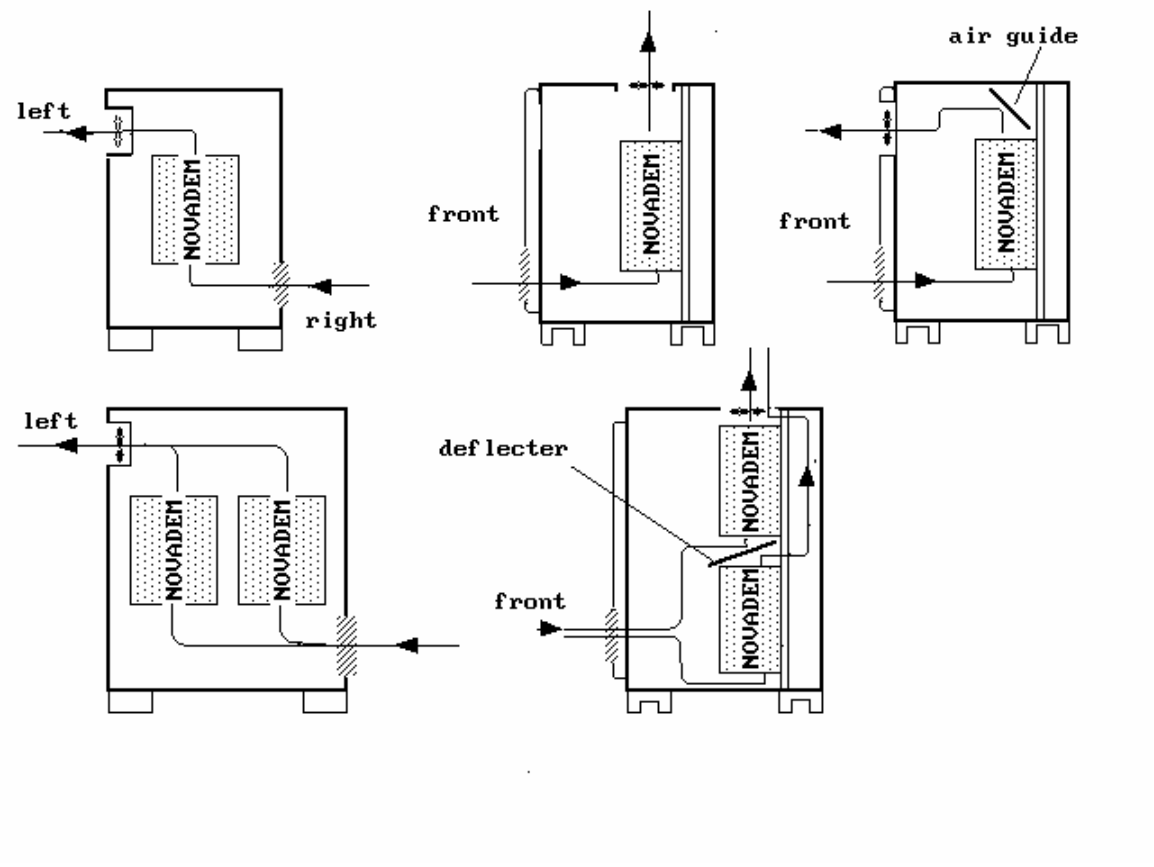
3.2 Mounting the NOVADEM S3

3.2.1 Precautions

When mounting the NOVADEM S3 in an enclosure, the following precautions must be taken:

- Allow a free space of at least 10 centimetres all around the NOVADEM S3.
- Where there are more than one NOVADEM S3 (or NOVADEM S3 together with other devices which require cooling) in the same enclosure, then allow 20 centimetres between each device.
  It is also advisable to mount a deflector between each vertical unit.
- The cooling air inlets should be at the base of the enclosure and warm air vents at the top. The NOVADEM S3 should be fitted within the air flow.
- To ascertain the aperture sizes and flow rate required in an enclosure, consult table hereafter dealing with thermal dissipation of NOVADEM S3.

3.2.2 Methods of mounting



3.2.3 Thermal dissipation of NOVADEM S3

Table below shows the volume of air required to dissipate the thermal energy, or if natural convection is not sufficient, the volume of air in m^3/hour for a maximum exterior temperature of 30°C (the difference between the inlet and outlet air being 10°C, for a temperature within the enclosure of 40°C).

The power dissipated is calculated on the basis of 10 starts per hour, each of 20 seconds.

Ventilation required for each type of S3

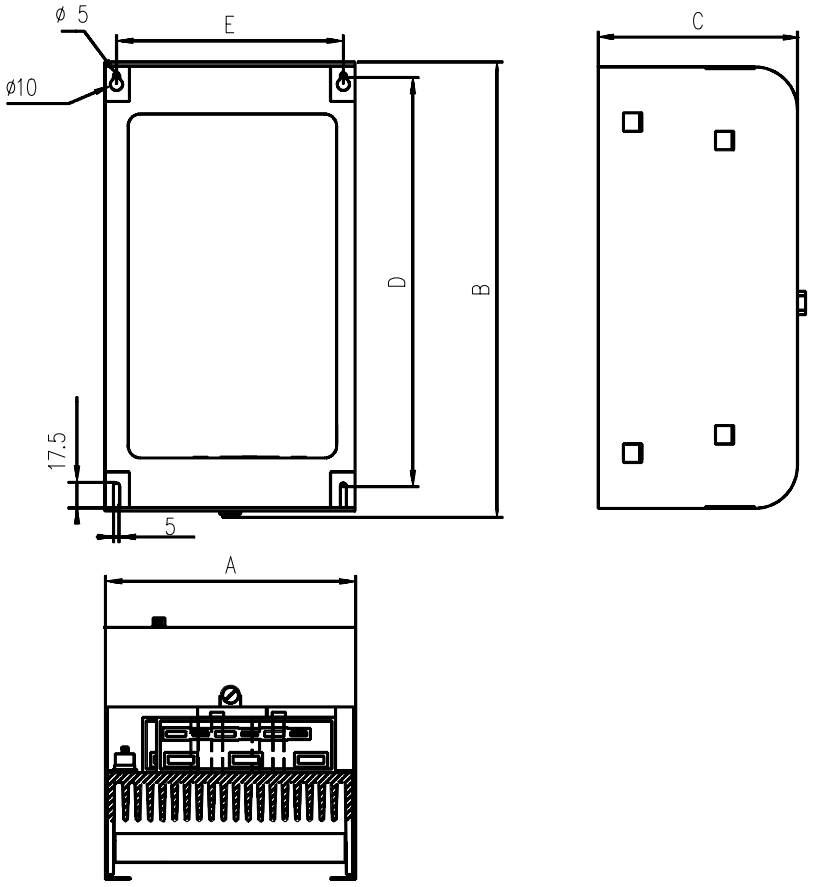
Type NOVADEM S3	Starting	Running	Ventilation required
NS x1-25	200 W	60 W	4 m^2 ①
NS x1-55	400 W	120 W	5 m^2 ①
NS x1-90	410 W	135 W	2 vents 0,065 m^2 ②
NS x2-90/91	710 W	190 W	2 vents 0,090 m^2 ②
NS x2-132	940 W	260 W	2 vents 0,130 m^2 ②
NS x2-160	1 150 W	360 W	2 vents 0,160 m^2 ②
NS x3-250/251	1 300 W	430 W	2 vents 0,250 m^2 ②
NS x3-300	2 050 W	520 W	4 vents 0,500 m^2 ②
NS x4-300	2 700 W	800 W	1 fan (200 m^3/h) ③
NS x4-500	4 200 W	1 000 W	1 fan (400 m^3/h) ③
NS x4-600	4 500 W	1 100 W	2 fans (500 m^3/h) ③
NS x5-760	5 000 W	1 350 W	2 fans (600 m^3/h) ③
NS x5-1200	5 300 W	1 500 W	2 fans (600 m^3/h) ③
NS x5-1500	5 700 W	1 800 W	2 fans (600 m^3/h) ③
NS x6-1200	5 700 W	1 800 W	Input/output 1 700 m^3/h ④
NS x7-1200	7 500 W	2 100 W	Input/output 3 400 m^3/h ④
NS x7-1800	8 900 W	2 600 W	Input/output 3 400 m^3/h ④
NS x7-2300	9 600 W	3 100 W	Input/output 3 400 m^3/h ④

① Surface area of the enclosure with no other objects closer than 20 cm.
② Surface area of the vent.
③ Enclosure ventilation flow.
④ Air flow required for ventilation of NOVADEM S3.

3.2.4 Dimensions and fixing

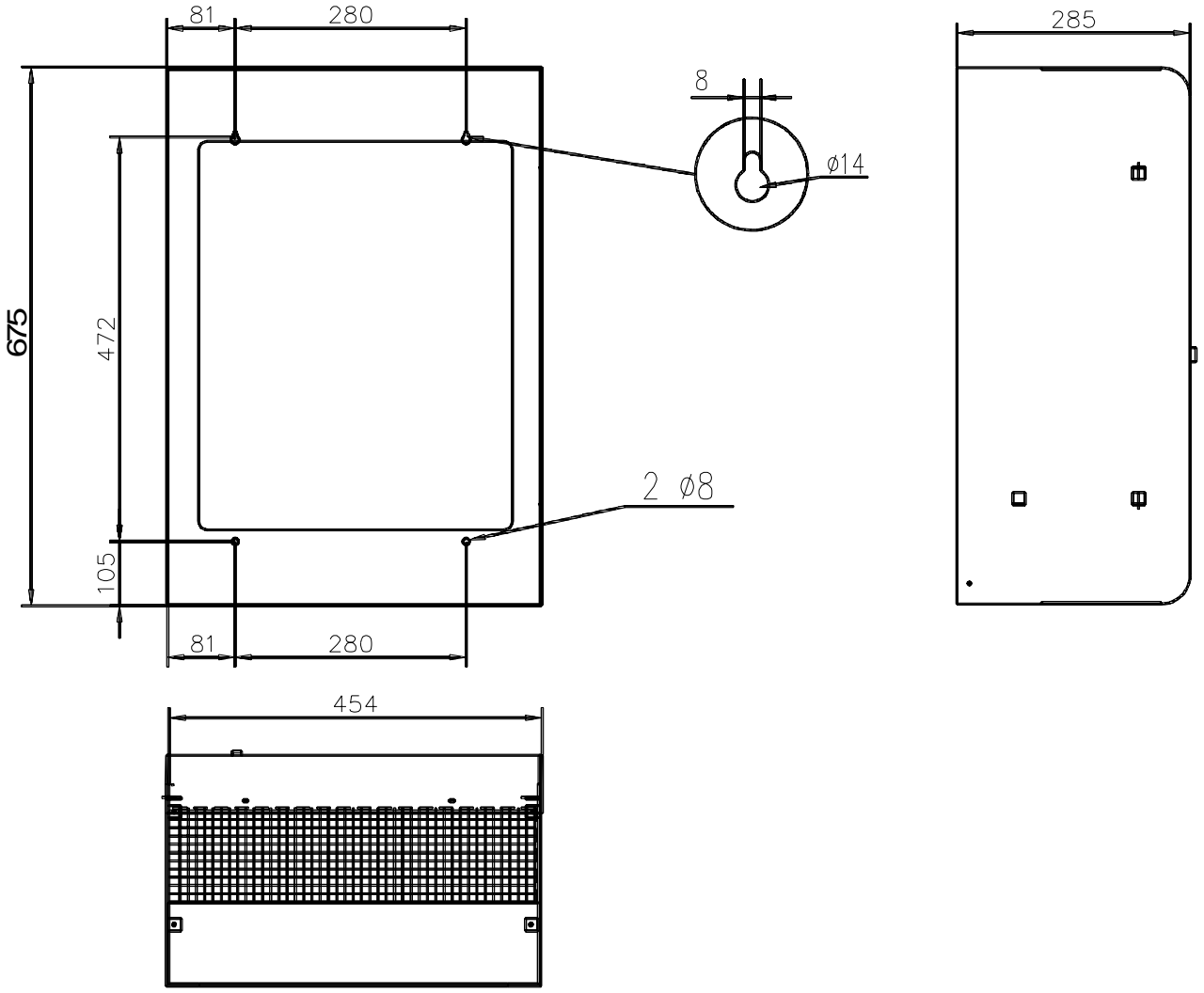
Refer also to table, paragraph 2.2.

3.2.4.1 From model NS x1-25 to model NS x3-300

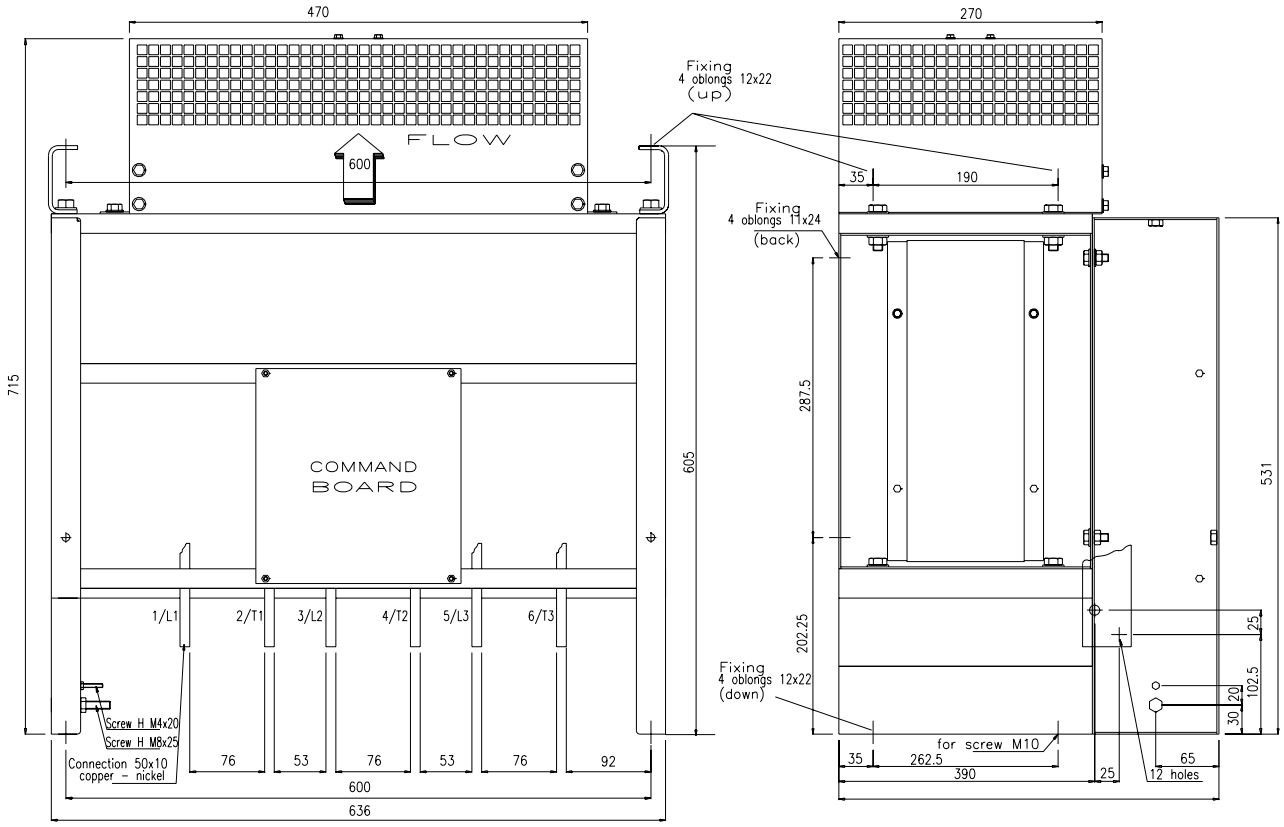


Model	A	B	C	D	E
Size 1 (NSx1-xx)	200	370	174	335	185
Size 2 (NSx2-xx)	200	370	247	335	185
Size 3 (NSx3-xx)	200	470	257	435	185

3.2.4.2 From model NS x4-300 to model NS x5-1500

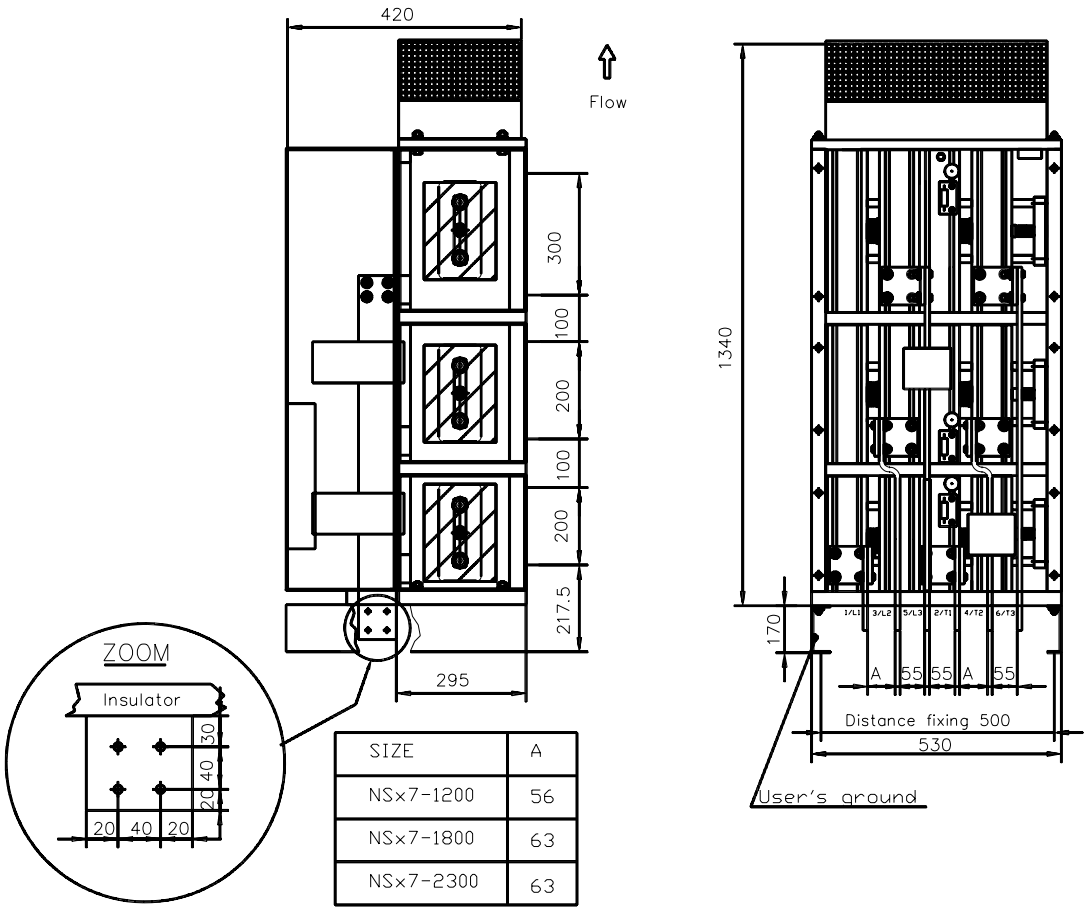


3.2.4.3 For model NS x6-1200



Earth connection: M8 x 25 screw.
Mains line connection: 50 x 10 bar.
Motor line connection: 50 x 10 bar.

3.2.4.4 From model NS x7-1200 to model NS x7-2300



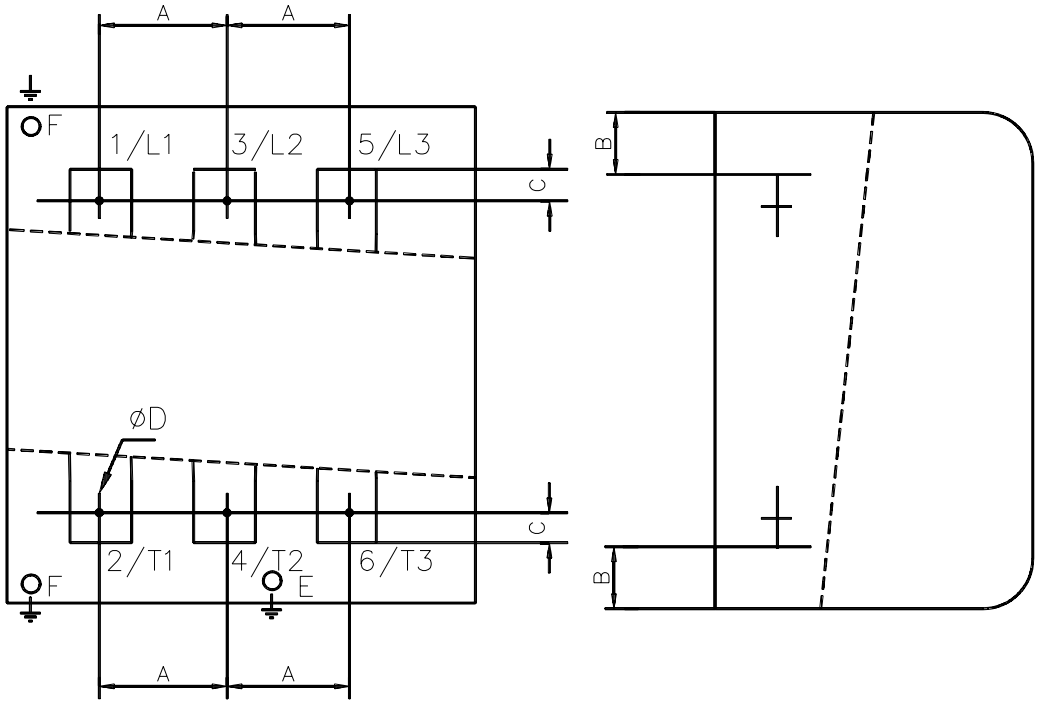
SIZE	A
NSx7-1200	56
NSx7-1800	63
NSx7-2300	63

Earth connection: M8 x 25 screw.
Mains line connection: 100 x 10 bar.
Motor line connection: 100 x 10 bar.

3.3 Connection

3.3.1 Power

3.3.1.1 From model NS x1-25 to model NS x5-1500



Model	Connector	A	B	C	D	E	F
NS x1-25 NS x1-55 NS x1-90	12 x 2	40	Top: 32 Bottom: 39	10	5	-	∅ M8
NS x2-90/91 NS x2-132 NS x2-160	15 x 3	40	30	10	8	-	∅ M8
NS x3-250/251 NS x3-300	20 x 5	53	50	15	8	-	∅ M8
NS x4-300 NS x4-500 NS x4-600	40 x 8	141	55	25	12	Bolt M8 x 20	-
NS x5-760 NS x5-1200 NS x5-1500	50 x 8	141	55	25	12	Bolt M8 x 20	-

3.3.1.2 For model NSX6-1200

Refer to paragraph 3.2.4.3.

3.3.1.3 From model NS x7-1200 to model NS x7-2300

Refer to paragraph 3.2.4.4.

3.3.1.4 Earth connection

The unit should be grounded using the terminal provided for this (see paragraph 3.3.1.1). For cross-section refer to table below (IEC Publication 60439-1).

Cross-section of phase conductors (S) mm2	Minimum cross-section of earth conductor (Sp) mm2
S =< 16	S
16 < S =< 35	16
35 < S =< 400	S/2
400 < S =< 800	200
S > 800	S/4

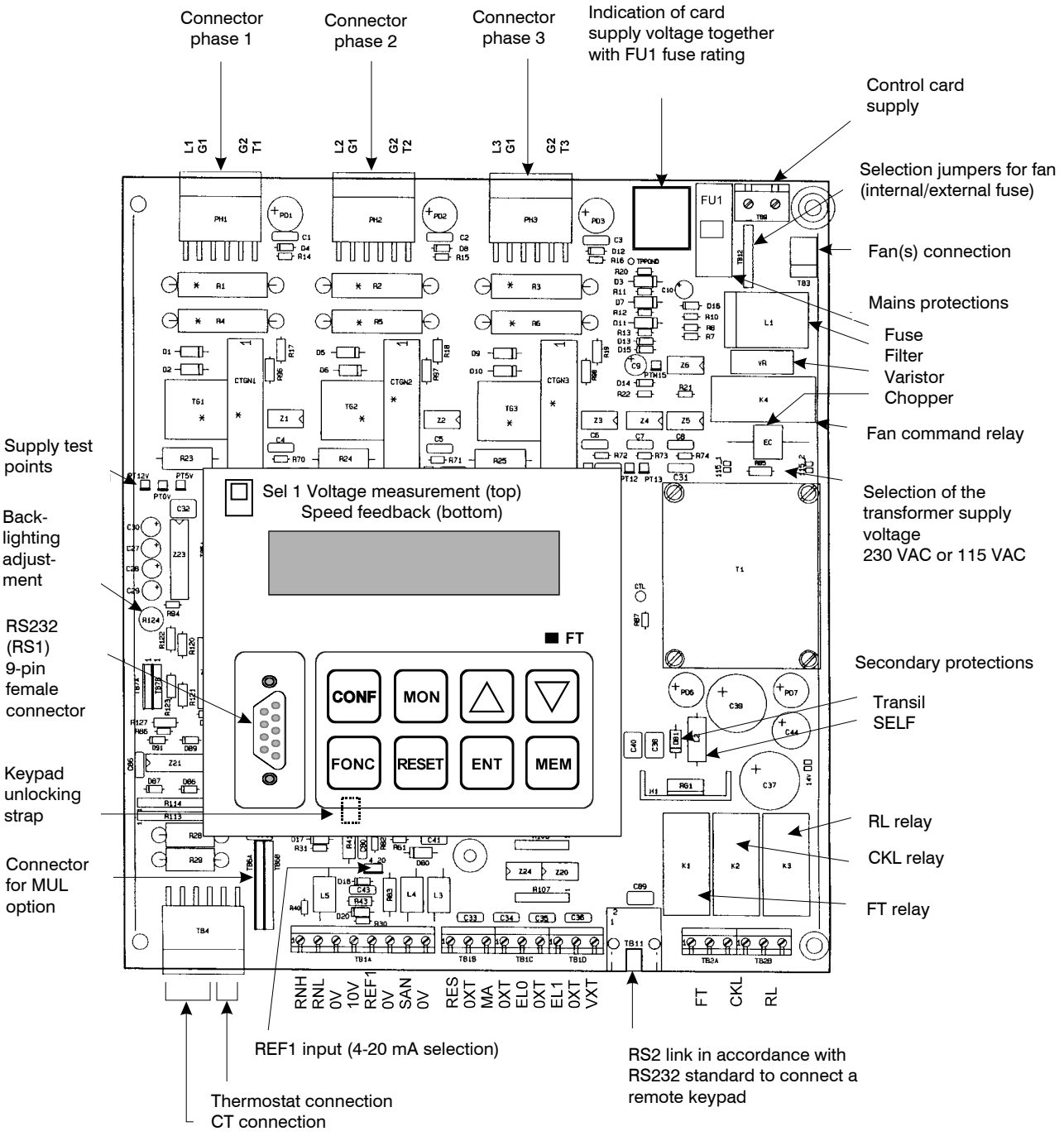
3.3.2 Control card

3.3.2.1 Precautions

The supply to the control card is connected via terminal TB9.

Before switching on, make sure that the supply source meets the voltage indicated on the card.

3.3.2.2 Presentation



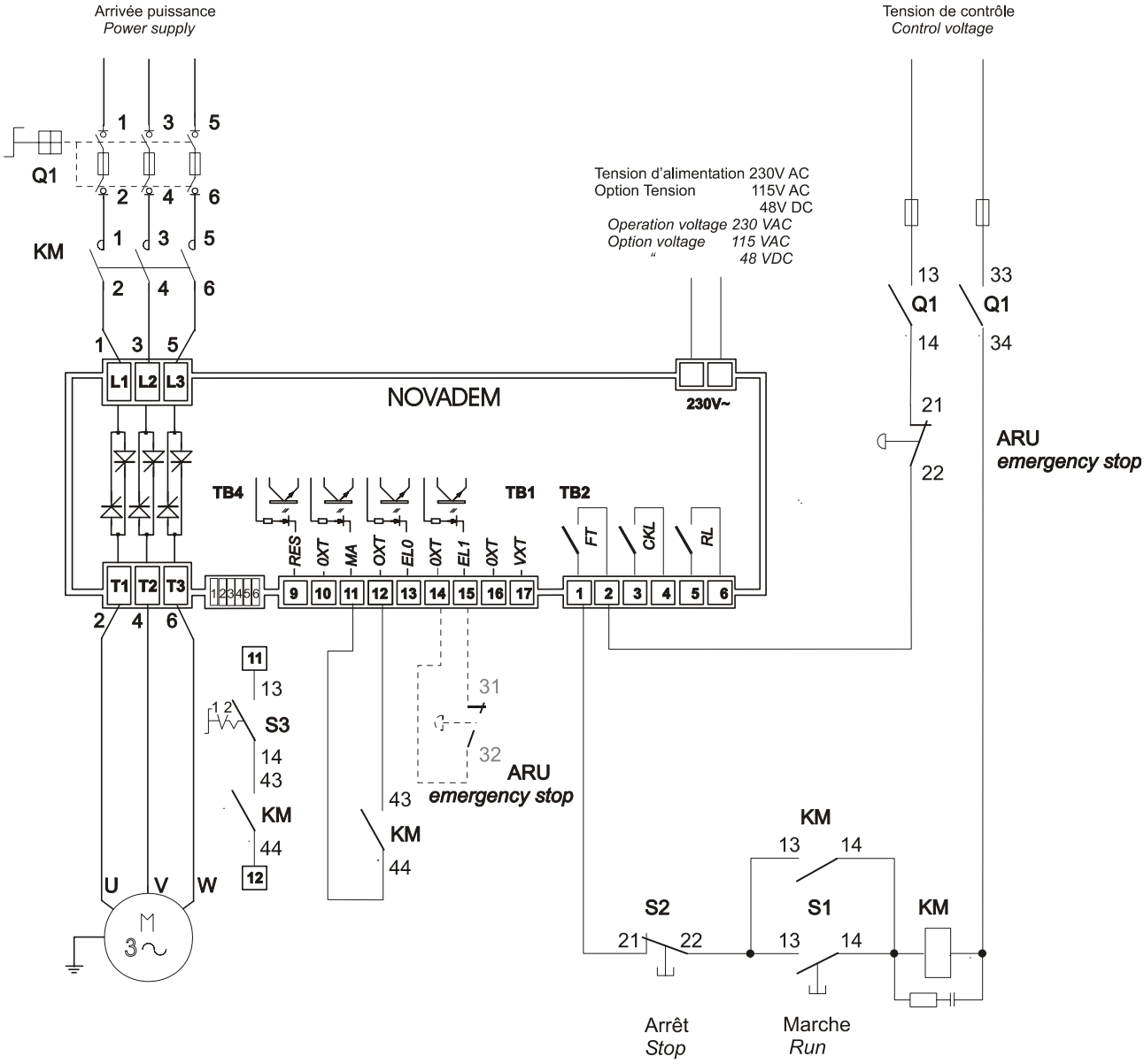
INTERNAL INPUTS/OUTPUTS (internal connections only)	
PH1, 2, 3	6 way connectors for connecting the three thyristor modules.
TB4	4 and 2 way connectors for current feedback (CT) and heat sink thermostat.
TB3	2 way connector for cooling fan control (sizes > 1).
TB11	RJ45 connector for connecting the optional remote display.

SETTING AND SIGNALLING DEVICES	
FT LED	The red LED signals a wrong operation.
DISPLAY	This comprises a 2 x 20-digit display which indicates the status of the starter (operation and faults) together with programming.
KEYPAD	Mounted on the front of the starter and has 8 keys for programming.

EXTERNAL INPUTS/OUTPUTS (for customer connections)	
TB9	Terminals to supply the electronic card.
TB1 (A)	Screw terminals for analogue inputs/outputs.
RNH-0V	Analogue input accepting a signal 0-200 Vdc (for tacho feedback).
RNL-0V	Analogue input accepting a signal 0-10 Vdc (for tacho feedback).
REF1-0V	Analogue input accepting a signal 0 V-10 V or 4-20 mA (set a jumper over the card to validate input in 4-20 mA current mode).
SAN-0V	Analogue output for connecting a voltmeter. As standard, this output is proportional to the motor current 0 to 5 V.
TB1 (B, C and D)	Screw terminals for logic inputs and VXT supply: 4 opto isolated inputs. These are associated with the following commands.
RES-0XT	Fault reset.
MA-0XT	Start/stop.
EL0-0XT EL1-0XT	Programmable inputs.
VXT-0XT	MUL option card supply.
TB2 (A and B)	Screw terminals for relay outputs: 3 relay outputs (volt free contact rated 250 V-12 A). These outputs are associated with the following signals.
FT	Starter fault.
CKL	Programmable relay.
RL	Programmable relay.

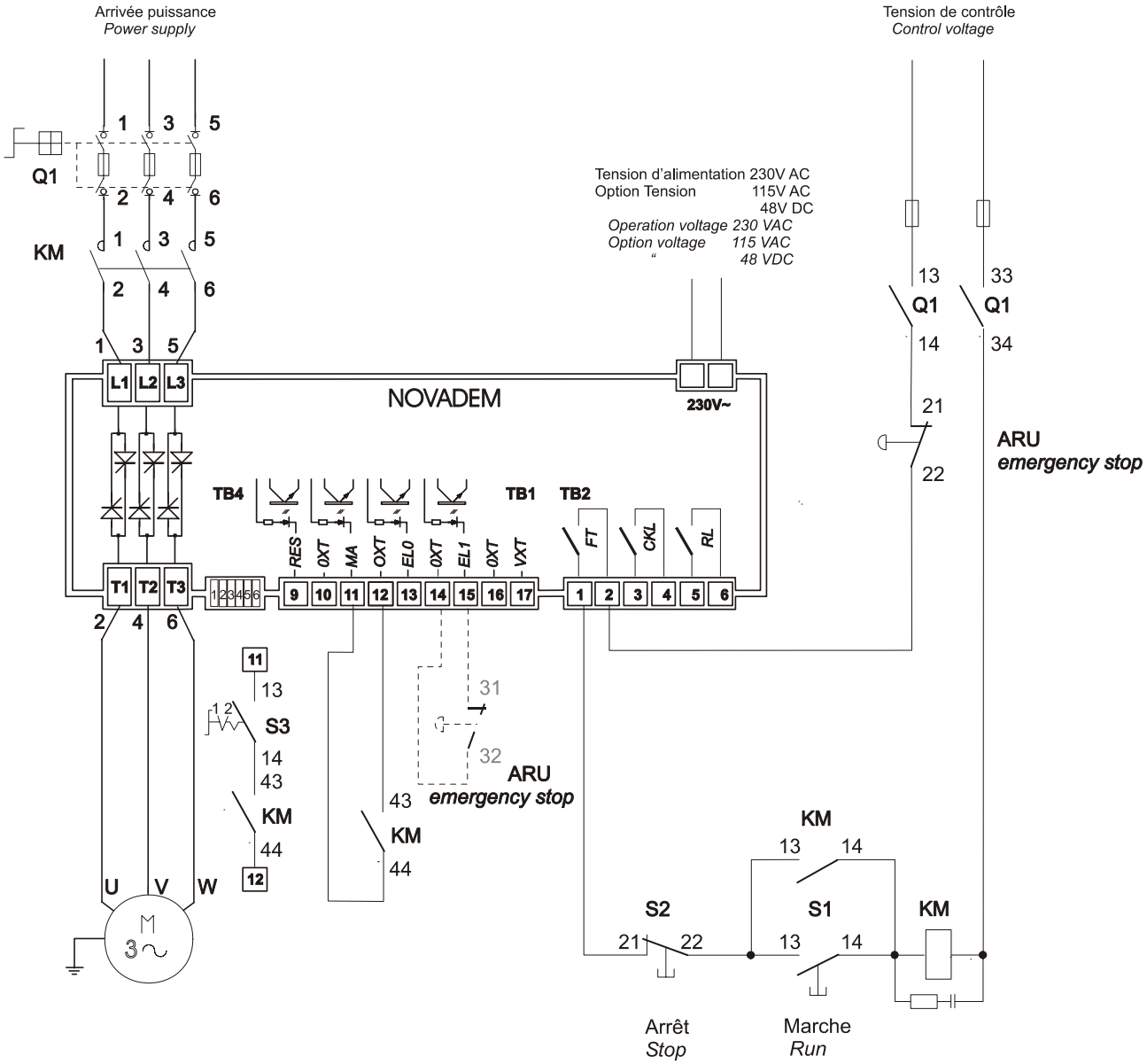
3.3.3 Connection example

The standard diagram is the one represented below where the NOVADEM S3 is set to start either by an auxiliary contact of the line contactor (NO) or by a volt free contact (in that case, the line contactor must be previously closed).
Other connection examples are given in the pages following.



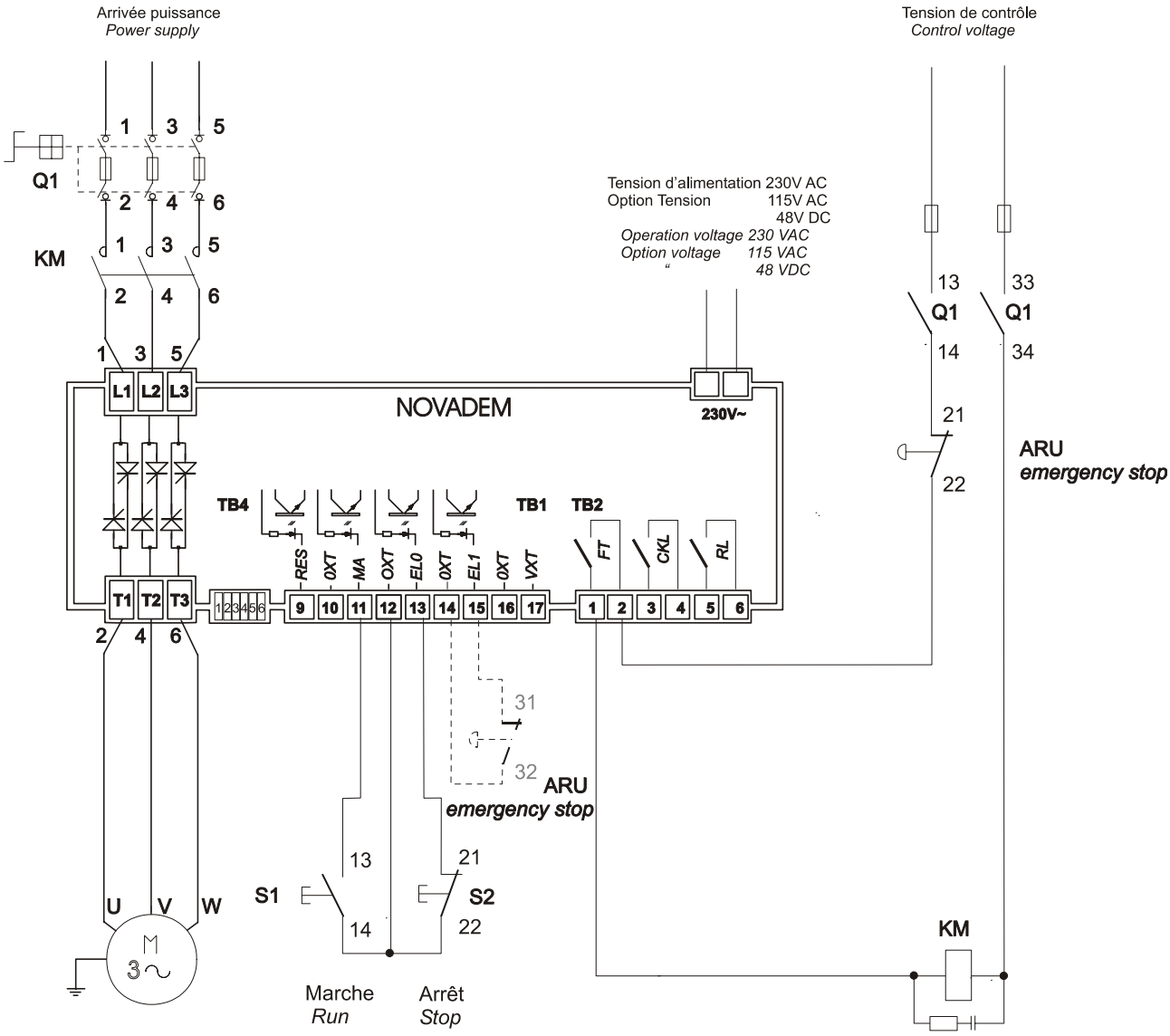
NOTE: In the case of supplies which are badly polluted or disturbed, the NOVADEM S3 may display an anomaly during the execution of certain functions. AOIP can supply, in these specific cases, optional solutions which can be fine tuned with the assistance of our technical department.

3.3.4 Standard connection for control either by contactor or independently



NOTE: The opening and closing of the line contactor initiates starting or stopping when an auxiliary contact (NO) from the contactor KM is used. An independent contact can also be used to initiate starting and stopping. In that case, make sure that power is present at closing of this contact.

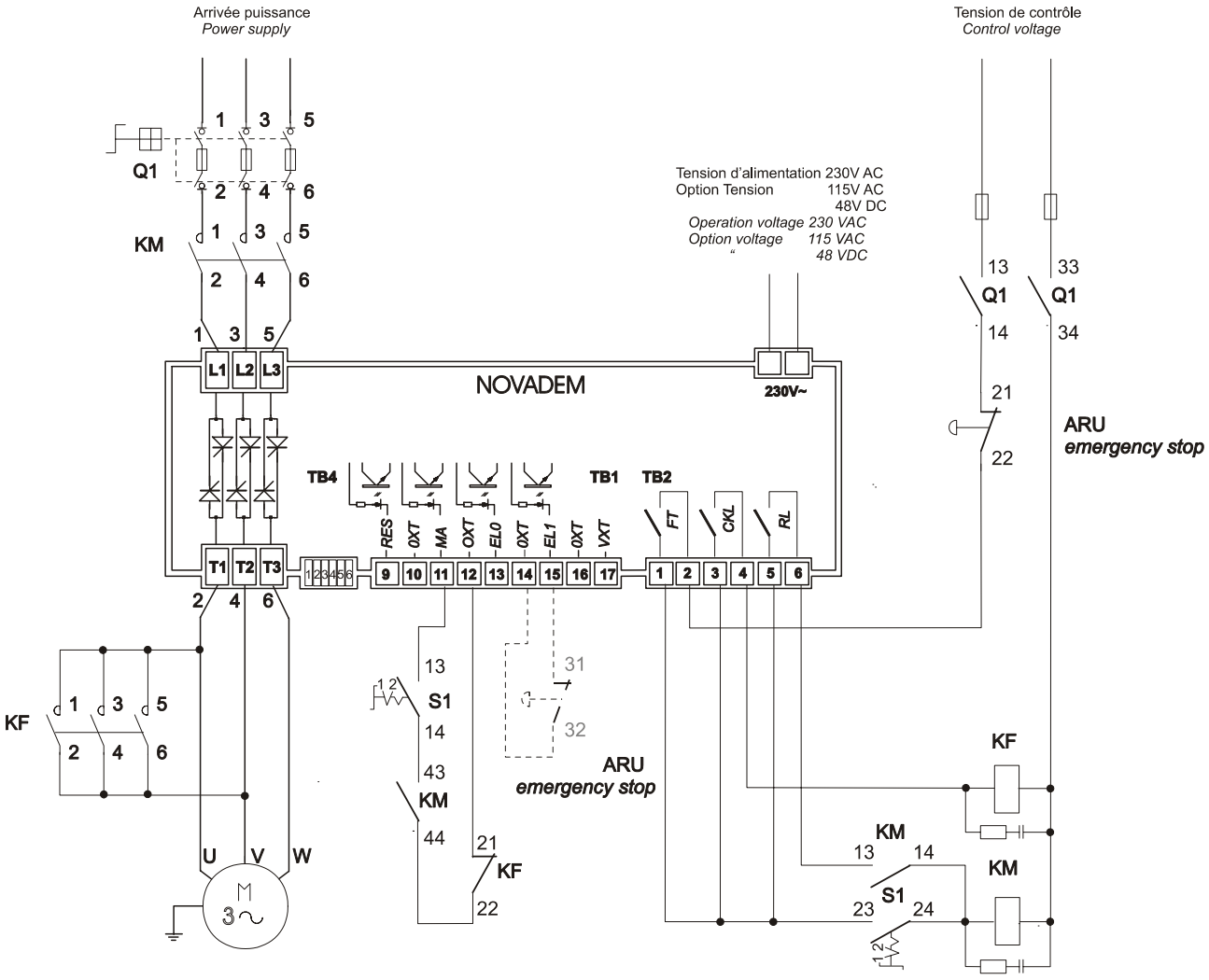
3.3.5 Connection for 3 wire command (remote command)



NOTES:

1. The NOVADEM S3 controls closing and opening of the line contactor.
2. Closing with pushbutton MA (S1) initiates the closing of the internal relay FT. Opening with pushbutton AR(S2) sets the internal relay FT to OFF position (programming is performed using function F02, EL0 input = 3 wire mode).

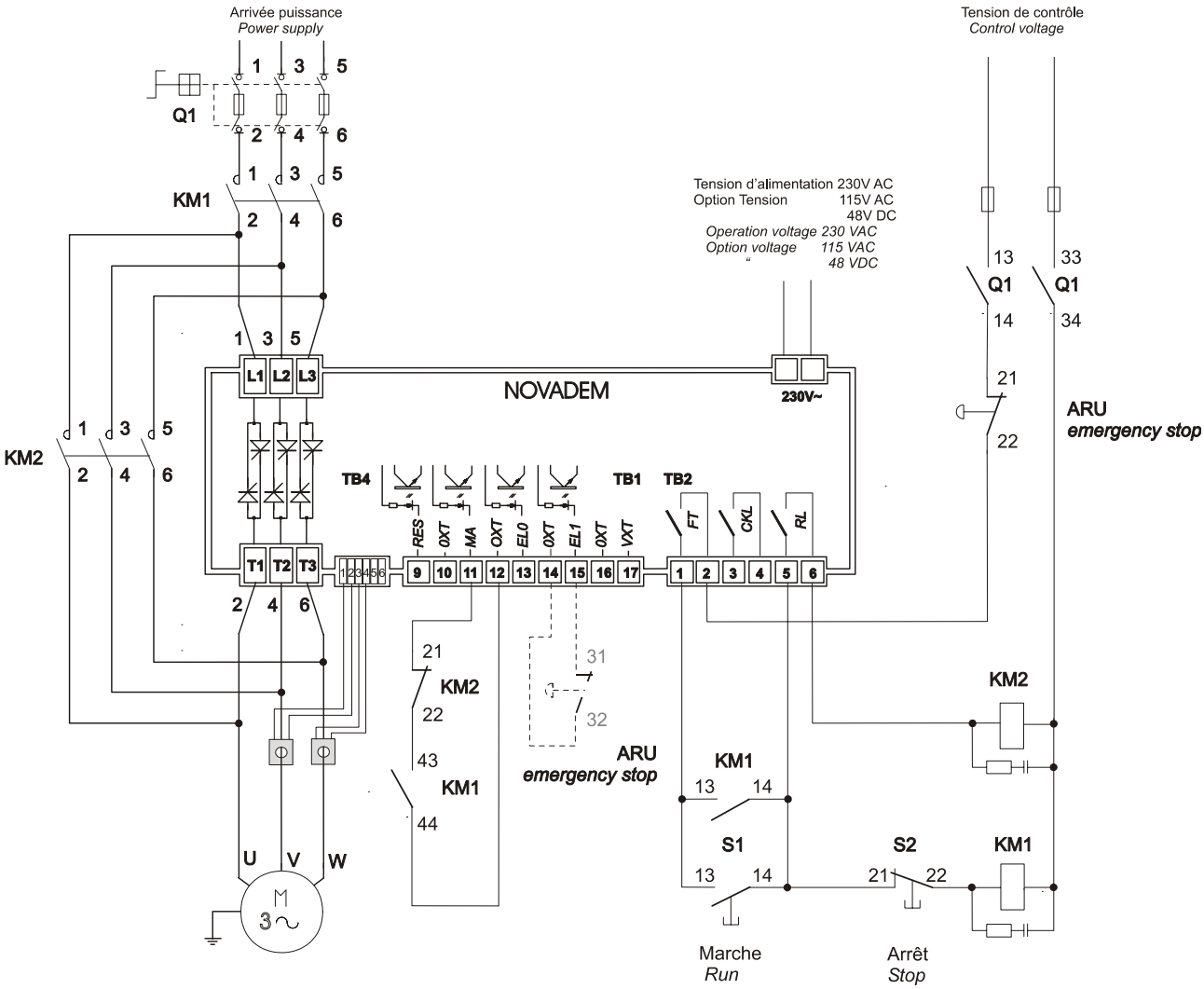
3.3.6 Connection for stopping using braking contactor



NOTES:

1. Braking signal from contactor KF is activated by the CKL relay (program relay CKL = braking using function F02) when contact AR opens (stop required).
2. **It is imperative** that the braking contactor (KF) is connected between 2/T1 and 4/T2.
3. Programming this operation mode is performed using function F04:
   - Stop type = 3 or 4.
   - Stop time = X s.
   - Braking current = XX %.

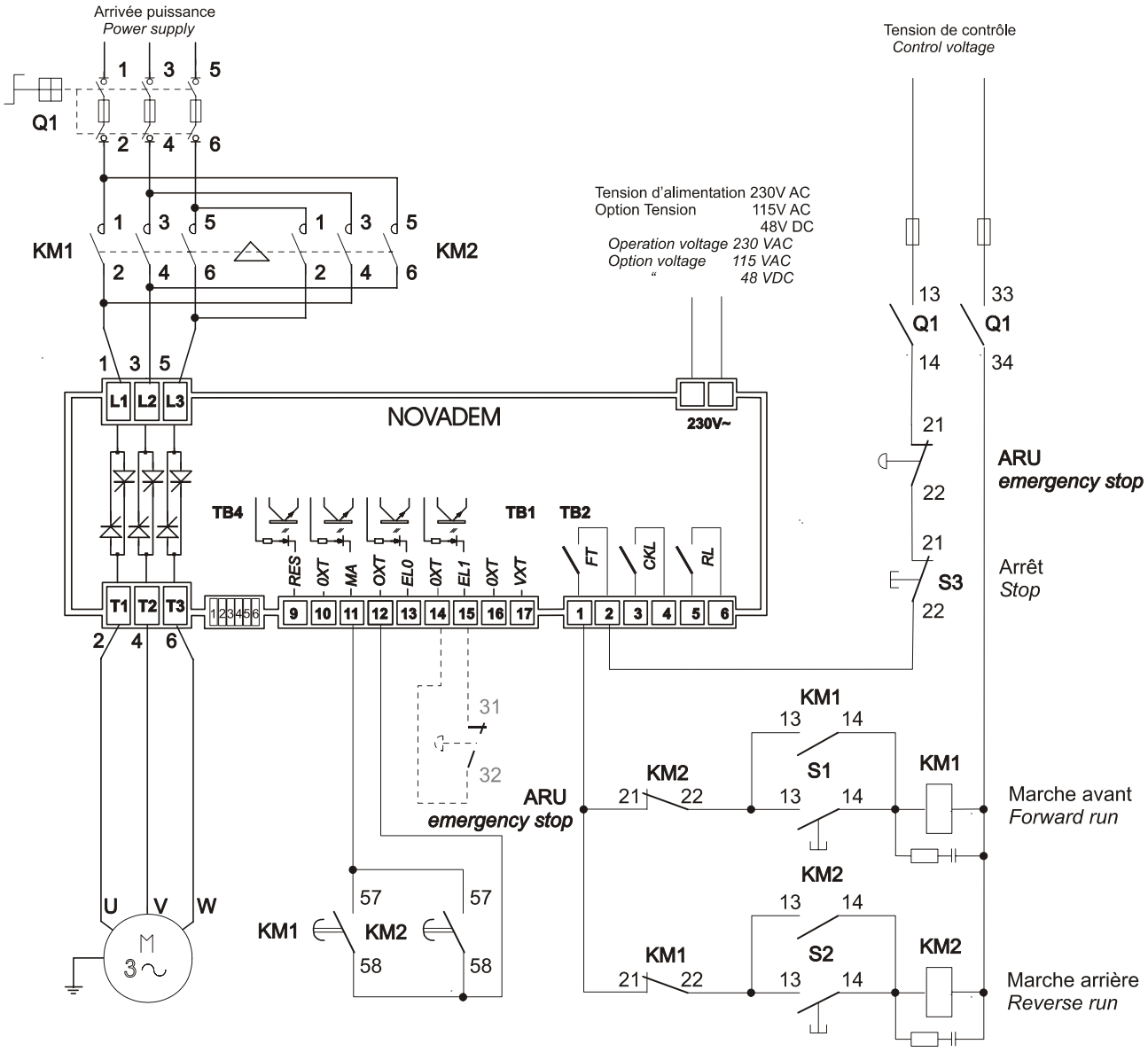
3.3.7 Cabling with bypass contactor



NOTES:

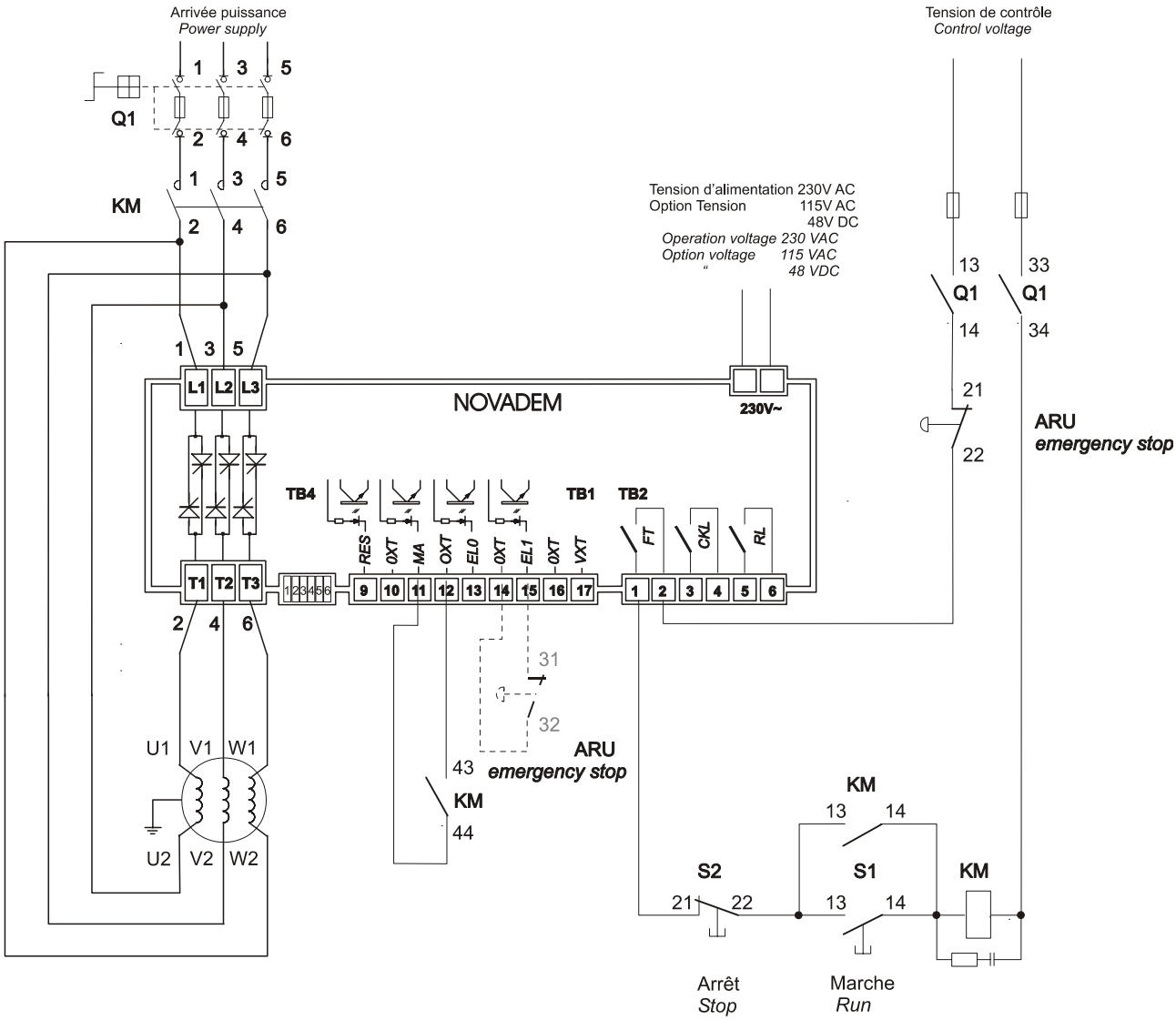
1. Relay RL, programmed as End Start using function F02, operates the shorting contactor KM2 at the end of start. KM2 gives a stop signal to NOVADEM S3 by opening RUN from the starter (RUN – OXT opened).
2. Activate Short circuit func. using function F26 and if required use functions decelerating, controlled decelerating, or braking.

3.3.8 Cabling for bi-directional operation



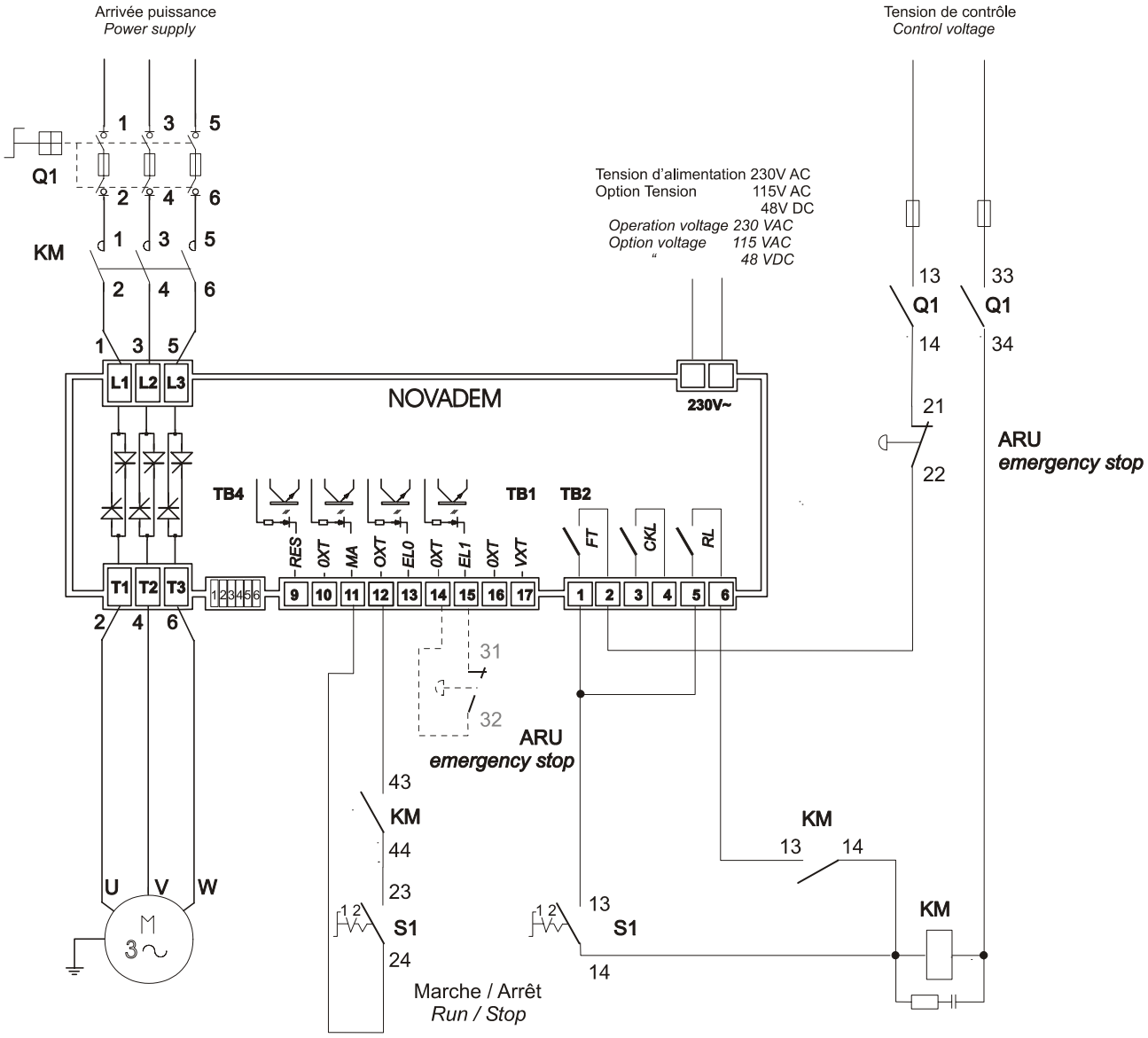
NOTE: The function of the NOVADEM S3 is not to open or close the line contactor AV (KM1) or AR(KM2) : the START/STOP command is given by a maintained contact from AV (KM1) or AR (KM2) .

3.3.9 DELTA cabling



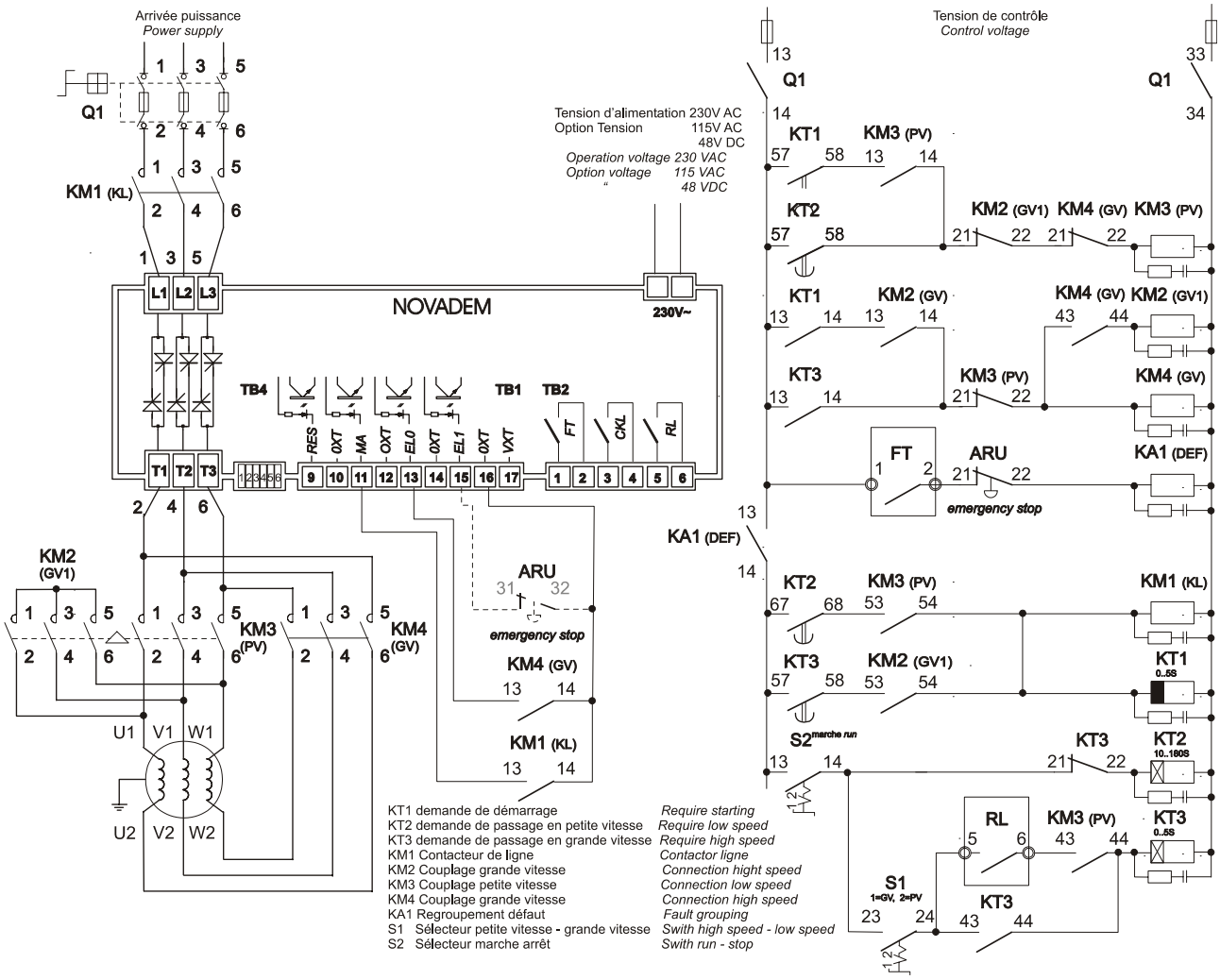
NOTE: In this diagram, triggering of the line contactor drives the NOVADEM S3. It may also operates with a MA/AR order coming from a contact independent from KM. In this case, make sure that power is present when this contact closes. To achieve this, the user may connect a contact from KM contactor in series with MA/AR switch.

3.3.10 Cabling for pumps (with soft stop)



NOTE: The START/STOP signal is given by switch S1. When S1 closes, KM closes, then the start operation is initiated. When S1 opens, the controlled soft stop occurs. At the end of soft stop, the relay RL opens KM (RL is programmed for "motor supply", in function F02).

3.3.11 Cabling for dual speed motor (DALHANDER)



NOTES:

1. Changing to low speed in all cases.
2. Thermal protection of windings may be ensured at both low and high speeds.

Notes

Notes

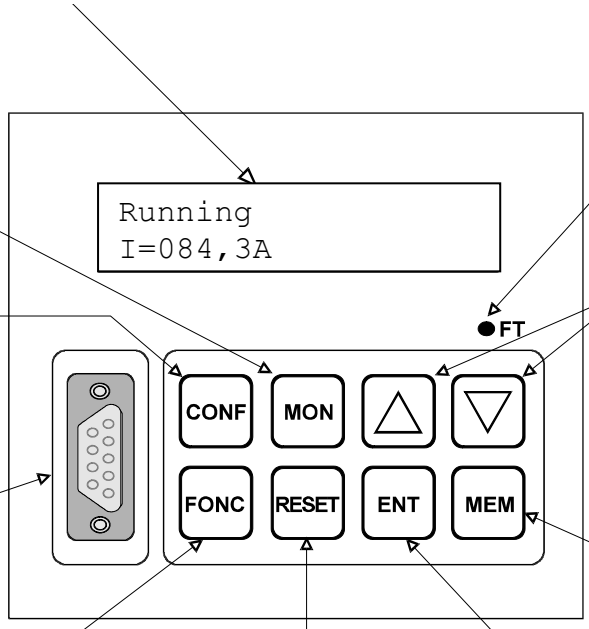
4. FAST PROGRAMMING, COMMISIONING AND OPERATION

⚠ When the NOVADEM S3 is installed and connected, replace the cover and power the card.
Power should not be present on the starter input.

4.1 Keypad description

Alphanumeric display, backlighted, composed of two lines of 20 characters.
The display enables the user to:
a) Program (read) functions and parameters.
b) Supervise the dynamic parameters and starter.
c) Read the statistics values and last 4 faults.

MONitor key
Access to subgroups:
a) Dynamic parameters.
b) Modified parameters.
c) Last 4 faults.
d) Statistics (counters).



Faul**T** LED
Signals all faults. The fault is exlained clearly on the display.

Keys ΔV to increase and decrease. These keys enable the user to:
a) Select a function, parameter or subgroup.
b) Modify the value of a parameter.

CONFigutation key
Access to subgroups:
a) Definition group (language, motor FLC and starter type).
b) Applications group (Selection of the machine, macroprograms).

RS 232
For connecting either a PC together with supervision and programming software, or PLC or network interface card.

MEMorization key
Download the modified parameters in permanent memory.

FONCtion (function) key
Access to reading and/or changing parameters.
a) Extended mode (F01 to F40).
b) Parameters defined by the selection of a macroprogram (pump, fan, …)

RESET key
a) Resetting fault which is signalled by the **FT** LED.
b) Exit from function or modifying without validation.

ENTer key
This key enables the user to:
a) Access a subgroup.
b) Access a function (group of parameters).
c) Modify parameters in modification mode.
d) Validate a modification.

4.2 Fast programming

At switching on, the display reads:

```
Phases not present
I=000,0A
```

The fast programming of the NOVADEM S3 is carried out in to three stages (see paragraph 4.7.1):

- Enter the motor full load current (indicated on the motor rating plate).
- Enter the chosen application. E.g.: Pump (to be selected from a list proposed by the NOVADEM S3).
- Memorise the configuration with the MEM key.

Each application is defined by a macroprogram. The macroprogram is the grouping and pre-programming of a whole set of functions especially designed to the user's application.

IMPORTANT: The external inputs/outputs terminal is also configured (do not forget to perform the connection in accordance with the programming). See paragraph 4.8, appendix 2.

Using the CONF key carries out accessing the 2 programming menus.

The menu DEFINITION GROUP enables the user to access reading and changing the language (ENGLISH/FRENCH), the full load current of the motor and consulting the starter type.

The menu APPLICATIONS GROUP enables the user to choose between 10 macroprograms. Selecting a macroprogram deactivates the previous choice and resets all the factory parameters, except those of the DEFINITION GROUP menu.
Access to programming by using functions going from F01 to F40 is activated by default.

Reading and/or changing the preset parameters are carried out with the FONC key.
Each application offers, at the end of its menu, access to protection and extended parameters (other parameters). Programming the extended parameters is explained in chapter 5.

4.3 Starting

Configuration and connection of the NOVADEM S3 being completed, the user will have to perform the tests following to be sure that the installation runs correctly.

Starter status and operation	Display
Starter power OFF.	Phases not present I=0000A
Set the KM line contactor.	Ready to start I=0000A
Initiate start order (if different from the KM line contactor).	Starting I=0200A
Check rotation and current limitation during starting.	Starting I=0280A
End of starting managed by the NOVADEM S3. The motor has started.	Running I=0090A

The user may improve the adjustments in order to optimise the starting. Some additional functions may be used. For that enter the macroprogram menu using the FONC key and either activate "Other parameters ?" or "Change protections ? if only protections have to be changed. Also refer to chapter 5
In case of anomaly, refer to chapter 7.

4.4 Supervision of the NOVADEM S3 dynamic parameters

4.4.1 Using MON key and display

Key MONitor advises the user on programming and allows him supervision of dynamic parameters.

Key MON gives access to 4 menus: Dynamic parameters, Modified parameters, Last 4 faults and Statistics.

- Selecting Dynamic parameters menu enables the user to read and display permanently two dynamic parameters from a list.
- Selecting Modified parameters menu enables the user to identify the parameters adjusted to a value different from the factory preset values.
- Selecting Last 4 faults menu enables the user to read the last 4 faults from the NOVADEM S3.
- Selecting Statistics menu shows the number of hours the motor has run together with the number of starts performed.

4.4.2 Using other means

The serial link connected either to a PC (together with the LOGIDEM option), or to a PLC, gives access to all parameters of the NOVADEM S3 (refer to chapter 6).

4.5 Operation anomaly

A message is displayed when an anomaly occurs.
If the anomaly has stopped the starter, the FT LED is lighted.
Refer to chapter 7 which deals with all the faults displayed.

4.6 Recommendations for use

4.6.1 Resetting

Resetting the parameters by using the macroprogram "Reset parameters" (Configuration menu, then Applications group) or function F37 re-writes, for all parameters, the factory preset values in EEPROM memory. Access to functions F01 to F40 is activated.

4.6.2 Security of information: locking the keypad

The keypad is essential for programming parameters. It is therefore imperative that no unauthorised alterations to the set parameters should be undertaken during the operation of the NOVADEM S3. For this reason, it is possible to lock the keypad by introducing a code (see function F38).

Any subsequent attempt to modify a parameter whilst the keypad is locked, would not be possible and the message "Keypad locked !" is displayed. However, all the display functions are accessible to the operator.

4.6.3 Data integrity

IMPORTANT: Note your program on the MEMO sheets located at the end of this chapter.

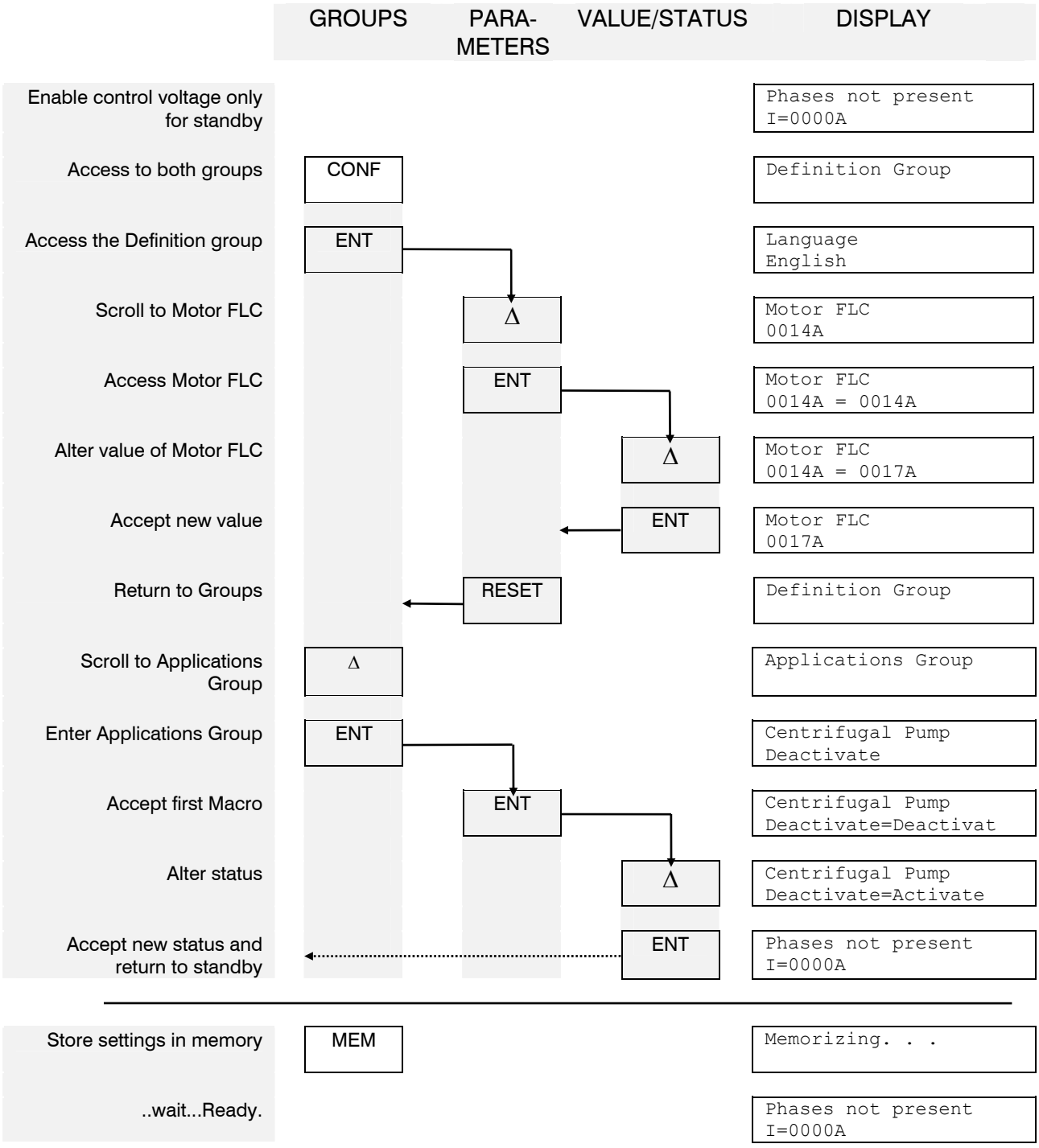
The data programmed is stored on EEPROM by using the MEM key. At each power up, the system verifies, by a checksum calculation, that the data has been correctly stored.

If a checksum fault occurs, the NOVADEM S3 displays "Eeprom fault". In this case, all the parameters are reset to factory preset values and resetting the fault initiates this. It then becomes necessary to reprogram all your parameters.

4.7 Appendix 1

4.7.1 NOVADEM S3 set-up

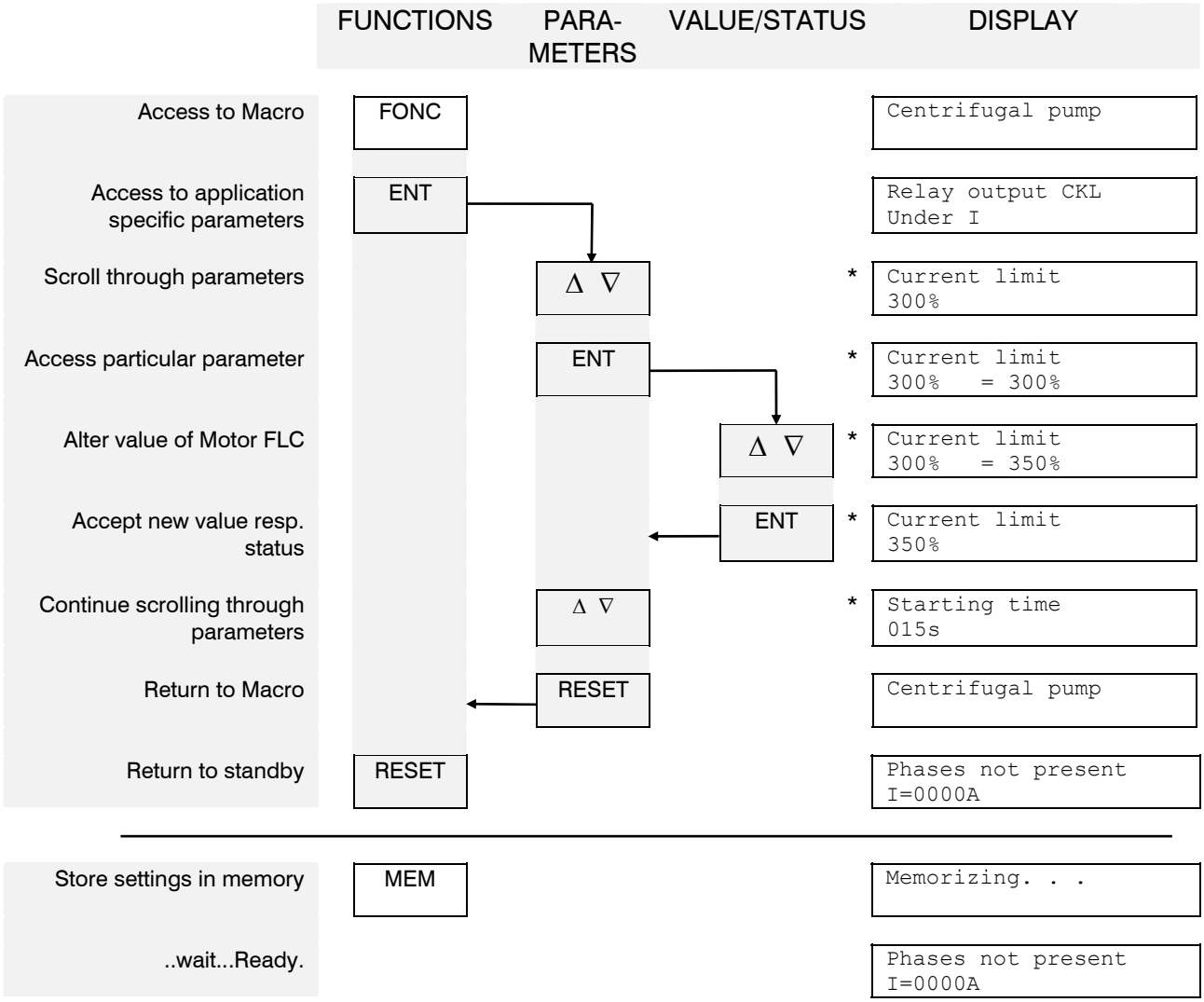
There are two ways of operating the NOVADEM S3, either by making use of one of the 10 different pre-programmed Application Macros or by accessing each function separately. Each macro fully configures not only a selection of between 6 and 15 parameters but also the Inputs and Outputs. Apart from programming the actual motor FLC, there is no need to alter any of these parameters. Therefore the NOVADEM S3 can be set-up quickly, knowing that no application specific parameters have been left out.



4.7.2 Macro programming

Once an Application Macro (E.g.: Active centrifugal pump) has been chosen and activated individual parameters can be accessed as follows below. Initially only a limited number of parameters, those relevant to the chosen application, are accessible. However, the last function in every macro provides an option to enable access to all 40 functions.

Example:

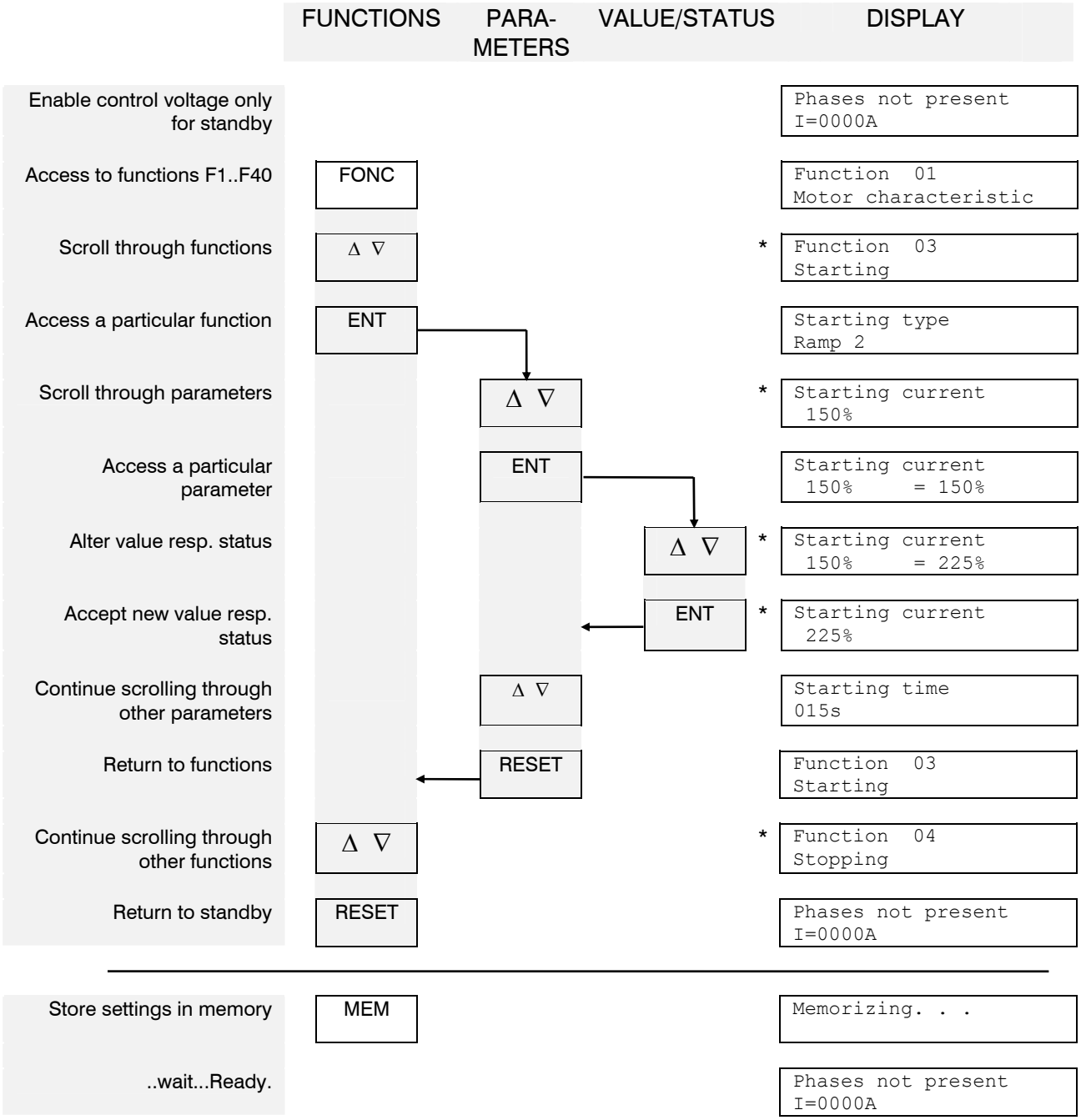


(* examples only)

The RESET button can be used at any time in the process of programming but when used whilst altering a value or status, the new value resp. status **will not be accepted**. To accept a new value resp. status, the ENT button must be pressed, followed by the MEMory button at any time before switching off the power.

4.7.3 Programming without using macro

The NOVADEM S3 has 40 different Functions and in return each function has one or more Parameters of which the Value and/or Status can be altered. These 3 different layers can be accessed by pressing following sequences of buttons, on condition there is no macro enabled:

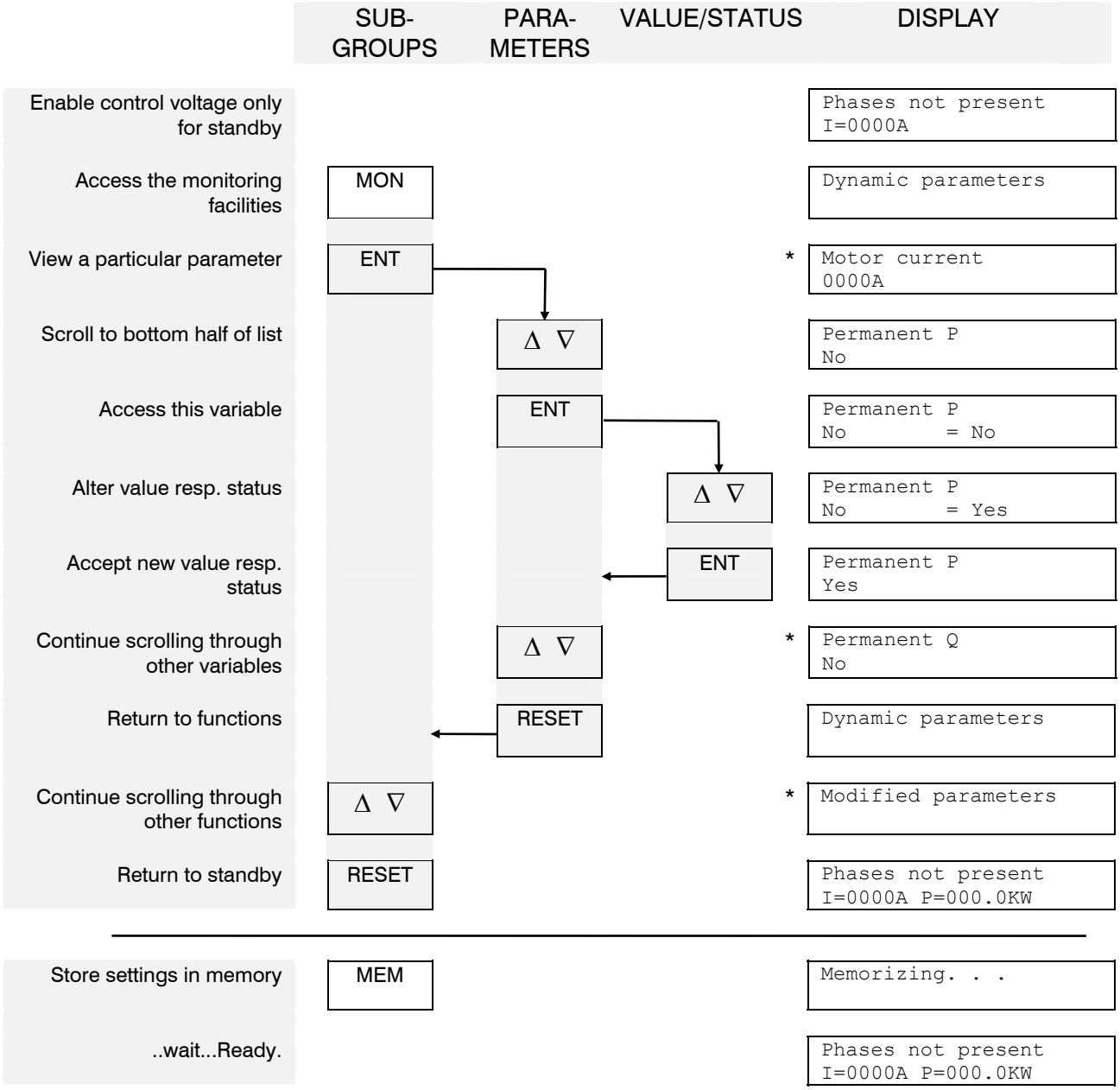


(* examples only)

The RESET button can be used at any time in the process of programming but when used whilst altering a value or status, the new value resp. status **will not be accepted**. To accept a new value resp. status, the ENT button must be pressed, followed by the MEMory button at any time before switching off the power.

4.7.4 Continuous monitoring

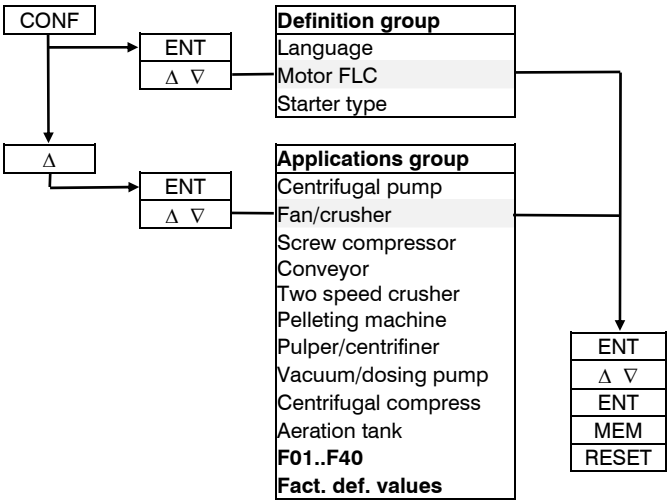
The 4 different types of monitoring facilities of the NOVADEM S3 can be accessed by pressing the MON button. From within the Dynamic Parameters sub-group it is possible to program one or two, out of eight, dynamic parameters to be displayed continuously. All parameters in this group are Read-Only and cannot be modified.



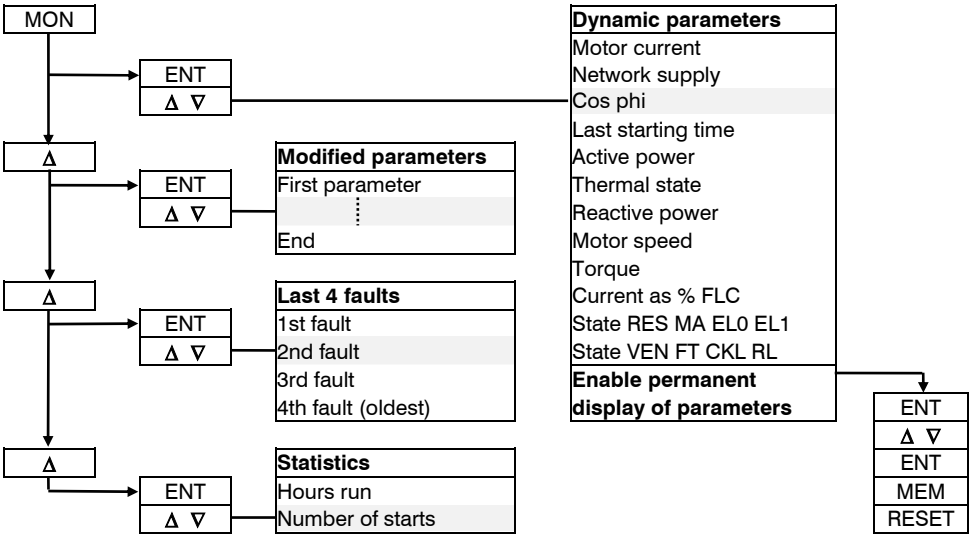
(* examples only)

The RESET button can be used at any time in the process of programming but when used whilst altering a value or status, the new value resp. status **will not be accepted**. To accept a new value resp. status, the ENT button must be pressed, followed by the MEMory button at any time before switching off the power.

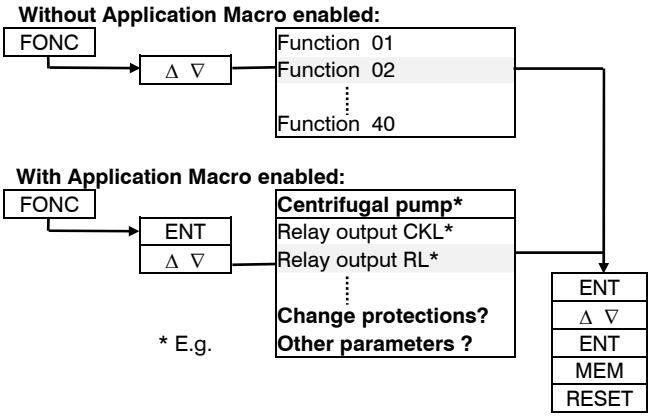
NOVADEM S3 configuration



Monitoring



Programming functions and parameters



4.8 Appendix 2: Settings for application or machine type

The values should be adjusted after test.

4.8.1 Centrifugal pump

See diagram, paragraph 3.3.10.

Relay output CKL	Underload	F02
Relay output RL	Motor supply	F02
Starting type	Ramp 2 (current limited)	F03
Current limit	300 %	F03
Starting current	230 %	F03
Starting time	15 s	F03
Stop type	Deceleration pump	F04
Stop time	15 s	F04
Deceleration type	Regulation COS	F09
Controller response	13	F09
Regulator gain	31	F09
Restart supply loss	Deactivate	F12
Inter-cycle time MC	0 s	F12
Short circuit func.	Deactivate	F26

4.8.2 Fan, crusher and other high inertia drives

See diagram, paragraph 3.3.4.

Relay output CKL	Overload	F02
Relay output RL	End start	F02
Starting type	Ramp 2 (current limited)	F03
Current limit	400 %	F03
Starting current	300 %	F03
Starting time	30 s	F03
Restart supply loss	Deactivate	F12
Inter-cycle time MC	0 s	F12

4.8.3 Screw compressor, low inertia drives, starting of unloaded machines

See diagram, paragraph 3.3.4.

Logic input EL1	Energy save	F02
Relay output CKL	Overload	F02
Relay output RL	End start	F02
Starting type	Ramp 2 (current limited)	F03
Current limit	300 %	F03
Starting current	230 %	F03
Starting time	20 s	F03
Auto energy saving	Deactivate	F10
Power factor level	75 %	F10
Restart supply loss	Deactivate	F12
Inter-cycle time MC	0 s	F12

4.8.4 Conveyor

See diagram, paragraph 3.3.4.

Logic input EL0	Boost	F02
Logic input EL1	Energy save	F02
Relay output CKL	Overload	F02
Relay output RL	End start	F02
Starting type	Ramp 2 (current limited)	F03
Current limit	300 %	F03
Starting current	200 %	F03
Starting time	20 s	F03
Boot current	0 %	F05
Boost time (x5ms)	0	F05
Boost type	Ramp	F05
Auto energy saving	Deactivate	F10
Power factor level	75 %	F10

4.8.5 Crusher or double speed

See diagram, paragraph 3.3.11.

Logic input EL0	Multi-parameters	F02
Relay output CKL	Overload	F02
Relay output RL	End start	F02
Multi-parameters act	Activate	F17
In between starts	1 x100 ms	F17
Low speed start type	Ramp 2 (current limited)	F17
Low speed FLC	Depending on range	F17
Low speed I limit	400 %	F17
Low speed start current	300 %	F17
Low speed start time	30 s	F17
High speed start type	Ramp 2 (current limited)	F17
High speed FLC	Depending on range	F17
High speed I limit	400 %	F17
High speed start current	300 %	F17
High speed start time	30 s	F17

4.8.6 Mill press

See diagram, paragraph 3.3.4.

Logic input EL0	Boost	F02
Relay output CKL	Blocking	F02
Relay output RL	End start	F02
Starting type	Constant I	F03
Current limit	400 %	F03
Starting current	350 %	F03
Starting time	15 s	F03
Boost current	0 %	F05
Boost time (x5ms)	0 x 5 ms	F05
Boost type	Constant	F05
Starting limitation	Deactivate	F13
Inter-cycle time	0 mn	F13

4.8.7 Pulper/centrifiner

See diagram, paragraph 3.3.4.

Relay output CKL	Overload	F02
Relay output RL	End start	F02
Starting type	Ramp 2 (current limited)	F03
Current limit	400 %	F03
Starting current	250 %	F03
Starting time	20 s	F03
Restart supply loss	Deactivate	F12
Inter-cycle time MC	0 s	F12

4.8.8 Vacuum pump/dosing pump, machines which require more than 4 x FLC with constant current

See diagram, paragraph 3.3.4.

Relay output CKL	Overload	F02
Relay output RL	End start	F02
Starting type	Ramp 2 (current limited)	F03
Current limit	450 %	F03
Starting current	300 %	F03
Starting time	20 s	F03

4.8.9 Centrifugal compressor

See diagram, paragraph 3.3.4.

Logic input EL1	Energy save	F02
Relay output CKL	Overload	F02
Relay output RL	End start	F02
Starting type	Ramp 1 (not limited)	F03
Current limit	300 %	F03
Starting current	230 %	F03
Starting time	20 s	F03
Auto energy saving	Deactivate	F10
Power factor level	75%	F10
Restart supply loss	Deactivate	F12
Inter-cycle time MC	0 s	F12

4.8.10 Aeration tank

See diagram, paragraph 3.3.4.

Relay output CKL	Overload	F02
Relay output RL	End start	F02
Starting type	Ramp 2 (current limited)	F03
Current limit	400 %	F03
Starting current	230 %	F03
Starting time	20 s	F03
Restart supply loss	Deactivate	F12
Inter-cycle time MC	0 s	F12

4.8.11 Change protections (at the end of each macro)

Underload	Activate	F06
Underload level	0 %	F06
Underload delay	19 s	F06
Thermal overload	Activate	F07
Overload level	105 %	F07
Overload delay	Class 30	F07
Tripping coefficient	1 s	F07
Overcurrent detection	Activate	F08
Overcurrent level	99 %	F08
Response time	9 x 20 ms	F08
Setting	Inhibit	F34
Cos phi level	30	F34
Delay before tripping	3 s	F34

MEMO

5.PROGRAMMING

5. PROGRAMMING

5.1 Introduction

Accessing the various programming functions in extended mode is performed as follows:

- At the end of each macroprogram "Other parameters ?", press the ENT key.
- By pressing the FONC key if the Applications group going from F01 to F40 has been activated.

Key functions:

- The ∇ Δ keys enable the user to scroll through the menus down and up.
- The ENT key enables the user to enter the variable to be modified and to validate the modification.
- The RESET key returns to the previous menu without modification.
- The MEM key downloads the modified parameters into permanent memory.

Refer also to paragraph 4.1.

Notes

5.2 F01 : Motor/NOVADEM S3 characteristics

Utilisation

This function provides the entry of the motor rating and characteristics and matches them to the rating of the starter:

- The starter type: this allows actual values of the parameters acquired by the starter to be calculated; 5 parameters are associated:
  - I max (A): maximum starter current (see table hereafter).
  - P nom (kW): U nom x I nom x 1,732 x Cos φ.
  - Q nom (kVAR): U nom x I nom x 1,732 x Sin φ.
  - N nom (RPM): full-scale speed for speed feedback (see function F02).
  - C nom (Nm): 30/π x P nom/N(RPM).

- The motor parameters: nominal power, nominal current, nominal voltage and nominal speed.

- The station number of a particular starter: in the case of a network, for the supervision of several NOVADEM S3 being operated from a control point.

- The language used for the messages.

These parameters should be programmed before the 1st start is performed.

Operating mode

Starter type **X1-25**	Starter type model See table hereafter.
Motor power **007kW**	Nominal motor power From 1 to 900 kW.
Motor FLC **0014A**	Nominal motor current See adjustment span in table hereafter.
Supply voltage **400V**	Mains nominal voltage From 200 to 700 V.

Motor speed 1500RPM

Nominal motor speed (RPM)
From 300 to 4 000 RPM.

Station number 00

Starter station number for the RS 232 link
00 = single station protocol; 01 to 99 = multi-station protocol (See chapter 6).

Novadem S2 Deactivate

Using the card on a NOVADEM S2

To be activated when the card is used on a NOVADEM S2.

Language English

Language used for the messages
English or French.

NS 3 model	Nominal current adjustment span (Inom)	Max. current (Imax)	n°
NS x1-25	11 to 37 A	117 A	1
NS x1-55	11 to 44 A	185 A	2
NS x1-90	11 to 59 A	236 A	3
NS x2-90	29 to 78 A	300 A	4
NS x2-91	29 to 87 A	360 A	5
NS x2-132	29 to 110 A	472 A	6
NS x2-160	29 to 130 A	590 A	7
NS x3-250	46 to 173 A	708 A	8
NS x3-251	46 to 210 A	708 A	9
NS x3-300	46 to 251 A	758 A	10
NS x4-300	94 to 302 A	1 159 A	11
NS x4-500	94 to 400 A	1 414 A	12
NS x4-600	94 to 560 A	1 886 A	13
NS x5-760	176 to 680 A	2 367 A	14
NS x5-1000	176 to 680 A	2 367 A	15
NS x5-1200	176 to 816 A	2 946 A	16
NS x6-1000	176 à 716 A	2 946 A	17
NS x5-1500	176 à 915 A	3 200 A	18
NS x6-1200	176 to 915 A	3 200 A	19
NS x7-1200	352 to 1 158 A	3 525 A	20
NS x7-1800	352 to 1 500 A	4 700 A	21
NS x7-2300	352 to 1 800 A	5 800 A	22

5.3 F02 : Programming NOVADEM S3 inputs/outputs

Utilisation

This function allows the programmable inputs/outputs on the control card to be configured as follows:

Operating mode

Logic input EL0 **Nothing**	Programmable logic input EL0 (see table hereafter).
Logic input EL1 **Nothing**	Programmable logic input EL1 (see table hereafter).
Relay output CKL **Nothing**	Programmable relay output CKL (see table hereafter).
Relay output RL **Nothing**	Programmable relay output RL (see table hereafter).
Analogue output SAN **Current**	Programmable analogue output SAN (see table hereafter).
Analogue output adj. **99%**	Scale coefficient for the SAN output From 10 to 99 %.
Feedback coef. RNL **1500**	Feedback coefficient From 300 to 4 000.

- The two programmable isolated inputs EL0 and EL1 may be programmed as follows:

Message	EL0 and EL1 logic inputs	n°
Nothing	Input not affected (standard).	00
3 wires	3 wire control for EL0 and emergency stop for EL1.	01
ENRG save	Energy saving (F10).	02
Drying	Drying (F15).	03
Contra-rot	Contra-rotation (F16).	04
Auto-test	Auto-test (F31).	05
Speed ctr	Speed control (F14).	06
Multi-par	Activate multiparametering (F17).	07
Ext start	Choice of type of external starting (F19).	08
Boost	Activation of boost (F05).	09
Forced st	Forced start (F24).	10

- The two programmable outputs CKL and RL may be programmed as follows:

Message	Relay outputs CKL and RL	n°
Nothing	Always opened (standard).	00
Braking	Closed during braking (F04).	01
End start	Closed at the end of starting.	02
As FT	Authorises line contactor to operate.	03
Overload	Closed during overload (F07).	04
Fault	Closed during a fault.	05
ENR save	Closed during energy saving (F10).	06
End decel	Closed for 1 second at the end of deceleration (F04).	07
Under I	Closed during underload (F06).	08
Band	Closed when high level is reached (F22).	09
Mot. sup.	Closed during active cycle (F25).	10
Blocking	Opened during blocking state. (F12, F13).	11
Fan	Closed when fan is controlled.	12

- The analogue output (SAN-0V) may be programmed as follows:

Message	Analogue variable	Scale (for adjusting SAN at 99 %)	n°
Current	Motor current (A)	5 V= I nom (Standard)	1
Firing	Firing angle (°)	5 V= 60°	2
Speed	Motor speed (RPM)	5 V= NMAX(cf. feedback coef.)	3
Cos	Cos φ	5 V= 100 %	4
Active P	Active power (kW)	5 V= P nom starter ①	5
Reac. P	Reactive power (kVAR)	5 V= Q nom starter ①	6
Torque	Motor torque (Nm)	5 V= C nom starter ①	7
Thermal	Thermal state of motor	5 V= 100 %	8
I max	Maximum current (A)	5 V= I max	9

① Defined in function F01.

5.4 F03 : Starting settings

Utilisation

This function customises the motor starting characteristics:
- The starting type.
- The current limit.
- The starting current.
- The starting time.

NOTE: These parameters are modified whilst the motor is stopped.

Operating mode

Starting type **Ramp 2**

Starting type
1 of 5 possible starting types (see table hereafter).

Current limit **300%**

Current limit for starting ramp 2 and speed feedback
From 100 to 500 % FLC.

Starting current **150%**

Starting current
From 100 to 500 % FLC.

Starting time **015s**

Starting time (s)
From 3 to 55 s as standard and may be extended to 220 s (function F30).

NOTE: The current limit is automatically reduced if the level is too high (above I max/ I nom). The actual value is shown in function F20.

Message	Starting type	n°
Ramp 1	Ramp 1 without current limit.	1
Ramp 2	Ramp 2 with current limit.	2
Const. I	The current is limited by the starting current.	3
Feed back	Starting with speed feedback	4
Borehole	Borehole pump starting	5

5.5 F04 : Stop settings

Utilisation

This function configures the parameters for stopping the motor:
- The stop type.
- The stopping time:
  This time applies for stopping types n° 2 to n° 5:
  n° 2 and n° 5 : Duration of the decelerating ramp.
  n° 3 and n° 4 : Duration of injection of braking current.
  The stopping time may be prolonged using function F30.
  Function F09 is also used to control the gentle deceleration of pumps (n° 5).

The braking current setting is used with braking n° 3 and n° 4.

NOTES:
1. These parameters can only be set when the motor has stopped.
2. Taking account the end of deceleration to close the line contactor may be managed by the starter using the programmable outputs (n° 7 or 10 in function F02).

Operating mode

Stop type **Free stop**

Stop type
1 from 5 possible stops (see table hereafter).

Stop time **005s**

Stop time (s)
From 1 to 55 s as standard and may be extended to 220 s (see function F30).

Braking current **10%**

Braking current
From 10 to 99 %. 99 % corresponds approximately to an average braking of 0.25 CN.

Message	Stop type	n°
Free stop	Freewheel stop.	1
Decel	Controlled decelerating.	2
Braking	Braking to a stop using a contactor (if starting has been completed).	3
All. Brak	Braking to a stop using a contactor (even if starting has not been completed).	4
Dece pump	Controlled decelerating for pumps (parameters in function 09 are taken into account.	5

5.6 F05 : Boost settings

Utilisation

This function controls the boost parameters.

- The auto boost activated at each start.
- The boost current.
- The boost time.
- The boost type.

NOTES:
1. The boost may be controlled via the inputs EL0 or EL1 (F02).
2. The boost time will automatically be shortened if the current is too great for the starter.

Operating mode

Auto boost **Deactivate**

Automatic boost
Activate or deactivate.

Boost current **00%**

Boost current
From 00 to 99 %.
Ramp: 99 % corresponds to 99 % of the voltage.
Constant current: 99 % corresponds to a current of 6 In.

Boost time x5ms **000**

Boost time
From 0 to 999 x 5 ms, i.e. 5 to 5 000 ms.

Boost type **Ramp**

Boost type (see table hereafter)
Ramp or constant current.

Boost type	Description	n°
Ramp	Creates a voltage ramp reducing the value of boost current down to the starting current.	1
Constant	Sets a current of between 0 and 6 In depending on the boost time (i.e. unblocking presses).	2

5.7 F06 : Setting underload

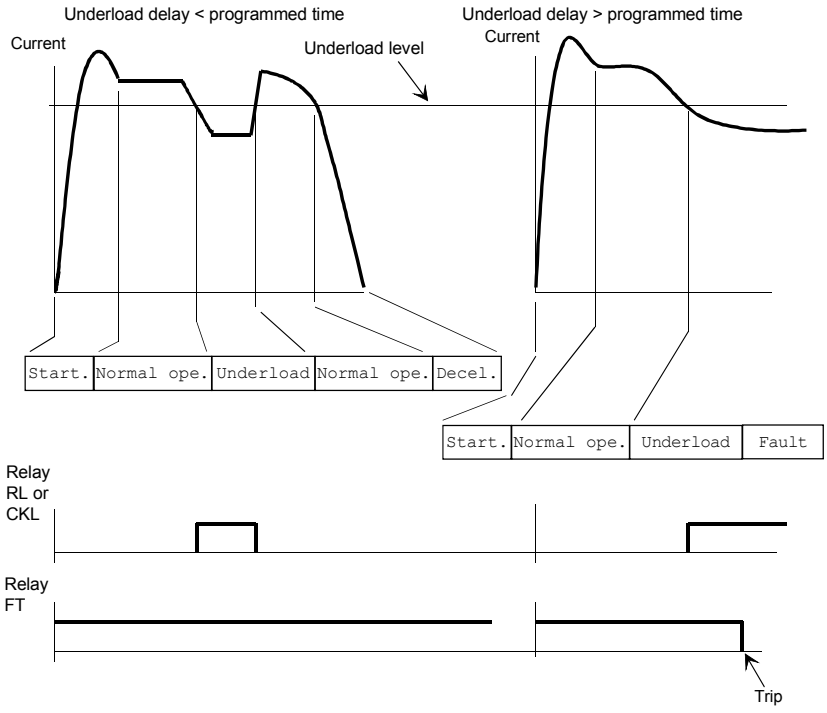
Utilisation

This function activates the underload protection of the motor:
- Stop or not on underload fault (activated at parameter initialisation).
- The underload level.
- The underload time before activating the underload fault. The underload is inhibited during controlled stop phase (deceleration or braking).

The underload alarm signal may be used on relay output (F02). In this case, the relay operates after a programmed time.

Operating mode

Underload Activate	Stop on underload fault Activate or deactivate.
Underload level 00%	Underload level From 0 to 99 % FLC.
Underload delay 19s	Delay before the underload is taken into account From 1 to 19 s.



5.8 F07 : Setting the overload and thermal emulation functions

Utilisation

This function sets the parameters for surveillance and overload protections of the motor:
- Stop or not on overload fault (activated at parameter initialisation).
- The level of overload detection (from 80 % to 150 % FLC).
- The time for the relay to open.
- The coefficient of rapidity with which a thermal fault is activated (see also paragraph 2.9).

⚠ This protection is activated during the starting phase.

The overload alarm signal may be used on relay output (F02). In this case, the relay operates after a programmed time (see diagrams hereafter).

Operating mode

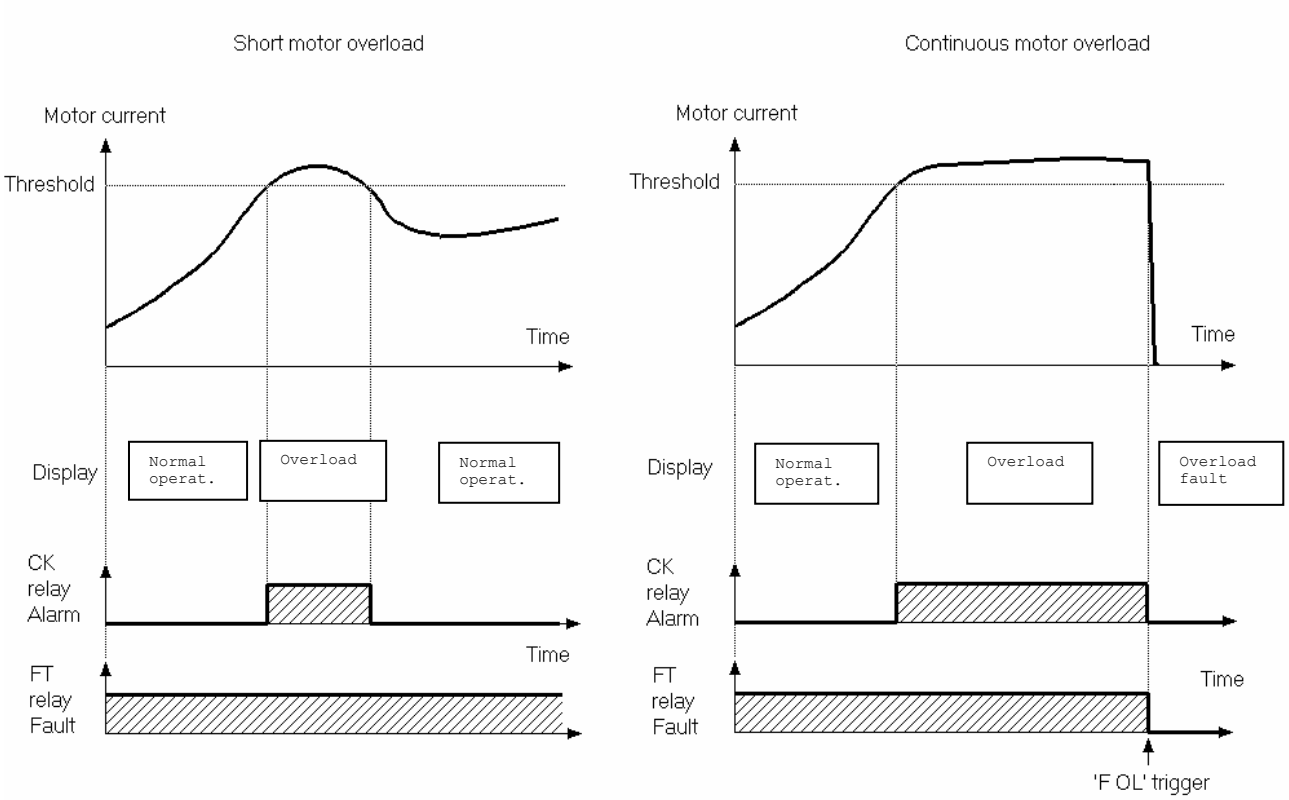
Thermal overload Activate	Stop on thermal fault Activate or deactivate.
Overload level 105%	Overload level From 80 to 150 %.
Tripping coefficient Cl.30	Tripping coefficient From 1 to 10 (1 = the slowest, 10 = the fastest).
Overload delay 01s	Time before the overload is taken into account From 0 to 19 s.

NOTE: A thermal class 30 corresponds to a thermal standard characteristic.

Message	Class	n°
Cl. 30	Class 30 (low limit).	1
Cl. 20	Class 20.	2
Cl. 10	Class 10.	3
Cl. 10A	Class 10A.	4
5	Not normalized.	5
6	Not normalized.	6
7	Not normalized.	7
8	Not normalized.	8
9	See note.	9
10	Class 30 (high limit)	10

Class used

NOTE: In case of difficult or frequent starts, the thermal relay, programmed in class 30 (low limit), may trip during the starting phase. In that case, program the thermal relay with a tripping coefficient 9. This tripping coefficient ensures a thermal protection of the motor during the starting phase in class 30 (high limit) and the other operating phases. It ensures the protection of the motor in class 30 (low limit).



Overload relay operation

5.9 F08 : Activating short-circuit protection

Utilisation

This function permits the adjustment of short-circuit overcurrent protection. The detection is for rapidly blocking abnormally high current thus protecting the NOVADEM S3 thyristors from damage (i.e. motor short-circuit or rotor blocking).

- Stop or not on overcurrent fault (activated at parameter initialisation).
- The level of overcurrent as a percentage of the maximum current I (see table in function F01).
- The detection time: it must be adjusted to select the sensitivity of the protection. The value corresponds to multiples of 2.5 ms.

Operating mode

Overcurrent detect. **Activate**	Stop on overcurrent fault Activate or deactivate.
Overcurrent level **99%**	Overcurrent level From 50 to 99 %.
Response time **9**	Response time From 1 to 9 x 2.5 ms i.e.: 2.5 to 22.5 ms.

IMPORTANT: This protection is an electronic protection provided to **reduce** thyristor destruction during a short circuit on the motor; full protection requires fast acting fuses upstream of the NOVADEM S3 (see paragraph 2.8).
Moreover, even if the protection is activated, **do use** the usual short circuit protection circuits on the installation (fuses or circuit breakers).

5.10 F09 : Controlled decelerating function

Utilisation

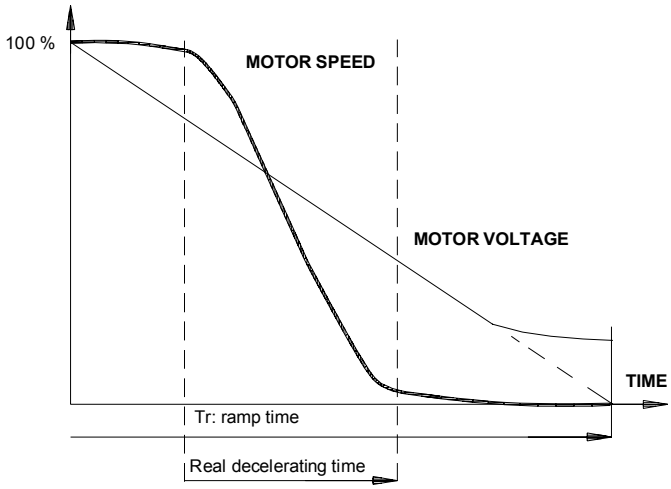
This function is activated by programming, in function F04, the decelerating pump (n° 5).

This function is used to prevent abrupt variations of the speed of the motor during the decelerating phase of a pump. It is therefore possible to use one of the following decelerations. With these types of deceleration, the NOVADEM S3 uses an internal PI controller to decrease the voltage to the motor:

- Control by internal monitoring of the power factor (Cos φ).
- Control by internal calculation of motor voltage.

The gain of the regulator is programmable as is the response time. They set the adjustment of the regulator of the motor plus pump characteristics. They must be modified only if the regulation doesn't give satisfaction with the standard parameters.

CHARACTERISTIC OF CONTROLLED DECELERATION



Operating mode

Deceleration type **Reg. COS**

Deceleration type
Control of Cos φ (n° 1) or control of motor voltage (n° 2).

Controller response
From 1 to 15.

Controller response **13**

Regulator gain **31**

Regulator gain
From 10 to 99.

5.11 F10 : Energy optimisation function

Utilisation

This function permits the adjustment of the energy optimisation feature. When the motor is operating at low load, the voltage to the motor terminals is reduced thus limiting the value of motor flux. This is translated into a reduction in the reactive current and an improvement to the power factor (Cos φ) of the installation.

The adjustment of this function controls the maximum level of the power factor.

NOTE: This function may be activated by an external signal on inputs EL0 or EL1 (see function F02).

Operating mode

Auto energy saving **Deactivate**

Reactive reduction
Activate or deactivate.

Power factor level **75%**

Value of Cos φ searched
From 40 to 80 %.

5.12 F11: Phase rotation function

Utilisation

This function prevents starting when the sequence of the supply phases is reversed.

When the protection is activated and the phases are reversed, the display shows "Phases inverted". If a start signal is given, the starter trips to fault and displays "Phase rotation fault".

Operating mode

Phase rotation **Deactivate**	Phase rotation protection Activate or deactivate.

⚠ The NOVADEM S3 verifies the order of phase rotation only on the supply side of the starter; it is necessary to ensure that the phases between the starter and the motor have the correct sequence.

5.13 F12: Automatic restart function

Utilisation

This function permits the automatic restart of the motor following a momentary supply failure or motor overload with the following adjustments:

- The number of consecutive starts following an overload (count is activated at each stop).
- The time delay before a restart following a supply failure or overload. During this time, the NOVADEM S3 displays "Blocking" to indicate that a restart is in operation.
- The sensitivity of the NOVADEM S3 to supply failure duration.

NOTE: If the voltage supply is not present at the moment of restarting, the starter signals "Phase loss fault".

Operating mode

Restart supply loss **Deactivate**	Automatic restart following a momentary supply failure Activate or deactivate.
Time before detect. **1**	Maximum time of the supply failure before detection From 1 to 9 x 100 ms.
Inter-cycle time MC **00s**	Time before restart and after supply failure detection From 0 to 99 s.
Overload srt act. **Deactivate**	Automatic restart following an overload Activate or deactivate.
Number of restarts **3**	Number of consecutive restarts following an overload before tripping to fault From 1 to 9.
OVL inter-cycle time **01mn**	Time before restart following an overload From 1 to 99 mn.

⚠ Before using this function, it is necessary to implement certain security measures in order to provide protection for personnel. Moreover, it is imperative to prohibit access to the machine as long as the disconnecting switch or the circuit breaker upstream of the NOVADEM S3 is not opened and locked.

5.14 F13: Starting limitation function

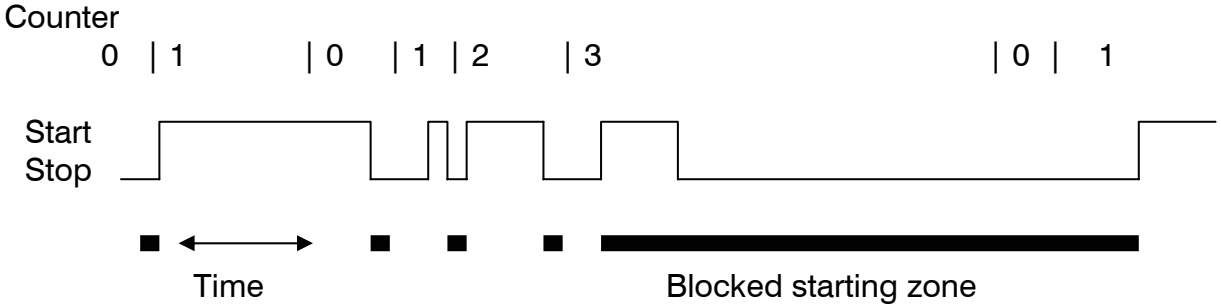
Utilisation

This function allows the number of starts and their frequency to be limited. It is destined to protect the motor and the starter from excessive use or abuse.

Programming the average inter-cycle time (in mn) corresponds to the maximum number of starts/hour.
Example: for 6 starts/hour, the inter-cycle time is 10 mn.
In every case, it is possible to perform 3 consecutive starts, after which all starting is blocked for 3 times the inter-cycle time.
There is a minimum time delay of 30 s between each start.

During the inter-cycle time, the display shows "Blocking".

Typical sequence



NOTES:
1. For safety reasons, at the end of the time delay, a re-start will not take place until the start signal has been re-applied.
2. Consider this function for re-starting after a momentary supply failure.

Operating mode

Starting limitation **Deactivate**

Starting limitation
Activate or deactivate.

Inter-cycle time **00mn**

Inter-cycle time
From 0 to 99 mn.

5.15 F14: Variable speed function

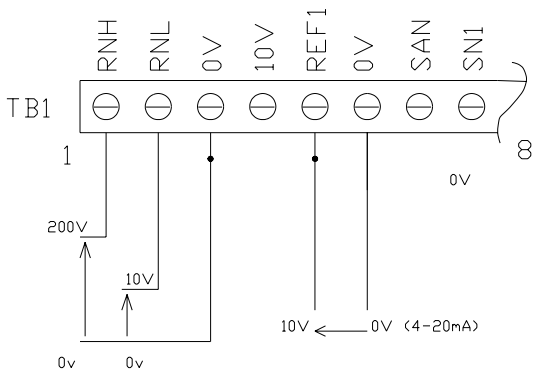
Utilisation

This function allows the NOVADEM S3 to be used as a voltage variator. The voltage variation adjusts the motor torque to be equal to the torque of the driven load (0 to 99 %).

This can either be open loop (voltage control) or closed loop (speed feedback).

The speed reference signal is given to the input REF1-0V of TB1 (0-10V or 4-20mA). When speed feedback is used, it is connected to input RNH-0V (200 V-0 V) or RNL-0V (10 V-0 V).

NOTE: This function may be activated by an external signal on inputs EL0 or EL1 (see function F02).



Cabling of the speed feedback and reference signals to the terminal block TB1

When this function is active, the starting function is inhibited and control is made using voltage or speed references (the display shows "Speed control"). The current limit function continues to be operational.

⚠ The use of slip variation should only be used with SPECIAL motors which permit slip control (resistive cage motors, slipring motors with rotor resistance, etc) or when slip levels are very small (a few percent of nominal speed). In the latter case a thermal derating of the motor must be made.

Operating mode

Speed feedback **Deactivate**

Speed feedback ①
Activate or deactivate.

Auto speed varia. **Deactivate**

Automatic speed variation
Activate or deactivate.

Voltage reduction **99%**

Voltage reduction
From 0 to 99 %.

Control type **Open loop**

Control type
Open loop (n° 0) or speed feedback (n° 1).

Input type REF1 **0-10V**

Input type
4-20 mA (n° 1) or 0-10 V (n° 2).

① Selects either the Voltage measurement input or the Speed feedback input, see paragraph 3.3.2.2, aim of Sel 1.

5.16 F15: Motor drying function

Utilisation

This function operates the motor drying parameter.
This is used to dry out damp motors by injecting a low value of current into the motor windings.

The adjustments for this function permit:
- Drying command locally from the keypad.
- Adjustment of drying current.
- Setting of drying time.

NOTES:
1. The drying function may be activated by a remote impulse signal on EL0 or EL1 inputs (see function F02).
2. As long as the EL0/EL1 input is maintained, the display shows "Anti-condens. oper. ".
3. Start command has priority, it stops drying cycle.

Operating mode

Anti-condens. keypad **Deactivate**	Anti-condensation command from the keypad Activate or deactivate.
Anti-cond. current **01%**	Anti-condensation current From 1 to 99 %.
Anti-condens. time **01mn**	Anti-condensation time From 1 to 99 mn.

5.17 F16: Contra-rotation function

Utilisation

This function is designed to stop motors which are being driven in the wrong direction prior to starting (application: ventilators, pumps, etc).
This function activates DC current injection.

The settings of this function permit:
- The control of the function locally from the keypad.
- The choice of the type of control:
  - manually from the keypad,
  - automatically before each start.
- The adjustment of the anti-rotation current.
- The adjustment of the anti-rotation time.

NOTES:
1. This function may be controlled by an external signal on EL0/EL1 inputs (see function F02).
2. As long as the EL0/EL1 input is maintained, the display shows "Contra-rotation".

Operating mode

Anti-rotation cmd **Deactivate**	Anti-rotation command from the keypad Activate or deactivate.
Anti-rotation type **Deactivate**	Anti-rotation before each start Activate or deactivate.
Anti-rota. current **10%**	Anti-rotation current From 10 to 99 %.
Anti-rotation time **05s**	Anti-rotation time From 1 to 99 s.

5.18 F17: Multiparameter function

Utilisation

This function allows the pre-programming of up to 4 different starting and stopping characteristics (principally used for cascade starting of different motors, variable loads, or two speed motors).

The selection of each characteristic (by selecting from motor 1 to motor 4) can be done locally from the keypad or externally with inputs EL0 and EL1 both programmed with multiparameter (see function F02), as follows:

- EL0= contact open, EL1= contact open: motor 1.
- EL0= contact closed, EL1= contact open: motor 2.
- EL0= contact open, EL1= contact closed: motor 3.
- EL0= contact closed, EL1= contact closed: motor 4.

These adjustments permit:

- To choose the type of motor selected.
- The successive adjustment of the starting and stopping characteristics of each motor.

When the multiparameter function is not activated, the starting and stopping parameters are those used in functions F03 and F04.
When the multiparameter function is activated, the starting and stopping parameters are those of the group selected by the number of the active motor and displayable in function F20.

The characteristics can be viewed in functions F03 et F04.

Operating mode

Multi-parameters act **Deactivate**

Multi-parameters
Activate or deactivate.

In between starts **15**

Time between 2 starts without fault
From 0 to 20 x 100 ms.

The programming of each motor group is carried out as follows:

Mot. 1 starting type **Ramp 2**

Starting type
1 type from 5 possible types (see table in function F03).

Motor 1 FLC 0014A

Motor 1 full load current
Depending on range.

Mot. 1 current limit 300%

Motor 1 current limit
From 100 to 500 % of nominal current.

Mot. 1 start current 150%

Starting current
From 100 to 500 % of nominal current.

Mot. 1 starting time 015s

Motor 1 starting time
From 3 to 55 s as standard and may be extended to 220 s (F30).

Mot. 1 stop type Free stop

Motor 1 stop type
1 from 5 possible stops (see table in function F04).

Mot. 1 stop time 005s

Motor 1 stop time
From 1 to 55 s as standard and may be extended to 220 s (F30).

Mot. 1 brake current 10%

Motor 1 braking current
From 10 to 99 %. 99 % corresponds approximately to an average braking of 0.25 CN.

Repeat for the following motors up to 4.

NOTE: Adjustments validated for each motor/winding can be viewed in function F20 when the EL0/EL1 combination is present on the terminal block.

5.19 F18: Programming inputs/outputs of the optional multi-function card

Please refer to the instruction manual of the optional card, part number OPT-MUL.

5.20 F19: External starting control

Utilisation

This function permits the replacement of the parameters of function F03 with the following external methods:

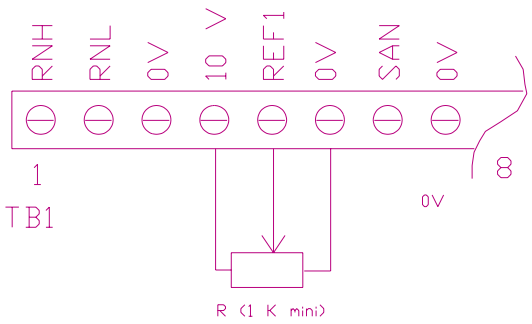
- the starting current in function F03 by connecting input REF1-0V,
- the starting type by input EL0 or EL1 (see function F02).

The other parameters are selected in function F03.

Input value (V)	0 V	1 V	2 V	3 V	4 V	5 V	6 V	7 V	8 V	9 V	10 V
Current (x In)	1.0	1.4	1.8	2.2	2.6	3.0	3.4	3.8	4.2	4.6	5

Relationship between the starting current and the value input at REF1

When function F02 is programmed on the external input, EL0 or EL1 closed corresponds to starting ramp type 1 (n° 1); otherwise the starting type will be constant current (n° 3).



Wiring diagram for control by a potentiometer

NOTE: For the external starting to be operative, the function should be activated and at least one of the two inputs EL0/EL1 should be assigned to external starting.
It is possible to use the boost.

Operating mode

External starting **Deactivate**	External starting activation Activate or deactivate.

5.21 F20: Monitoring of the principal settings

Utilisation

This function allows the active parameters of the NOVADEM S3 to be viewed. The parameters are taken into account at stop.

Operating mode

Starting type **Ramp 2**	Type of active starting 1 from 5 possible starting types.
Current limit **300%**	Active current limit From 100 to 500 % of full load current.
Starting current **150%**	Active starting current From 100 to 500 % of full load current.
Starting time **015s**	Active starting time From 3 to 220 s.
Stop type **Free stop**	Type of active stopping From 1 to 5.
Stop time **005s**	Active stopping time From 1 to 220 s.
Braking current **10%**	Active braking current From 10 to 99 %.
Motor FLC **0014A**	Active full load current Depending on type of starter.
Motor selected **0**	Number of the selected motor

From 0 to 4 (0 = no multiparameter).

5.22 F21: Monitoring the parameters of operation

Utilisation

This function permits viewing of the principal dynamic parameters of the motor and starter as well as the permanent dynamic variables.

The values are displayed as real quantities.

Operating mode

The following values are given as an example.

Motor current **0013A**	Current absorbed by the motor
Network supply **400 V**	Network supply (phase 1 and phase 2)
Cos phi **0,62**	Power factor (Cos φ) NOVADEM S3 + motor
Last starting time **005s**	Last starting time
Active power **007,5kW**	Active power of starter
Thermal state **20%**	Thermal state of the motor
Reactive power **003kVAR**	Reactive power of the motor

Motor speed **0000RPM**

Motor speed (if a feedback is connected)

Torque **0000n/m**

Motor torque

Current as % of FLC **092%**

Current absorbed by the motor expressed as % of the full load current

State RES MA EL0 EL1 **0100**

4 logic input status
0 = input opened; 1 = input closed.

State VEN FT CKL RL **1100**

4 relay output status
0 = relay not activated; 1 = relay activated (contact closed).

Direct supply order **Yes**

1/L1, 2/L2, 5/L3 phase rotation order
Yes or no.

Selection of dynamic variable display (up to 2 variables from 8). The last two variables selected will be taken into account.

Permanent I (A) **Yes**

Permanent display of the current absorbed
Yes or no.

Permanent Cos **No**

Permanent display of power factor (Cos φ) NOVADEM S3 + motor
Yes or no.

Permanent P **No**

Permanent display of the absorbed active power
Yes or no.

Permanent Q **No**

Permanent display of the absorbed reactive power
Yes or no.

Permanent speed **No**

Permanent display of speed (if a feedback is connected)
Yes or no.

Permanent thermal **No**

Permanent display of thermal status
Yes or no.

Permanent torque **No**

Permanent display of the motor torque (if feedback)
Yes or no.

Perm. current (%FLC) **No**

Permanent display of the absorbed current expressed as % of the full load current
Yes or no.

Permanent network V **No**

Permanent display of the network voltage (U12)
Yes or no.

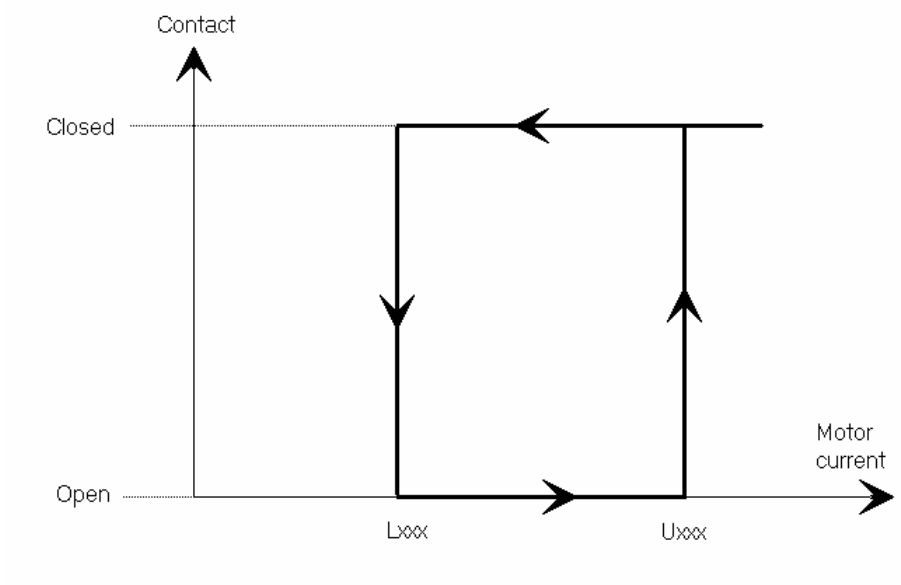
5.23 F22: Range of current band

Utilisation

This function programs the current levels for the hysteresis relay output.

A relay contact is closed when the adjustable upper level of current is reached and it opens when the current falls below the adjustable lower level.

The output relay can be programmed in function F02, relay CKL or RL may be selected as well as function F18 (option).



Operating mode

High current level **120%**

High current level
0 to 120 % of nominal motor current.

Low current level **120%**

Low current level
0 to 120 % of nominal motor current.

5.24 F23: Starting on polluted supply

Utilisation

This function allows starting to take place if the three-phase supply is corrupted (earth fault). A mini boost supplies the full voltage to the motor during the two first interruptions (40 ms) and enables starting during the interference period.

It is also possible to assure correct operation whilst the supply is badly polluted (spikes due to commutation associated with the presence of thyristor bridge rectifiers, for example).

When this function is active, the surveillance which checks phase rotation and thyristor short circuit is inhibited. Consequently, the faults "Phase rotation fault", "Phase loss fault" and "Thyr. short cir. fault" are not displayed.

⚠ It is imperative that before connection, the order of phases (1/L1-3/L2-5/L3) is ascertained. (Activate function phase rotation).

Operating mode

Mini-boost **Deactivate**	Mini-boost activation Activate or deactivate.
RP, MP, tS inhib. **Deactivate**	Inhibition of "Phase rotation fault", "Phase loss fault" and "Thyristor short circuit fault" Activate or deactivate.

5.25 F24: Forced start

Utilisation

This function inhibits **all** the protections and **all** the defaults of NOVADEM S3. It is designed to be used in extreme situations or when starting the motor is imperative (security, "critical" phase of production, fume extraction, etc), **with regard to the protection of the material**.

NOTES:
1. The disabling of the defaults corresponds to an exceptional operation of the installation. It is imperative that the safety of personnel is always assured in all operating modes.

2. Inhibiting the internal protections of the starter causes the annulment of the guarantee for the operating phases in forced start.

3. From the point of view of the starter, it is obvious that the operation of the motor is not guaranteed in the event of a card failure (loss of control) or in the case of a problem with the firing of the thyristors (loss of conduction). If it is imperative to execute a start, then a shorting contactor should be fitted.

Operation

The input EL0 or EL1 are activated for a forced start in function F02.
If this programmed input is not closed, then the functioning of the starter is as standard.
The relay FT is always closed and the faults which appear on the display are not acted upon (no trip occurs).

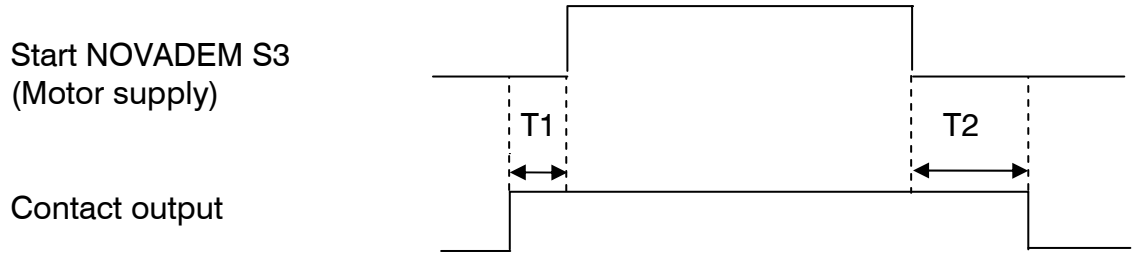
Operating mode

All faults inhib. **Deactivate**	All faults are inhibited Activate or deactivate.

5.26 F25: Start contact

Operation

This function allows the use of a relay contact CKL or RL to interlock an automated function with the operation of the starter (E.g.: interlocking of two NOVADEM S3 mounted in parallel, one forward the other reverse for a motor operating in both directions or the interlocking of the activation of a braking module).



The time T1 is in the order of 20 ms.
The time T2 is programmable from 20 to 999 ms and corresponds to a timed reset of the contact after an effective blocking of the thyristor pulses of the NOVADEM S3.

The output contact CKL or RL is programmed in function F02 (Motor supply).

Operating mode

Falling relay **100ms**

Adjustment of the reset time of the contact
From 20 to 999 ms.

5.27 F26: Starter short-circuiting

Utilisation

This function allows the inhibition of the surveillance of the effective firing of the thyristors during the normal running of the starter. This function could perhaps be used for operation with a shorting contactor when soft stop is required or to desensitise the starter on polluted supplies.

Whilst this function is activated, the thyristor starting fault is inhibited but the surveillance of the presence of phases at the starter terminals continues to be active.

Operating mode

Short circuit fonc. **Deactivate**	Inhibition of firing fault Activate or deactivate.

5.28 F27: RS 232 transmission speed

Utilisation

This function provides the facility to modify the data transmission speeds using the serial link.

Operating mode

RS1 baud rate **2400B**

Transmission speed
From 1 200 to 9 600 bauds.

RS2 baud rate **2400B**

Transmission speed
From 1 200 to 9 600 bauds.

Message	Speed	n°
1200B	1 200 bauds	1
2400B	2 400 bauds	2
4800B	4 800 bauds	3
9600B	9 600 bauds	4

5.29 F28: Thermal motor protection with PTC thermistor

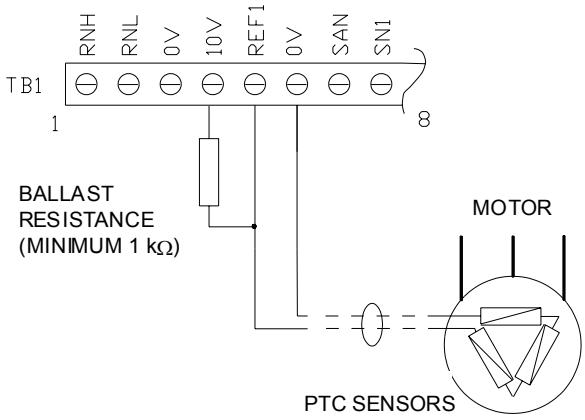
Utilisation

This function permits the detection of a high motor winding temperature using a PTC thermistor (the resistance of which increases with the rise in temperature).
It is possible to control the following parameters:

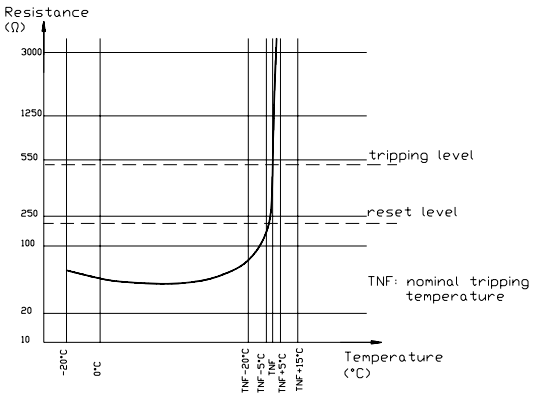
- the operation type (deactivated, auto or manual),
- the tripping level PTC,
- the reset level PTC after the temperature has dropped (only for the automatic operation type).

When the temperature of the probe has reached the tripping level, the starter displays "PTC thermistor fault". If the automatic reset level has been chosen, the fault is automatically reset when the temperature reaches the reset level.
A fault is also signalled if a cable is cut or the probe is short circuited.

Connection diagram



PTC probe characteristics



Calculating the tripping level (Sd)

$$Sd = 100 \times \frac{\text{Tripping R.}}{\text{Ballast R.}}$$

Calculating the reset level (Sr)

$$Sr = 100 \times \frac{\text{Reset R.}}{\text{Ballast R.}}$$

Operating mode

Operation type **Deact.**

Operation type
Deactivated, automatic or manual.

Tripping level PTC 90%

Tripping level (Sd)
Sd from 1 % to 99 %.

Reset level PTC 10%

Reset level (Sr).
Sr from 1 % to 99 %.

The operation types are as follows:

Message	Operation	n°
Deact.	Function deactivated	0
Auto	Function activated with automatic reset	1
Manual	Function activated with manual reset	2

Example
Motor with 3 PTC thermistors < 250 Ω in series, Ballast R. = 1 000 Ω.
- Tripping level R. 600 Ω Sd= 100 x (600/1 000)= 60 %.
- Reset level R. 400 Ω Sr= 100 x (400/1 000)= 40 %.

5.30 F29: Starting without a start signal

Utilisation

This function controls the starting and stopping of the motor with the operation of the line contactor.

As soon as the supply appears on the input to the starter, the motor starts and when it disappears, the motor is stopped.

NOTE: In this specific mode of operation the faults: "Phase loss fault", "Thyr. short cir. flt", "Thyr. firing fault" and "Brownout fault" are no longer active. Consequently, a problem with a thyristor or the supply will not be seen and translated into a stop or a non-start of the motor.

Operating mode

Run w/o start signal **Deactivate**	Run without start signal Activate or deactivate.

⚠ The use of this function requires certain security measures to be implemented in order to protect personnel. Moreover, it is imperative to prohibit access to the machine as long as the disconnecting switch or the circuit breaker upstream of the NOVADEM S3 is not opened and locked.

5.31 F30: Extension of starting and stopping times

Utilisation

This function is used to increase the standard starting and stopping times which are accessed through functions: starting (F03), stopping (F04) and multiparameter (F17).

⚠ The time of 55 s can be exceeded only in the case of a special operation (difficult startings). It is then necessary to control the motor heating.

Operating mode

Maximum time **55s**	Maximum starting and stopping time

Message	Duration	n°
55s	Maximum starting or stopping time = 55 seconds	1
110s	Maximum starting or stopping time = 110 seconds	2
165s	Maximum starting or stopping time = 165 seconds	3
220s	Maximum starting or stopping time = 220 seconds	4

5.32 F31: Auto-test

Utilisation

This function tests the motor phases before starting in order to detect anomalies (short-circuit of phases, etc).

The test types are as follows:
- Auto-test command locally from the keypad.
- Adjustment of the current level detection depending on the motor used.

NOTES:
1. The auto-test may be controlled by EL0/EL1 input (function F02).
2. A fault is detected when the impedance is abnormally low and is signalled by the message: "Mot. short cir. flt".
3. As long as the command input is maintained, the display shows "Motor wirings ok".

Operating mode

Auto-test command **Deactivate**

Auto-test command
Activate or deactivate.

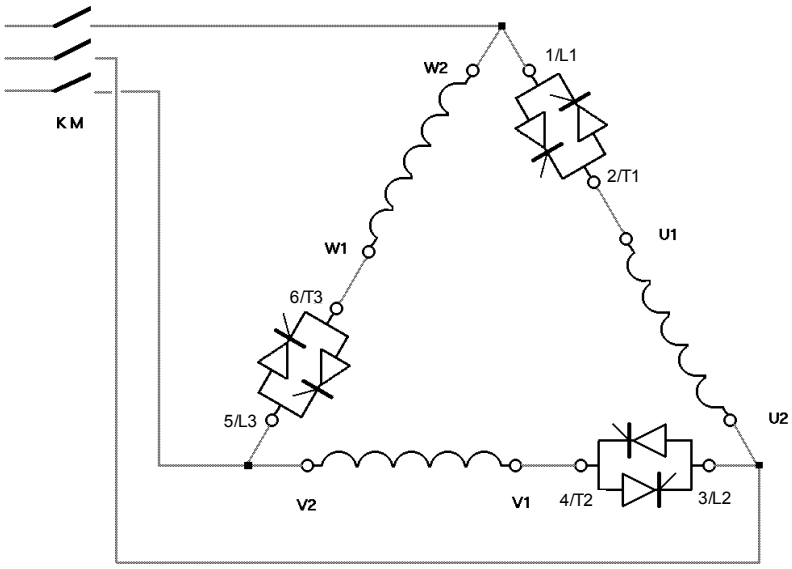
Level detection **99%**

Level coefficient
From 20 to 99 % (maximum sensitivity at 20 %).

5.33 F32: NOVADEM S3 in delta motor

Utilisation

This function permits the insertion and connection of the starter in series with each winding of delta coupled motor (see diagram below). This type of connection uses 6 cables via the motor.



Operating mode

NS in delta **Deactivate**	NOVADEM S3 in delta motor Activate or deactivate.

NOTE: The detailed connection diagram is shown in paragraph 3.3.9.

5.34 F33: Operation statistics

Utilisation

Function permits display of:
- The motor operating time.
- The number of motor starts.

These parameters are stored on the card and cannot be modified.

Operating mode

The following values are given as an example.

Hours run **00000000h**

Number of operating hours
From 0 to 99 999 999 hours.

Number of starts **00000000**

Number of starts
From 0 to 99 999 999 starts.

5.35 F34: Locked rotor detection at start

Utilisation

This function permits adjustments of trigger parameters with locked rotor fault during motor starting.

The detection is performed from the Cos φ measurement: during starting, the Cos φ increases as the motor rises in speed. The function consists of:

- Tripping to fault if the Cos φ has not reached an adjustable value (level) at the end of an adjustable time.
- Activating an automatic boost if the Cos φ has not reached an adjustable value (level) at the end of an adjustable time.

NOTE: Automatic starting on boost takes account of the parameters defined in function F05 when activated.

Operating mode

Message	Operation	n°
Inhibit	Detection inhibited.	0
Frb detect	Trip to "Locked rotor fault" if locked rotor detected.	1
Mini bst	Automatic activation of mini boost and restart when locked rotor fault is detected (F05).	2

```
Setting
Inhibit
```

Operating type
Inhibited, locked rotor fault or boost activation on fault.

```
Cos phi level
  30
```

Cos φ level
From 5 to 50.

```
Delay before tripp.
  03s
```

Time before locked rotor fault triggering
From 1 to 5 s.

5.36 F35: Display of the last four faults

Utilisation

The function F35 keeps in memory occurrence of the last four faults on the starter.

Operating mode

The following values are given as an example

1st fault PTC thermistor fault	Preceding error code
2nd fault Eeprom fault	Second retrospective error code
3rd fault Emergency stop flt	Third retrospective error code
4th fault (oldest) Emergency stop flt	Fourth retrospective error code

5.37 F36: Current and voltage adjustments

Utilisation

This adjustment allows the starter current or voltage display to be corrected within the range ± 5% with a clip on ammeter as a reference.

Operating mode

Current correction **100%**

Adjusting current
From 95 to 105 %.

Voltage correction **100%**

Adjusting voltage
From 95 to 105 %.

5.38 F37: Reset parameters to default values

Utilisation

This function resets all the parameters to their initial values.

⚠ This mode also resets the adjustments made at our works. It is then necessary to reprogram all the parameters.

Upon activation of this function, the starter passes an "Eeprom fault". When this fault is reset, the parameters are stored in permanent memory.

Operating mode

Fact. def. values **Deactivate**	Factory default values To be activated.

5.39 F38: Locking the keypad

Utilisation

This function allows the keypad to be locked when the programming is completed, in order to prevent unauthorised or accidental modifications.

Locking is achieved by a 4 digit code (other than "0000"). The same code must be used to unlock the keypad.

When the keypad is locked, the operator may access all the display functions, but cannot modify any of the parameters. This is indicated by "Keypad locked !" on the display.

In order to assure good security of operation, it is strongly recommended that the programmer uses this function, once the settings are effected.

It is possible to unlock the keypad if the code is lost, as follows:
a) Fit a jumper to "ST1" on the card (see diagram of the card in paragraph 3.3.2.2).
b) Enter function F38 and validate code 0000 displayed.
c) The keypad is unlocked, remove the jumper from "ST1".

Operating mode

Keypad lock code **0000**

Locking/unlocking the parameters
From 1 to 9 999.

1st case: You wish to lock the keypad:
- Enter a confidential code other than "0000".
- Press the MEM key to memorise the code.

2nd case: You wish to unlock the keypad:
- Enter the code.
  - the code is correct and the keypad is unlocked.
  - the code is incorrect and you are returned to the display mode.
- If required, press the MEM key to memorise the unlocking.

5.40 F40: Version number and date

Utilisation

This function displays the version and the date of verification of the program.

Operating mode

NSxx DD MM YYYY C00	Version number, Day, Month, Year of verification of the program.

5.41 Table summarising the functions

This table shows the various parameter codes which appear for each function together with their initial value.
Also given are descriptions, units and minimum and maximum values for each parameter.
The column located at the right hand side shows the variable name for modification using RS 232.

Description	Values	Bits	Factory	Name
F01: Motor/NOVADEM S3 characteristics				
Starter type	X1-25 to X7-2300 (n° 1 to n° 22)	8	X1-25	F1CD
Motor power	1 to 1 200 kW	16	7 kW	F1PM
Motor FLC	11 to 2 000 A	16	14 A	F1CM
Supply voltage	200 to 700 V	16	400 V	F1TM
Motor speed	300 to 4 000 RPM	16	1 500 RPM	F1VNM
Station number	0 to 99	8	0	F1NS
NOVADEM S2	Activate or deactivate	16	Deactivate	PMOT.0
Language	English or French (n° 1 or 0)		French	F1LNG
F02: Programming NOVADEM S3 inputs/outputs				
Logic input EL0	Nothing with forced start (n° 0 to 10)	8	Nothing	F2EL0
Logic input EL1	Nothing with forced start (n° 0 to 10)	8	Nothing	F2EL1
Relay output CKL	Nothing with fan (n° 0 to 12)	8	Nothing	F2CKL
Relay output RL	Nothing with fan (n° 0 to 12)	8	Nothing	F2RL
Analogue output SAN	Current at Imax (n° 1 to 9)	8	Current	F2SA
Analogue output adj.	10 to 99 %	8	99 %	F2GN
Feedback coef. RNL	300 to 4 000	16	1 500	F2CV
F03: Starting settings				
Starting type	Ramp 1 (n°1 to 5)	8	Ramp 2	F3TYD
Current limit	100 to 500 % of nominal current	16	300 %	F3CL
Starting current	100 to 500 % of nominal current	16	150 %	F3CD
Starting time	3 to 55 s	16	15 s	F3TED
F04: Stop settings				
Stop type	Free stop, pump deceleration (n°1 to 5)	8	Free stop	F4TA
Stop time	1 to 55 s	16	5 s	F4TR
Braking current	10 to 99 %	8	10 %	F4CF
F05: Boost settings				
Auto boost	Activate or deactivate	16	Deactivate	PMOT.2
Boost current	0 to 99 %	8	0 %	F5CB
Boost time (x 5ms)	0 to 999 x 5 ms	16	0	F5TB
Boost type	Ramp or constant (n° 1 or 2)	8	Ramp	F5ty
F06: Setting underload				
Underload	Activate or deactivate	16	Activate	PMOT.5
Underload level	0 to 99 %	8	0 %	F6SSO
Underload delay	0 to 19 s	8	19 s	F6TI

Description	Values	Bits	Factory	Name
F07: Setting the overload and thermal emulation functions				
Thermal overload	Activate or deactivate	16	Activate	PMOT.1
Overload level	80 to 150 %	16	105 %	F7SSU
Overload delay	1 to 10	8	Cl. 30	F7CD
Tripping coefficient	0 to 19 s	8	1 s	F7TI
F08: Activating short circuit protection				
Overcurrent detection	Activate or deactivate	16	Activate	PFON.9
Overcurrent level	50 to 99% of Imax	8	99 %	F8SI
Response time	1 to 9 x 20 ms	8	9	F8DR
F09: Controlled decelerating function				
Deceleration type	Reg. Cos φ or U motor (n° 1 or 2)	8	Reg. Cos	F9TY
Controller response	1 to 15	8	13	F9TC
Regulator gain	10 to 99	8	31	F9AT
F10: Energy optimisation function				
Auto energy saving	Activate or deactivate	16	Deactivate	PFON.1
Power factor level	40 to 80 %	8	75 %	F10SCP
F11: Phase rotation function				
Phase rotation	Activate or deactivate	16	Deactivate	PFON.2
F12: Automatic restart function				
Restart supply loss	Activate or deactivate	16	Deactivate	PFON.3
Time before detection	1 to 10 x 100 ms	8	1	F12TMC
Inter-cycle time MC	0 to 99 s	8	0 s	F12MC
Overload restart act.	Activate or deactivate	16	Deactivate	PFON.7
Number of restarts	1 to 9	8	3	F12ND
Overload inter-cycle time	1 to 99 mn	8	1 mn	F12SU
F13: Starting limitation function				
Starting limitation	Activate or deactivate	16	Deactivate	PFON.4
Inter-cycle time	0 to 99 mn	8	0 mn	F13TI
F14: Variable speed function				
Speed feedback	Activate or deactivate	16	Deactivate	PMOT.3
Automatic speed variation	Activate or deactivate	16	Deactivate	PFON.5
Voltage reduction	0 to 99 %	8	99 %	F14RT
Control type	Open loop or speed feedback (n° 0 or 1)	8	Open loop	F14CRB
Input type REF1	0-10 V or 4/20 mA (n° 1 or 2)	8	0-10 V	F14R1
F15: Motor drying function				
Anti-condensation keypad	Activate or deactivate	16	Deactivate	PCOM.0
Anti-condensation current	1 to 99 %	8	1 %	F15CS
Anti-condensation time	1 to 99 mn	8	1 mn	F15TS

Description	Values	Bits	Factory	Name
F16: Contra-rotation function				
Anti-rotation command	Activate or deactivate	16	Deactivate	PCOM.1
Anti-rotation type	Activate or deactivate	16	Deactivate	PFON.6
Anti-rotation current	10 to 99 %	8	10 %	F16CA
Anti-rotation time	1 to 99 s	8	5 s	F16TA
F17: Multi-parameter function				
Multi-parameters act	Activate or deactivate	16	Deactivate	PFON.8
In between starts	0 to 20 x 100 ms	8	15 x 100 ms	F17IRE
Motor 1 starting type	Ramp 1 (n° 1 to 5)	8	Ramp 2	F17YD1
Motor 1 FLC	11 to 2 121 A	16	14 A	F17IM1
Motor 1 current limitation	100 to 500 %	16	300 %	F17CL1
Motor 1 starting current	100 to 500 %	16	150 %	F17CD1
Motor 1 starting time	3 to 55 s	16	15 s	F17TD1
Motor 1 stop type	Free stop or deceleration pumps (n° 1 to 5)	8	Free stop	F17TA1
Motor 1 stop time	1 to 55 s	16	5 s	F17TR1
Motor 1 brake current	10 to 99 %	8	10 %	F17CF1
Repeat for motors 2 to 4				
F18: Programming inputs/outputs of the optional multifunction card				
Output relay S3	Nothing at fan (n° 0 to 12)	8	Nothing	F18S3
Output relay S4	Nothing at fan (n° 0 to 12)	8	Nothing	F18S4
Output 4/20mA	Current at I max (n° 0 to 9)	8	Current	F18SA
Output adjust	0 to 99 %	8	99 %	F18GC
E3 input pulses	0 to 100	8	0	F18E3
F19: External starting control				
External starting	Activate or deactivate	16	Deactivate	PFON.11
F20: Monitoring of the principal settings				
Starting type	Ramp 1 (n° 1 to 5)	8	Ramp 2	VTYD
Current limit	100 to 500 %	16	300 %	VIL
Starting current	100 to 500 %	16	150 %	VID
Starting time	3 to 220 s	16	15 s	VTDEM
Stop type	Free stop or deceleration pumps (n° 1 to 5)	8	Free stop	VTA
Stop time	1 to 220 s	16	15 s	VTDEC
Braking current	10 to 99 %	8	10 %	VCF
Motor FLC	0 to 1 800 A	16	14 A	VINOM
Motor selected	0 to 4	8	0	NUMOT
F21: Monitoring the parameters of operation				
Motor current	0 to 1 800 A	16	14 A	VCM
Network supply	0 to 1 000 V	16	400 V	V TENSION
Cos φ	0.00 to 1.00	16	0,00	VCOS
Last starting time	0 to 220 s	16	0 s	VMTD

Description	Values	Bits	Factory	Name
F21: Monitoring the parameters of operation				
Active power	0 to 999 kW	16	0 kW	VPEF
Thermal state	0 to 99 %	8	0 %	VSTHM
Reactive power	0 to 999 kVAR	16	0 kVAR	VPRE
Motor speed	0 to 4000 RPM	16	0 RPM	VMOT
Torque	0 to 1000 n/m	16	0 n/m	VCPLE
Current as % FLC	0 to 600 %	16	0 %	VIN
State RES MA EL0 EL1	0000_b to 1111_b (1= closed)	8	0000	VENTREE
State VEN FT CKL RL	0000_b to 1111_b (1= closed)	8	0000	VSORTIE
Direct supply order	Yes or no	16	Yes	STATUS.8
Permanent I (A)	Yes or no	16	Yes	PMOT.8
Permanent Cos φ	Yes or no	16	No	PMOT.9
Permanent P	Yes or no	16	No	PMOT.10
Permanent Q	Yes or no	16	No	PMOT.11
Permanent speed	Yes or no	16	No	PMOT.12
Permanent thermal	Yes or no	16	No	PMOT.13
Permanent torque	Yes or no	16	No	PMOT.14
Permanent current (%FLC)	Yes or no	16	No	PMOT.15
Permanent display of the network voltage	Yes or no	16	No	PMOT.6
F22: Range of current band				
High current level	0 to 120 %	16	120 %	F22SH
Low current level	0 to 120 %	16	120 %	F22SB
F23: Starting on polluted supply				
Mini-boost	Activate or deactivate	16	Deactivate	PFON.12
PL, RL, tS inhibited	Activate or deactivate	16	Deactivate	PFON.0
F24: Forced start				
All faults inhibited	Activate or deactivate	16	Deactivate	PFON.13
F25: Start contact				
Falling relay	20 to 999 ms	16	100 ms	F25TA
F26: Starter short-circuiting				
Short circuit function	Activate or deactivate	16	Deactivate	PFON.14
F27: RS232 transmission speed				
RS232 baud rate	1 200 bauds to 9 600 bauds (n° 1 to 4)	8	2 400 bauds 2 400 bauds	F27BAUD F27BAUD2
F28: Thermal motor protection with PTC thermistor				
Operation type	Deactivated, automatic or manual (n° 0 to 2)	8	Deactivate	F28TY
Tripping level PTC	1 to 99 %	8	90 %	F28DE
Reset level PTC	1 to 99 %	8	10 %	F28AR

6.SERIAL LINK

6.1 Link characteristics

6.1.1 Introduction

It is recommended that an isolated RS 232 interface be used between the NOVADEM S3 serial link and the utility. In the case of an electrical installation with an isolated link from the neutral conductor main to earth, it is compulsory to use an isolated interface.

6.1.2 Serial link configuration

Type	Non isolated serial link RS-232
Mode	Half duplex.
Synchro	Asynchronous communication.
Speed	Transmission rate: from 1 200 to 9 600 bauds.
Code	Transmission type 8 bits-ASCII.
Parity	No parity.
Stop bit	1 stop bit.
Distance	Maximum transmission distance: 15 m.
Support	Via a 9 pin female SUB-D connector.

6.1.3 Internal diagram and signals available

NOVADEM S3 Pin number	Function	Direction	Pin number 9 pin terminal	Pin number 25 pin terminal
2	RD	←	3	2
3	TD	→	2	3
5	Common	--	5	7

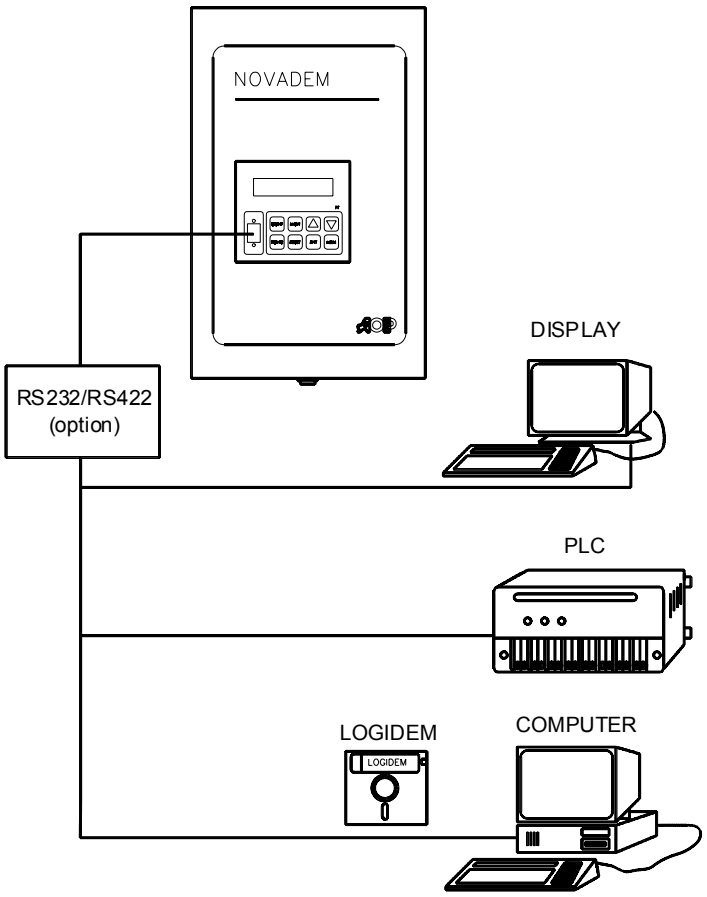
6.2 Communication protocol

6.2.1 Presentation and utilisation

With the serial link which is mounted on the control card, it is possible to use ASCII communications protocol which will allow the following:

- The transfer and the reading and writing of data for use with a PLC or a supervisory PC ®. LOGIDEM software is used with this for supervision of the starter.
- The operations controlled by a PC® or a PLC.
- The visualisation, the control and the modification of the parameters whilst connected to a terminal screen (alphanumeric console).

This monitor may be used for the visualisation and direct control of all NOVADEM S3, and permits the programming of these (via a PLC, a PC® of the LOGIDEM).



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6.2.2 Transmission frames

All data is transmitted in the ASCII code.

Three types of commands may be executed:
- Reading one of the programming variables.
- Writing one of the programming variables.
- Starter command.

Each of these commands must be terminated with character: "CR" ($0D_h$)

The frame, once it is received by the monitor, is executed or it returns an error message as follows: CR LF BEL "error message ", then the monitor returns: CR LF > indicating it is ready to receive the next command.

6.2.3 Data transfer commands

R: reading a memory address

The R command permits reading of the contents of one of the programmable variables (see table summarising the functions, chapter 5). The data is 2 bytes long (16 bits) even if the variable is an 8-bit variable; in such a case, the 8 LSB bits should not be taken into account.

Frame for reading the current absorbed by the motor (VCM variable):
```
'R@VCM='CR
```

Monitor return:
```
CR LF *'address contents 16bits' CR LF '>'
```

W: Writing one word to an address

The W command permits to write one word (2 bytes) in a programming variable (see table summarising the functions, chapter 5). When this variable is one byte long, the second is not taken into account.

Frame for writing an overload level of 110 %:
```
'W@F7SSU=0110' CR
```

Monitor return:
```
CR LF '>'
```

6.2.4 Status and control commands

C: starter control command

C0: serial link test. When the command is executed, the monitor sends the initialisation message from the link:

Send frame:	Monitor return:
'C0' CR	CR LF *'VERSION Day Month Year'CR LF '>'

C1: start order. The command starts the starter.

Send frame:	Monitor return:
'C1' CR	CR LF *'Start order'CR LF '>'

C2: stop order. The command stops the starter.

Send frame:	Monitor return:
'C2' CR	CR LF *'Stop order'CR LF '>'

C3: clearing starter fault

Send frame:	Monitor return:
'C3' CR	CR LF *'Clear faults' CR LF '>'

C4: emergency stop. When the command is activated, the starter blocks pulses, opens the line contactor and trips to fault "Emergency stop flt".

Send frame:	Monitor return:
'C4' CR	CR LF *'Emergency stop' CR LF '>'

C5: save programming parameters.

Send frame:	Monitor return:
'C5' CR	CR LF *'Save parameters' CR LF '>'

6.2.5 Network operation and multi-station protocol

6.2.5.1 Network programming

Assign a station number to the starter different from 00 using function F01.

6.2.5.2 Network operation

When several NOVADEM S3 are connected to a "master" (PC or PLC) the operation is as follows:
The character ">" activates the station and the two following characters give the station number. If the station number is not recognised by the station, the station is deactivated until the next character ">".

So, when all the stations are deactivated (at switching on) or when the master changes the communication to another station, the first command frame should be preceded with character ">". This also applies after a transmission fault on the communication network.

NOTE: The connection of several NOVADEM S3 on a communication network must be realised by using interface cards RS 232/RS 422.

6.2.5.3 Protocol

The characters CR and LF at the beginning of each frame are replaced by the two characters of the station number.

Example: reading the current absorbed by the motor of the starter number 03:

```
'03R@VCM='CR
```

Monitor return:

```
03*'motor current value (16bits)'CR LF '>'
```

Frame for reading the current absorbed by the motor with changing the station number:

```
'>25R@VCM='CR
```

6.3 Appendix

6.3.1 Address table of starter parameters and variables

The name of the variables accessible by the user is given in the table summarising the functions in chapter 5, using the serial link protocol.

The value returned is always a 16-bit word.

6.3.2 Monitor messages

Error messages returned by the monitor:

1. Unknown frame:

```
CR LF BEL *'Syntax error' CR LF '>'
```

2. Address outside the accessible memory zone:

```
CR LF BEL *'Illegal address' CR LF '>'
```

3. Value out of limits:

```
CR LF BEL *'Illegal value' CR LF '>'
```

6.3.3 Address to read the main control registers of the NOVADEM S3

Bit	FAULT variable	STATUS variable	PCOM variable
15	1= Starter fault	*Not used*	*Not used*
14	1= Overload fault	*Not used*	*Reserved*
13	1= Underload fault	1= Automatic restart	*Reserved*
12	1= Motor fault (overload...)	*Reserved*	*Reserved*
11	1= External fault (Emergency stop...)	*Reserved*	*Reserved*
10	1= Internal fault (Thyr SC...)	*Reserved*	1=Reset parameters (F37)
09	1= Momentary supply failure fault	1= Supply 60 Hz; 0= 50 Hz	Forced start (F24)
08	1= Thyristor(s) firing fault	1= Direct phase rotation	Boost (F05)
07	1= End of starting	1= Unbalanced phases	External starting (F19)
06	1= Reactive reduction on	1= Locked rotor fault	*Not used*
05	1= Auto-test on	1= Rotor locked	*Reserved*
04	1= Stopping on	1= Underload fault	Auto-test (F31)
03	1= Starting on	1= Motor overload	Energy saving (F10)
02	1= Main power supply on	1= Unbalanced phase fault	*Reserved*
01	1= Motor started	1= Overload fault	Contra-rotation cmd (F16)
00	1= Thyristors fired	1= Motor underload	Drying (F15)

Bit	CMODE variable	PMOT variable	PFON variable
15	*Reserved*	1= Var. perm. current (% FLC)	1= Motor in delta (F32)
14	*Reserved*	1= Var. permanent torque	1= Ground fault inhibition (F26)
13	1= Saving parameters	1= Var. permanent thermal	1= Forced start (F24)
12	1= Emergency stop	1= Var. permanent speed	1= Starting on polluted supply (F23)
11	1= Reset faults	1= Var. permanent Q	1= External starting (F19)
10	1= Stop	1= Var. permanent P	1= *Not used*
09	1= Start	1= Var. permanent COS	1= Overcurrent protection (F08)
08	1= Program version and date	1= Var. permanent I	1= Multiparameter (F17)
07	*Not used*	1= Start phases present	1= Auto restart on overload (F12)
06	*Not used*	*Not used*	1= Drying (F15)
05	*Not used*	1= Underload after start	1= Voltage reduction (F14)
04	*Not used*	*Not used*	1= Starting number limitation (F13)
03	*Not used*	*Not used*	1= Auto restart on supply failures (F12)
02	*Not used*	*Not used*	1= Phase rotation (F11)
01	1= Recorder hold	1= Thermal	1= Energy saving (F10)
00	1= Recorder running	1= Card over NS2	1= Phase control inhibition (F23)

7.MAINTENANCE AND TROUBLESHOOTING

7.1 Messages

7.1.1 List of operating messages and associated function

Message	Description
Phases not present	The three-phase voltage is not seen on the starter input.
Thyr. short cir. flt	A thyristor is in short-circuit.
Ready to start	The voltage is present on the starter input.
Phases inverted	Order of phases is inverted on starter input (F11).
Motor overload	The current exceeds the programmed level (F07).
Phases out of balance	The current is not identical in all starter phases.
Locked motor	The current exceeds 5 times the motor nominal current.
Motor underloaded	The current absorbed by the motor is lower than the programmed level (F06).
Blocking starter	Starting the motor remains prohibited (F12 and F13).
Anti-rotation oper.	Anti-rotation function (F16).
Anti-condens. oper.	Drying function (F15).
Motor testing	Testing the motor cabling (F31).
Motor wirings ok	The auto-test is correct (F31).
Starting	The voltage increases at terminals of the motor.
Speed control	Motor voltage command (F14).
Reactive reduction	The voltage is reduced at terminals of the motor (F10).
Running	The motor is fully supplied.
Decelerating	The voltage decreases at terminals of the motor according to a ramp (F04).
Braking	DC current is injected in the motor windings (F04).
Boost	Boost phase (F05).

7.1.2 List of fault messages and associated function

Message	Description
Start command fault	Start order is given at switching on (unblocking).
CT loss fault	The current transformers do not detect the starting current.
Over temper. fault	The thermostat circuit is opened.
Phase rotation fault	The phases are inverted when starting (F11).
Failure to start fault	The motor has not reached speed at the end of the starting time.
Motor overload fault	The time allocated to overload has been reached (F07).
Motor underload flt	The time allocated to underload has been reached (F06).
Phase loss fault	Loss of at least one phase during starting order.
Brownout fault	The time allocated to supply failure has been reached (F12).
Thyr. firing fault	One or more thyristors do not fire correctly.
Eeprom fault	Programming parameters are lost, return to factory values.
PTC thermistor fault	The tripping level has been reached (F28).
Thyr. short cir. flt	At least one of the thyristors is short-circuited at the time of starting order.
Mot. short cir. flt	At least one of the motor windings is seen short-circuited (F31).
Overcurrent fault	The current level has been reached (F08).
Emergency stop flt	RL1 input is opened (F02).
Locked rotor fault	The current has exceeded 5 times the nominal current for 3 s.
Phase imbalance flt	The motor phases have been unbalanced for 10 s.
Eeprom trans. fault	Storage in the eeprom is not carried out correctly.

7.2 Troubleshooting

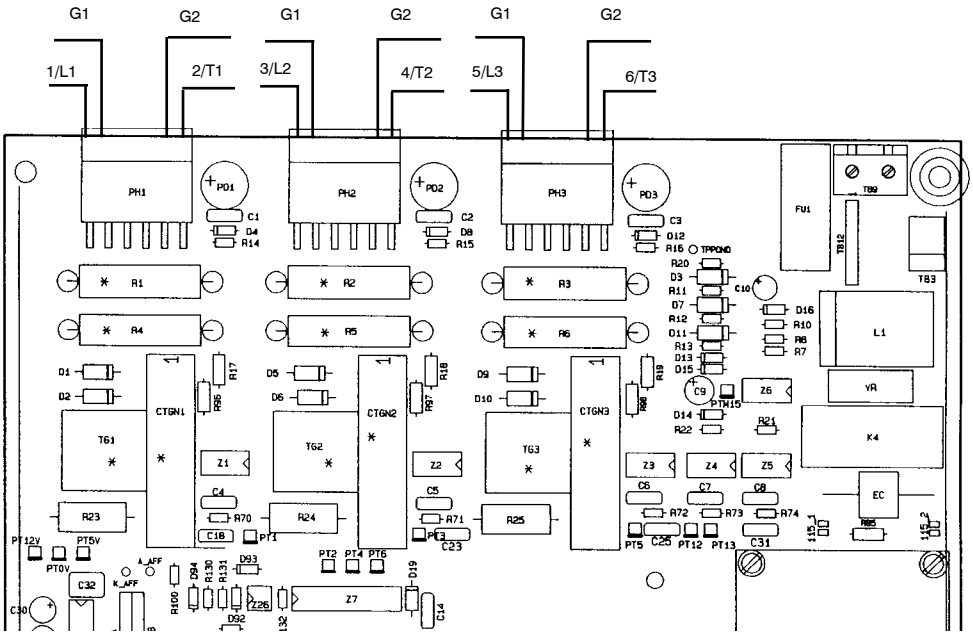
FAULTS	PROBABLE CAUSES	TESTS/REMEDIES
Start fault command	• Start contact present at switching on.	• Check start command operation.
	• The card is highly disturbed (failure, overcurrent) in normal operation.	• Check the voltage levels on the control card.
Phase loss fault	• The order of start is given but the phases are not seen at the starter input.	• Check for presence of the three-phase supply before initiating a start.
	• Connections of terminations are faulty.	• Verify the motor resistance between terminals 2/T1-4/T2-6/T3.
Thyristor firing fault	• Supply isolation fault.	• Check the supply isolation.
	• Thyristor disconnection or firing fault.	• Check the impedance on the firing circuit on the connectors TB10, TB11 and TB12 on the card.
	• Faulty firing due to card fault.	• Check that the supply to card complies with the transformer tapping. Check voltages on the control card. • Change the card. Initiate a start. If the fault persists, contact AOIP after sales.
	• Supply failure or opening of the contactor or fuse during starting.	• Check command operation of the line contactor.
Thyristor short circuit fault	• Thyristor short-circuit.	• If the fault is permanent, disconnect the starter. Check, using an ohmmeter, that the impedance between L1-T1, L2-T2, L3-T3 is greater than 100 kΩ.
	• Supply failure at contactor trigger.	• Delay start order for 1 to 2 seconds after the line contactor closes.
Brownout fault	• The overload has tripped after starting.	• Check the setting(if it exists).
	• One of the main fuses has blown.	• Check the fuse rating and if OK test for short circuit between input phases.
	• Momentary supply failure.	• The supply is polluted. Select the auto restart or use a shorting contactor for the starter after starting.

FAULTS	PROBABLE CAUSES	TESTS/REMEDIES
Phase rotation fault	• Order of connection of phases is not correct.	• Reconnect 1/L1, 3/L2, 5/L3 in the correct order.
Over temperature fault	• The ambient temperature is too high.	• Increase enclosure ventilation.
	• The ventilation of the starter is faulty.	• Check the operation of the fans.
	• The starting duty is too high.	• Reduce the starting duty or select a NOVADEM S3 of a higher rating.
	• Thermostat fault.	• If temperature of heat sink(s) is normal, check contact of thermostat(s).
CT loss fault	• No reading of the motor current at start.	• Check connection of the TB4 connector on the card.
Failure to start fault	• The starter adjustment is not correct.	• Check the motor full load current (F01). • Check the starting adjustments.
	• Motor starting information is not shown on the control card.	• Verify phase balance on supply to the motor by comparing neutral and earth. • Change the card.
Locked rotor fault	• Locked rotor.	• Check there is not any mechanical locking between rotor and machine.
Phase imbalance fault	• Motor phase imbalance.	• Check NOVADEM S3 output voltage balance.
	• Network imbalance.	• Check motor windings.
	• Incorrect reading of motor current.	• Check current value read on display.
Motor underload fault	• Motor underload.	• Check motor load variations.
	• Inadequate settings (F06).	• Check settings. • Check current reading.
Motor overload fault	• Motor overload (F07).	• Check motor load variations.
	• Large voltage drop on three phase supply.	• Check overload settings (nominal current, overload level).
	• Inadequate settings of the overload level.	• Check current read by the starter (F21).
PTC thermistor fault	• The temperature of the motor is too high (F28).	• Check the motor load. • Check the levels programmed using function F28 together with the connection of the ballast resistance.

FAULTS	PROBABLE CAUSES	TESTS/REMEDIES
Overcurrent fault	• Motor short circuit.	• Check motor impedance.
	• The setting of function F08 is reached.	• Increase the overcurrent level or the response time in function F08.
Motor short circuit fault	• Motor short circuit.	• Check motor windings between phases and earth.
	• Impedance level adjustment is too low (F31).	• Increase value of the impedance level. (F31).
Eeprom fault	• EEPROM memory fault. • Control card supply is highly disturbed.	• Reprogram. Check parameters stored after powering down several times. If the fault persists, change the EEPROM memory.
Eeprom transmission fault	• EEPROM memory fault.	• Reprogram. Check parameters stored after powering down several times. If the fault persists, change the EEPROM memory.
Emergency stop fault	• Remote stop activated.	• Check programming of inputs. • Check control circuit.

7.3 How to test the thyristors

To perform this operation isolate the starter: power supply **and** control card supply switched off.
Use an ohmmeter.
Measurement is done from the PH1, PH2, PH3 connectors located on the card together with the thyristors (see diagram below).



Operation	Result
Measuring resistance between 1/L1 and 2/T1 Measuring resistance between 3/L2 and 4/T2 Measuring resistance between 5/L3 and 6/T3	• Resistance above 100 kΩ: OK. • Resistance below few ohms: thyristor phase short circuit.
Over PH1, measuring resistance between 1/L1 and G1 Over PH1, measuring resistance between G2 and 2/T1 Over PH2, measuring resistance between 3/L2 and G1 Over PH2, measuring resistance between G2 and 4/T2 Over PH3, measuring resistance between 5/L3 and G1 Over PH3, measuring resistance between G2 and 6/T3	• Resistance from a few ohms to 50 Ω: OK. • Resistance above 50 Ω: check the electrical continuity between the connector and the thyristor. If the continuity is correct, the thyristor must be changed.

7.4 Checking the card supplies

Card switched on (control supply).
Use a DC voltmeter.

Operation	Results
Measuring voltage (0V-10V) on TB1 connector.	Value above 9 V DC: OK.
Measuring voltage (OXT-VXT).	Value above 9 V DC: OK.

7.5 Spare parts

When ordering spare parts, indicate the type of NOVADEM S3 together with the power voltage and control card voltage.

NOVADEM S3 type	THYRISTORS (power voltage)			FAN(S) (Control card voltage)			FUSE (control card voltage)		
	230 V/400 V	500 V	690 V	230 Vac	115 Vac	48 Vdc	230 Vac	115 Vac	48 Vdc
NS x1-25 NS x1-55 NS x1-90	TY222	TY300	-	-	-	-	ER 48124-501		
NS x2-90 NS x2-91 NS x2-132 NS x3-160	TY223	TY101401	-	VE233	ER 40838-001	ER 40856-001	ER 48124-501		ER 48124-102
NS x3-250 NS x3-251 NS x3-300	ER 60174-001	ER 60154-000	ER 60160-001 - ER 60160-002	VE234	ER 40838-002	ER 40856-002	ER 48124-501	ER 48124-102	
NS x4-300 NS x4-500 NS x4-600	TY101203	TY101313	ER 60160-003 ER 60160-004 -	VE233	ER 40838-001	-	ER 48124-501	ER 48124-102	-
NS x5-760 NS x5-1200 NS x5-1500	TY298 TY101440 ER 60189-000	TY101335 ER 60157-000 ER 60190-000	ER 60160-005 ER 60160-006 ER 60160-007	VE234	ER 40838-002	-	ER 40838-002	ER 48124-202	-
NS x6-1200	TY101440	-	ER 60160-007	①	-	-	ER 48124-501	-	-
NS x7-1200 NS x7-1800 NS x7-2300	TY101440 TY101441 TY101442	-	ER 60160-007 ER 60160-008 ER 60160-009	②	-	-	ER 48124-501	-	-

① : ECOFIT 2RRE25 225X40R H06-16. FUSE: ER 48124-502
② : ECOFIT 2RRE45 250X56R H06-17. FUSE: ER 48124-502

Control card: CA 60002-000C or CA820-423TC
Keypad display: 9CA820-NC.

List of options

Part number	Description
OPT-MUL	Inputs/outputs card.
OPT-DEP	Remote keypad.
OPT-LGD	LOGIDEM processing software.
MDB-NS	Network interface card.