GE Power Controls

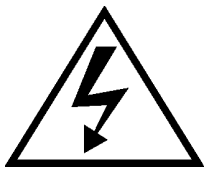
STATIC
SOFT STARTER

# ASTAT-C
# ASTAT-CD

## USER MANUAL

**REMARKS :**

1. Read this manual throughly before using the ASTAT-C, ASTAT-CD, and store in a safe place for reference.
2. Make sure that this manual is delivered to the end user
3. **CE MARKING**
   When using ASTAT-C and ASTAT-CD in the EU, compliance with EMC is required. ASTAT-C and ASTAT-CD are according with the generic EN 50081-2 and EN 50082-2



**WARNINGS**

**1.** Disconnect power before installing or servicing.

**2** Hazardous voltages are present in the motor circuit even when the starter is OFF. An isolation contactor is recommended, configured to provide automatic isolation when the motor is turned OFF.

**3.** Unit may contain more than one live circuit. Disconnect both control and main circuits before installing or servicing.

**4.** Soft stop should not be used as an Emergency stop.

**5.** Stopping mode must be set to meet applicable standards for operator safety.

**6.** Separate motor overcurrent protection is required to be provided in accordance with the Canadian Electrical Code, Part 1. ASTAT-CD provides separate motor protection.

**CAUTIONS**

**1.** Semi-conductor fuses specified may not provide branch circuit protection. Refer to local applicable electrical codes.

**2.** Overload relay setting should be properly coordinated with motor.

**3.** Slow speed running will affect the motor thermal characteristic due to reduced cooling. Care must be taken when operating motor under these conditions.

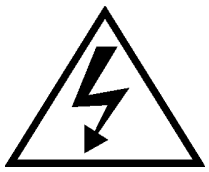
**4** DC braking - braking current may cause motor overheating. Select the lowest braking current and time.

**5.** DC braking must use additional (DC2) in the motor circuit. See wiring diagram page 3.5.

**6.** Abnormal starting times in excess of 30 seconds, or closely repeated operations of acceleration ramp/deceleration ramp, slow speed, or DC injection braking may cause motor damage. Contact motor manufacturer for proper motor selection.

**7.** If control power is lost between starts, the overload relay protection is reset to cold start conditions.

# 2. Types and powers



**PRECAUTIONS**

**1.** Debranchez l'alimentation en courant électrique avant de raccorder ou d'intervenir.

**2.** Des tensions dangereuses sort présente dans le circuit moteur même si le soft starter indique la position "arrêt". Un contacteur d'isolement assurant un isolement automatique quand le moteur est arrête, est recommendé.

**3.** L'appareil peut renfermer plus d'un circuit sous tension de'brancher les circuits principaux et les circuits de controle avant de raccorder ou d'intervenir.

**4.** Délestage "soft stop" ne devrait jamais être utilisé en lieu de délestage d'urgence.

**5.** Procédés de délestage doivent être conforme aux normes de sécurité des utilisateurs.

**AVERTISSEMENTS**

**1.** Les fusibles semi-conducteurs specifies ne protégent pas obligatoirement les circuits se conformer aux codes locaux d'installations électriques.

**2.** Le relais de courant de surcharge doit être proprement coordonné avec la marche du moteur.

**3.** La marche en sous-régime agira sur les caracteristiques thermiques à cause de la réduction de refroidessement. Opérez le moteur avec précaution dans en ce cas.

**4.** Ralentissement courant continu peut provoquer la surchauffe de moteur. Choisissez le plus foible courant de décéleration et la durée de ralentissement la plus courte.

**5.** Pour freinage courant continu, un contacteur (DC2) additional est nécessaire dans le circuit moteur, voir le schéma de raccordement page 3.5.

**6.** Les délais anormaux de mise en service d'une durée supérieure à 30 secondes, ainsi que les montées/descentes en regime, les exploitations régime lent ou les freinages par injection de courant continu répétés et rapportes sont suseptibles d'edommager le moteur. Mettez-vous en rapport avec votre fabricant en ce qui concerne le choix du moteur adéquat.

**7.** En cas d'interruption de l'alimentation entre deux dèmarrages, la protection assurée par démarrage à froid.

**8.** Le moteur doit être muni d'une protection distincte contre les surintensites, et la surchauffe conformement au code de l'electricite, premiere partie. ASTAT-CD le relais de courant de surcharge doit être proprement coordonne avec la marche du moteur.

# Index

# 1. Generalities

## 1-1. Comparison of starting systems

There are numerous applications where soft starting and limited current peak are needed and thereby making direct starting of squirrel-cage motors impossible. Traditionally in such cases other types of starting with reduced stator voltage have been resorted to. The best-known are star-delta starters, autotransformer starters, stator resistance starters or using part winding motors.

Any reduced starting voltage imposes a current limitation, and as a consequence the starting torque is also reduced, but there will always be peaks during the change from one point or state to another which can damage the machine being driven. In order to analyse the performances offered by each of these different types of starters, the following table shows the special characteristics of each of them, comparing with the ASTAT system.

Note that in general all reduced voltage starts produce a reduction in torque in squared proportion to the current in the phases of the motor (not on the line) and the latter in turn is reduced in linear proportion to the voltage. From this it can be deduced that any start with reduced voltage reduces the torque in squared proportion to the voltage per motor phase. From this point of view soft starting produces, just like any other reduced voltage start, a reduction in starting torque, according to the adjusted parameters. The advantage, of course, is the ease with which this ramp can be controlled to produce a soft start in accordance with the actual requirement of the machine.

From the comparison table it can be seen that the maximum starting torque attainable using the soft system is 80% of that which direct starting tends to.

Bearing in mind that the direct starting torque varies between 1.5 and 2.4 times rated torque, it can be deduced that with the soft starter, starting torques which are somewhat higher than rated are obtained.

This area includes the starting of pumps, fans, conveyor belts, etc., where a torque in the region of 60% of rated is usually sufficient for correct starting.

As a general rule it can be guaranteed that soft starter will allow starting of drives which are currently used in conventional starting systems, with the advantages outlined, and above all the facility to adjust the current peaks and torque at the machine, faced with the impossibility or difficulty of varying the steps in conventional systems.

| | **CONVENTIONAL STARTERS** | | | | | **SOFT STARTER** |
|---|---|---|---|---|---|---|
| | Direct | Autotransfo | Stator resistance | Part winding motor | Star-delta | |
| **% of direct start current (in the line)** | 100% | 30 - 40 or 64% | 58 - 70% | 65% | 33% | Depending on adjust, max. 90% |
| **% of direct start torque** | 100% | 30 - 40 or 64% | 33 - 49% | 48% | 33% | Depending on adjust, max. 80% |
| **Starting steps (1)** | 1 | 4, 3 or 2 | 3 or 2 | 2 | 2 | Continuous, no steps |
| **Connections to motor** | 3 | 3 | 3 | 6 | 6 | 3 |
| **Line overload (approx.)** | 5 In | 1,5 - 2,1 or 3,2 In | 3 - 3,5 In | 3,25 In | 1,65 In | Depending on adjust, max. 5 In |
| **Change or starting pause** | NO | NO | NO | NO | YES | NO |

(1) "Steps" mean sharp changes of speed during the time from rest until rated speed is reached.

## 1-2. Advantages of the ASTAT-C/CD static soft starter

### 1 Increase in productivity and reliability with the use of static soft starters.

Starting and stopping the motor without steps or transitions lengthens the life of power-driven machine mechanical elements, greatly reducing stress on transmision and coupling parts.
Consequently, overhauling times are reduced and machine and facility lifespans are lengthened.

### 2 Improvement in acceleration / deceleration characteristics

Being able to start by using the voltage ramp or alternatively by limiting current lets acceleration fit the load characteristics. Application of a pulse start may also be selected in cases of high static friction load.
Braking may be made by cutting-off power or by stop ramp, and it is also possible to brake more energetically by feeding a DC current to the motor stator, so there are many ways to obtain the best possible deceleration.

### 3 Protected motor

The soft starter protects the motor from overloads as well as from incorrect operating conditions such as loss of an input or output phase, blocked rotor, thyristor short circuit, etc.

### 4 Digital technology

The control system is based on the use of a highly specialized microcontroller by which signals are treated digitally, thereby avoiding deratings and adjustments common to analogue circuits and obtaining excellent precision and speed of execution.
The control board is made with the technology of surface mounting devices (SMD), which increases equipment reliability.

### 5 High level of immunity

Design of the unit was closely tied to the conditions of supply lines, which handle more disturbance every day. The control signals are optoelectronically isolated and various levels of protection have been set up in the circuits to immunize the equipment against external disturbance and its effects.

### 6 Easy to run and adjust

This unit can be used for a wide range of applications.
Adjustments are very easy to make and diverse options may be selected to have equipment capabilities suited to application needs every time.

### 7 Easy maintanence due to full monitoring

The signalling code based on four LEDs (ASTAT-C) or alphanumeric display (ASTAT-CD) makes the equipment working conditions known at any time and gives a quick diagnosis when protection security is violated.

### 8 Communications and digital adjustment versions

The ASTAT-CD allows a larger margin of adjust of the parameters, and offer the following options: linear acceleration lamp, slow speed and connection to a computer by series communication (RS 422/485).
These performances allows the incorporation of the soft starter to a distributed control net, in automated plant processes, together with other soft starters, programmable controllers, variable speed drives, etc.

### 9 Pump control

The ASTAT-CD has a new feature which is more effective than the standard soft stop, reducing fluid surges or hammering in a pipe line system.
This method reduces the motor speed, by controlling internal parameters in the motor as well as the output voltage in a close-loop system.

# 2. Types and powers

## 2-1. IEC Ratings

| Current rating | Max. starting current | Standard duty 220V / 240V | Standard duty 380V / 415V | Standard duty 440V | Standard duty 480V / 500V | Heavy duty 220V / 240V | Heavy duty 380V / 415V | Heavy duty 440V | Heavy duty 480V / 500V | Degree of protection | TYPE (1) | Weight unit | Cooled |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | A | kW | kW | kW | kW | kW | kW | kW | kW | | | Kg. | |
| 14 | 70 | 3 | 5,5 | 6,3 | - | 3 | 5,5 | 6,3 | - | IP-20 | **QC1F- □ A** | 4,3 | Natural |
| | | - | - | - | 7,5 | - | - | - | 7,5 | IP-20 | **QC2F- □ A** | 4,3 | Natural |
| 17 | 85 | 4 | 7,5 | 7,5 | - | 4 | 7,5 | 7,5 | - | IP-20 | **QC1G- □ A** | 4,3 | Natural |
| | | - | - | - | 10 | - | - | - | 10 | IP-20 | **QC2G- □ A** | 4,3 | Natural |
| 22 | 110 | 5,5 | 10 | 11 | - | 5,5 | 10 | 11 | - | IP-20 | **QC1H- □ A** | 4,6 | Natural |
| | | - | - | - | 13 | - | - | - | 13 | IP-20 | **QC2H- □ A** | 4,6 | Natural |
| 34 | 170 | 7,5 | 15 | 18,5 | - | 7,5 | 15 | 17 | - | IP-20 | **QC1I- □ A** | 4,6 | Natural |
| | | - | - | - | 20 | - | - | - | 20 | IP-20 | **QC2I- □ A** | 4,6 | Natural |
| 48 | 240 | 13 | 22 | 25 | - | 13 | 22 | 25 | - | IP-00 | **QC1J- □ A** | 12,5 | By fan |
| | | - | - | - | 30 | - | - | - | 30 | IP-00 | **QC2J- □ A** | 12,5 | By fan |
| 63 | 315 | 17 | 30 | 37 | - | 17 | 30 | 37 | - | IP-00 | **QC1K- □ A** | 12,5 | By fan |
| | | - | - | - | 40 | - | - | - | 40 | IP-00 | **QC2K- □ A** | 12,5 | By fan |
| 72 | 360 | 20 | 37 | 40 | - | 20 | 37 | 40 | - | IP-00 | **QC1L- □ A** | 17,0 | By fan |
| | | - | - | - | 45 | - | - | - | 45 | IP-00 | **QC2L- □ A** | 17,0 | By fan |
| 105 | 525 | 30 | 55 | 63 | - | 25 | 50 | 55 | - | IP-00 | **QC1M- □ A** | 17,0 | By fan |
| | | - | - | - | 75 | - | - | - | 63 | IP-00 | **QC2M- □ A** | 17,0 | By fan |
| 156 | 780 | 40 | 75 | 80 | - | 40 | 75 | 80 | - | IP-00 | **QC1N- □ A** | 45,0 | By fan |
| | | - | - | - | 90 | - | - | - | 90 | IP-00 | **QC2N- □ A** | 45,0 | By fan |
| 240 | 1200 | 63 | 110 | 132 | - | 63 | 110 | 132 | - | IP-00 | **QC1Q- □ A** | 45,0 | By fan |
| | | - | - | - | 147 | - | - | - | 147 | IP-00 | **QC2Q- □ A** | 45,0 | By fan |
| 315 | 1575 | 90 | 160 | 185 | - | 90 | 160 | 185 | - | IP-00 | **QC1R- □ A** | 55,0 | By fan |
| | | - | - | - | 220 | - | - | - | 220 | IP-00 | **QC2R- □ A** | 55,0 | By fan |
| 370 | 1850 | 110 | 200 | 220 | - | 100 | 165 | 200 | - | IP-00 | **QC1S- □ A** | 55,0 | By fan |
| | | - | - | - | 250 | - | - | - | 220 | IP-00 | **QC2S- □ A** | 55,0 | By fan |
| 500 | 2500 | 150 | 250 | 315 | - | 132 | 220 | 250 | - | IP-00 | **QC1T- □ A** | 80,0 | By fan |
| | | - | - | - | 335 | - | - | - | 315 | IP-00 | **QC2T- □ A** | 80,0 | By fan |
| 630 | 3150 | 200 | 335 | 400 | - | 165 | 315 | 375 | - | IP-00 | **QC1U- □ A** | 105,0 | By fan |
| | | - | - | - | 450 | - | - | - | 425 | IP-00 | **QC2U- □ A** | 105,0 | By fan |
| 850 | 4250 | 258 | 475 | 530 | - | 220 | 450 | 515 | - | IP-00 | **QC1V- □ A** | 120,0 | By fan |
| | | - | - | - | 600 | - | - | - | 560 | IP-00 | **QC2V- □ A** | 120,0 | By fan |
| 1180 | 5900 | 335 | 630 | 750 | - | 330 | 600 | 700 | - | IP-00 | **QC1X- □ A** | 150,0 | By fan |
| | | - | - | - | 850 | - | - | - | 750 | IP-00 | **QC2X- □ A** | 150,0 | By fan |

(1) Substitute □ by one of the following letters :

- **N** = Analogical control panel
- **D** = Digital control panel
- **C** = Digital control panel + Communications
- **E** = **D** + Linear ramp (T.G.)
- **F** = **C** + Linear ramp (T.G.)
- **G** = **D** + Slow speed
- **H** = **C** + Slow speed

## 2-2. UL Ratings

| Current rating | Max. starting current | Standard duty 200V | Standard duty 230V | Standard duty 460V | Heavy duty 200V | Heavy duty 230V | Heavy duty 460V | Degree of protection | TYPE | Weight (1) | Cooled unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | A | HP | HP | HP | HP | HP | HP | | | Kg. | |
| 14 | 70 | 3 | 3 | - | 3 | 3 | - | IP-20 | QC1F- □ A | 4,3 | Natural |
| | | - | - | 7,5 | - | - | 7,5 | IP-20 | QC2F- □ A | 4,3 | Natural |
| 17 | 85 | 3 | 3 | - | 3 | 3 | - | IP-20 | QC1G- □ A | 4,3 | Natural |
| | | - | - | 10 | - | - | 10 | IP-20 | QC2G- □ A | 4,3 | Natural |
| 22 | 110 | 5 | 7,5 | - | 5 | 7,5 | - | IP-20 | QC1H- □ A | 4,6 | Natural |
| | | - | - | 15 | - | - | 15 | IP-20 | QC2H- □ A | 4,6 | Natural |
| 34 | 170 | 7,5 | 7,5 | - | 7,5 | 7,5 | - | IP-20 | QC1I- □ A | 4,6 | Natural |
| | | - | - | 20 | - | - | 20 | IP-20 | QC2I- □ A | 4,6 | Natural |
| 48 | 240 | 15 | 15 | - | 10 | 15 | - | IP-00 | QC1J- □ A | 12,5 | By fan |
| | | - | - | 30 | - | - | 30 | IP-00 | QC2J- □ A | 12,5 | By fan |
| 63 | 315 | 20 | 20 | - | 15 | 20 | - | IP-00 | QC1K- □ A | 12,5 | By fan |
| | | - | - | 40 | - | - | 40 | IP-00 | QC2K- □ A | 12,5 | By fan |
| 72 | 360 | 20 | 25 | - | 20 | 20 | - | IP-00 | QC1L- □ A | 17,0 | By fan |
| | | - | - | 50 | - | - | 40 | IP-00 | QC2L- □ A | 17,0 | By fan |
| 105 | 525 | 30 | 30 | - | 30 | 30 | - | IP-00 | QC1M- □ A | 17,0 | By fan |
| | | - | - | 75 | - | - | 60 | IP-00 | QC2M- □ A | 17,0 | By fan |
| 156 | 780 | 50 | 60 | - | 40 | 50 | - | IP-00 | QC1N- □ A | 45,0 | By fan |
| | | - | - | 125 | - | - | 100 | IP-00 | QC2N- □ A | 45,0 | By fan |
| 240 | 1200 | 75 | 75 | - | 60 | 75 | - | IP-00 | QC1Q- □ A | 45,0 | By fan |
| | | - | - | 200 | - | - | 150 | IP-00 | QC2Q- □ A | 45,0 | By fan |
| 315 | 1575 | 100 | 125 | - | 75 | 100 | - | IP-00 | QC1R- □ A | 55,0 | By fan |
| | | - | - | 250 | - | - | 200 | IP-00 | QC2R- □ A | 55,0 | By fan |
| 370 | 1850 | 125 | 150 | - | 100 | 125 | - | IP-00 | QC1S- □ A | 55,0 | By fan |
| | | - | - | 300 | - | - | 250 | IP-00 | QC2S- □ A | 55,0 | By fan |
| 500 | 2500 | 150 | 200 | - | 150 | 150 | - | IP-00 | QC1T- □ A | 80,0 | By fan |
| | | - | - | 400 | - | - | 350 | IP-00 | QC2T- □ A | 80,0 | By fan |
| 630 | 3150 | 200 | 250 | - | 200 | 200 | - | IP-00 | QC1U- □ A | 105,0 | By fan |
| | | - | - | 500 | - | - | 400 | IP-00 | QC2U- □ A | 105,0 | By fan |
| 850 | 4250 | 300 | 350 | - | 300 | 350 | - | IP-00 | QC1V- □ A | 120,0 | By fan |
| | | - | - | 700 | - | - | 700 | IP-00 | QC2V- □ A | 120,0 | By fan |

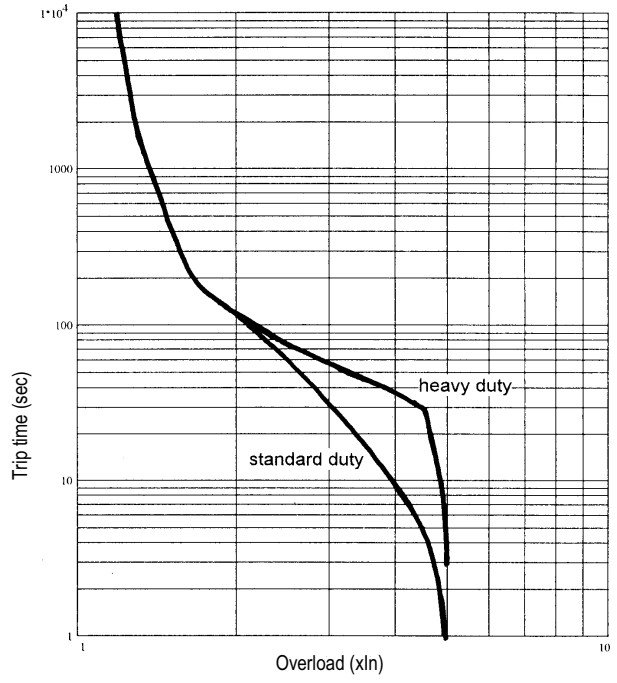
(1) Substitute □ by one of the following letters :

**N** = Analogical control panel
**D** = Digital control panel
**C** = Digital control panel + Communications
**E** = **D** + Linear ramp (T.G.)
**F** = **C** + Linear ramp (T.G.)
**G** = **D** + Slow speed
**H** = **C** + Slow speed

## 2-3. Thermal characteristics

### Time / overload characteristic

The following illustration shows the overload trip curves according to the duty selected by the "ol" parameter. (ASTAT-CD)
The ASTAT-C units only have the standard duty curve available.




**Thermal memory:** (ASTAT-CD only)
If the control voltage is not removed, the unit has i cool down characteristic, being the cool down time 300 sec. after the overload trip.
If the control voltage is removed after tripping, you must wait, at least, 2 minutes before the unit can be restarted.

# 3. Technical specifications

## 3-1. ASTAT-C. Analogical control panel

| | | | |
|---|---|---|---|
| **Control specifications** | Control system | | Digital system with microcontroller. Starting ramp with progressive increase in voltage and current limitation |
| | Initial voltage (pedestal) | % | 40 - 90 Un |
| | Starting torque | % | 15 - 80 $M_{direct\ start}$ |
| | Kick start | % | 90 Un (80% $M_{direct\ start}$), 400ms |
| | Current limitation | | 2 to 5 x In |
| | Accelartion ramp time ($t_{ramp}$) | s | 0,5 to 60 |
| | Energy savings | | Output voltage reduction according to power factor |
| | Override | | Fixed output voltage permanently equal to supply voltage |
| | Brake time by ramp | s | max = 2 x t acceleration ramp (as per energy savings state) |
| | Brake time DC injection | s | 5 sec. ór $t_{ramp}$/3 (choice) |
| | Braking intensity by DC injection | | 2 In |
| **Operation** | External control | | Start - Stop - Override |
| | Acceleration phase | | Adjustable time |
| | Permanent phase | | Energy savings / override choice |
| | Stop phase | | Power cut-off / Ramp / Direct current input choice |
| **Inputs / Outputs** | Inputs | | 3 optical couplings for Run / Stop / Override commands |
| | Outputs | | 3, relays for Run/Stop (1 changeover), end of ramp (1NO) and DC brake (1NO) |
| **Protections** | Current limit | | Adjustable from 2 In to 5 In |
| | Overload (I x t) | | See Standard duty curve on page **5** |
| | Loss on input phase | s | Trip at 3 |
| | Thyristor short circuit | ms | Trip at 200 |
| | Radiator overheating | ms | Trip at 200 |
| | Loss on output phase | s | Trip at 3 |
| | Stalled rotor | ms | Trip at 200 |
| | Supply frequency error | Hz | If f < 48 ór f > 62, will not start |
| | Error (CPU) | ms | 60 |
| **Environmental conditions** | Temperature | ºC | 0 to +55 (1) |
| | Relative humidity | % | 95 without condensation |
| | Maximum altitude | m | 3000 (2) |
| | Mounting positions | | Vertical |
| **Description of terminals** | **1L1, 3L2, 5L3** | | Power supply inputs (max. 440 ór 500V, according to type) +10%, -15% |
| | **2T1, 4T2, 6T3** | | Outputs to motor |
| | **A1 / A2 , B1 / B2** | | Command supply inputs (110/120 - 220/240V AC) +10%, -15% |
| | **11, 12, 14** | | Run/Stop internal relay output (11-12 = NC ; 11-14 = NO) |
| | **23, 24** | | End of ramp internal relay output |
| | **33, 34** | | DC brake internal relay output |
| | **1, 57** | | Run command input |
| | **2, 57** | | Stop command input |
| | **3, 57** | | Override input |
| **Output contact specifications** | Maximum usage voltage | V AC | 380 |
| | Thermal current Ith | A | 8 |
| | Usage specifications | | |
| | AC-15 | V / A | 220 / 3 - 380 / 1 |
| | DC-15 | V / A | 30 max. / 3,5 |

(1) Derate output current by 1,5% /ºC above 45º

(2) Derate output current by 1% /100m above 1000 meters.

## 3-2. ASTAT-CD. Digital control panel

| | | | |
|---|---|---|---|
| **Control specifications** | Control system | | Digital system with microcontroller |
| | | | Starting ramp with progressive increase in voltage and current limitation |
| | Initial voltage (pedestal) | % | 30 - 95 Un |
| | Starting torque | % | 10 - 90 $M_{direct\ start}$ |
| | Kick start | % | 95 Un (90% $M_{direct\ start}$), adjustable 0 to 999 ms |
| | Motor current (Im) | | 0,5 to 1 Ir (rated ASTAT current) |
| | Current limitation | | 1 to 5 x Im |
| | Acceleration ramp time | s | 1 to 999 |
| | Energy savings | | Output voltage reduction according to power factor |
| | Override | | Fixed output voltage permanently equal to supply voltage |
| | Brake time by ramp | s | 1 to 999 adjustable independently of starting ramp time (Standard, Pump control or Linear ramp down) |
| | Brake time DC injection | s | 0 to 99 |
| | Braking intensity by DC injection | | 0,5 to 2,5In |
| **Operation** | External control | | Start - Stop - Override |
| | Acceleration phase | | Adjustable time |
| | Permanent phase | | Energy savings / Override choice |
| | Stop phase | | Power cut-off / Ramp / DC braking/Pump control |
| **Inputs / Outputs** | Inputs | | 4 optocoupled for Start / Stop / Bypass order and input (PTC) |
| | Outputs | | 3, by relay. Run/Alarm (programmable, 1 changeover) end of ramp (1NO) and Stop by DC injection (1NO) |
| **Protections** | Current limit | | Adjustable from 1 Im to 5 Im |
| | Overload ($I^2$ x t) | | See figure on page **5** for time / overload characteristic |
| | Cool-down time after overload trip | s | 300 |
| | Loss on input phase | s | Trip at 3 |
| | Thyristor short circuit | ms | Trip at 200 |
| | Radiator overheating | ms | Trip at 200 |
| | Motor thermistor | ms | Trip at 200 if thermistor impedance > response value |
| | Loss on output phase | s | Trip at 3 |
| | Stalled rotor | ms | Trip at 200 |
| | Supply frequency error | Hz | If f < 48 or f > 62, will not start |
| | No motor load | s | 10 |
| | Error (CPU) | ms | 60 |
| | Memory | | 4 former errors |
| | Long start time | s | 2 x ta if ta ≤ 120 s. ; 240 if ta > 120 s. (ta = acceleration ramp time) |
| | Long slow speed time | s | 120 |
| **Environmental conditions** | Temperature | ºC | 0 to +55 (1) |
| | Relative humidity | % | 95% without condensation |
| | Maximum altitude | m | 3000 (2) |
| | Mounting positions | | Vertical |
| **Description of terminals** | **1L1, 3L2, 5L3** | | Power supply inputs (max. 440 or 500V, according to type) +10%, -15% |
| | **2T1, 4T2, 6T3** | | Outputs to motor |
| | **A1 / A2 , B1 / B2** | | Command supply inputs (110/120 - 220/240V AC) +10%, -15% |
| | **11, 12, 14** | | Internal Run / Alarm relay output (11-12 = NC ; 11-14 = NO) |
| | **23, 24** | | End of ramp internal relay output |
| | **33, 34** | | DC brake internal relay output |
| | **1, 57** | | Run command input |
| | **2, 57** | | Stop command input |
| | **3, 57** | | Override input |
| | **4, 57** | | Inching / Slow speed input (option) |
| | **5, 6** | | Motor thermistor inputs. Response value : 2,8 - 3,2 KΩ. Reset value : 0,75 - 1KΩ |
| | **7, 8** | | Tachogenerator input (option) (0 - 5V, positive to 7 negative to 8) |
| **Output contact specifications** | Maximum usage voltage | V | 380 AC |
| | Thermal current Ith | A | 8 |
| | Usage specifications | | |
| | AC-15 | V / A | 220 / 3 - 380 / 1 |
| | DC-15 | V / A | 30 max. / 3,5 |
| **Options** | Linear ramp with tachogenerator feedback (selected with dip-switch 3) | s | 1 - 999 |
| | Slow speed (selected with dip-switch 4. Selec. 7% or 14% speed with dip-switch 3) | | Time limit : 120 s. |

**Communications (optional)**

| | |
|---|---|
| **Transmission mode** | RS-422 or RS-485; 2 or 4 threads; semi-dúplex; 1 : NA |
| **Transmission method** | Asynchronous (1 bit START, 1 bit STOP, 8 bits ASCII DATA, selectable parity bit O/E/N) |
| **Baud rate** | 9600, 4800, 3400 or 1200, selectable |
| **Errors detection** | Parity and CHECKSUM |
| **Maximum distance** | 1 Km |
| **Maximum Nº. of ASTAT stations within the net** | 16 |

(1) Derate output current by 1,5% /ºC above 45º

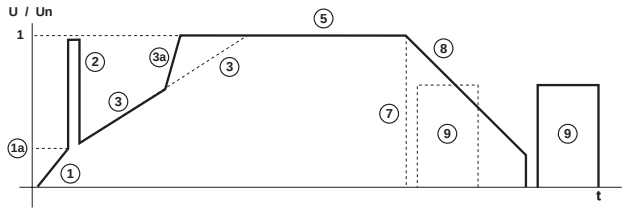
(2) Derate output current by 1% /100m above 1000 meters.

## 3-3. Operating modes

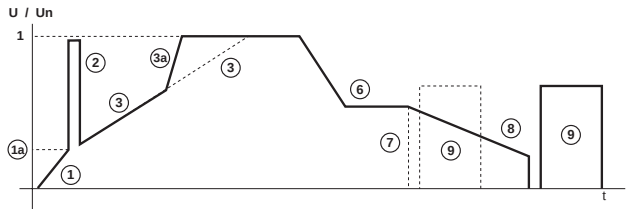
| | | | ASTAT with Analogical control panel (ASTAT-C) | ASTAT with Digital control panel (ASTAT-CD) |
|---|---|---|---|---|
| Initial ramp | | 1 | 5 main frequency cycles | 5 main frequncy cycles |
| Initial voltage (pedestal) | | 1a | 40 to 90% Un (adjustable) | 30 to 95% Un (adjustable) |
| Kick start | | 2 | 90% Un (choice) | 95% Un (choice) |
| Acceleration ramp ($t_{ramp}$) | | 3 | 0.5 to 60s (adjustable) | 1 to 999s (adjustable) |
| | | 3a | Fast increase of output voltage when motor speed get the nominal value | |
| Current limit | | 4 | 2 to 5 In | 1 to 5 In |
| Permanent state | Choice | 5 | Nominal voltage (Override) | Nominal voltage (Override) |
| | | 5a | Nominal current | Nominal current |
| | | 6 | Energy savings | Energy savings |
| Brake | Choice | 7 | Motor power cut-off (stopped by inertia) | Motor power cut-off (stopped by inertia) |
| | | 8 | Deceleration ramp. Max. time 2 x $t_{ramp}$ | Deceleration ramp 1 to 999s (adjustable) |
| | | | | The following ramp down systems are available : |
| | | | | - Standard voltage ramp down |
| | | | | - Pump control |
| | | | | - Linear ramp down (option) |
| | | 8a | Evolution of current in deceleration ramp mode | Evolution of current in deceleration ramp mode |
| | | 9 | DC brake (5 sec or $t_{ramp}$ / 3) | DC brake (0 to 99s adjustable) |

### Starting by voltage ramp

**Override**




**Energy savings**

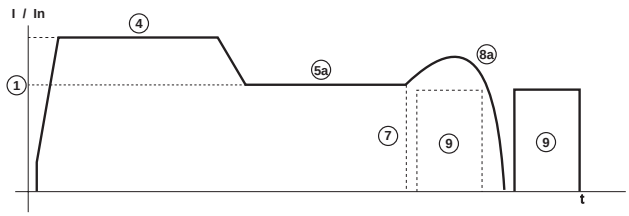



Ramp stop: 8

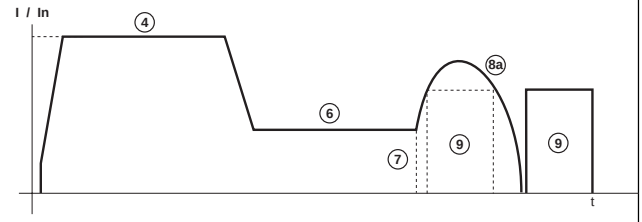
Power cut-off stop: 7

### Starting by current limitation

**Override**




**Energy savings**



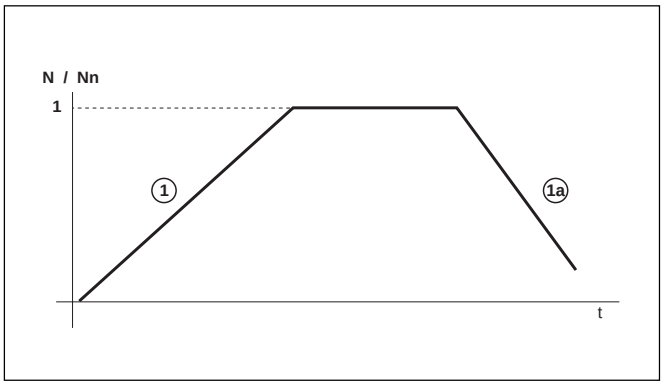

Ramp stop: 8a

Power cut-off stop: 7

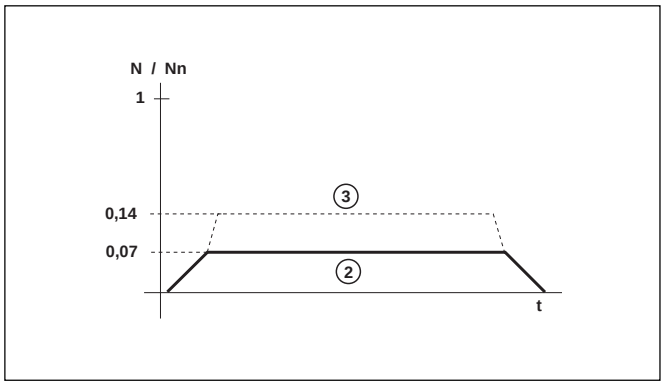
## 3-4. Options. Operating modes (ASTAT-CD)

| | | |
|---|---|---|
| Linear acceleration and deceleration ramp | 1 1a | Ramp time adjustable (selection : DS3 = 1 ; DS4 = 0) |
| Low slow speed (7%) | 2 | (Selectión: DS4 = 1 ; DS3 = 0) |
| High slow speed (14%) | 3 | (Selectión: DS4 = 1 ; DS3 = 1) |
| Slow speed (7% or 14%) | 4 | (Selectión: DS4 = 1) |
| Acceleration ramp | 5 | Ramp time adjustable |
| Soft stop (deceleration ramp) | 6 | Ramp time adjustable |
| Slow speed (7% or 14%) | 7 | (Selectión: DS4 = 1) |
| DC Brake | 8 | Current and time adjustables |

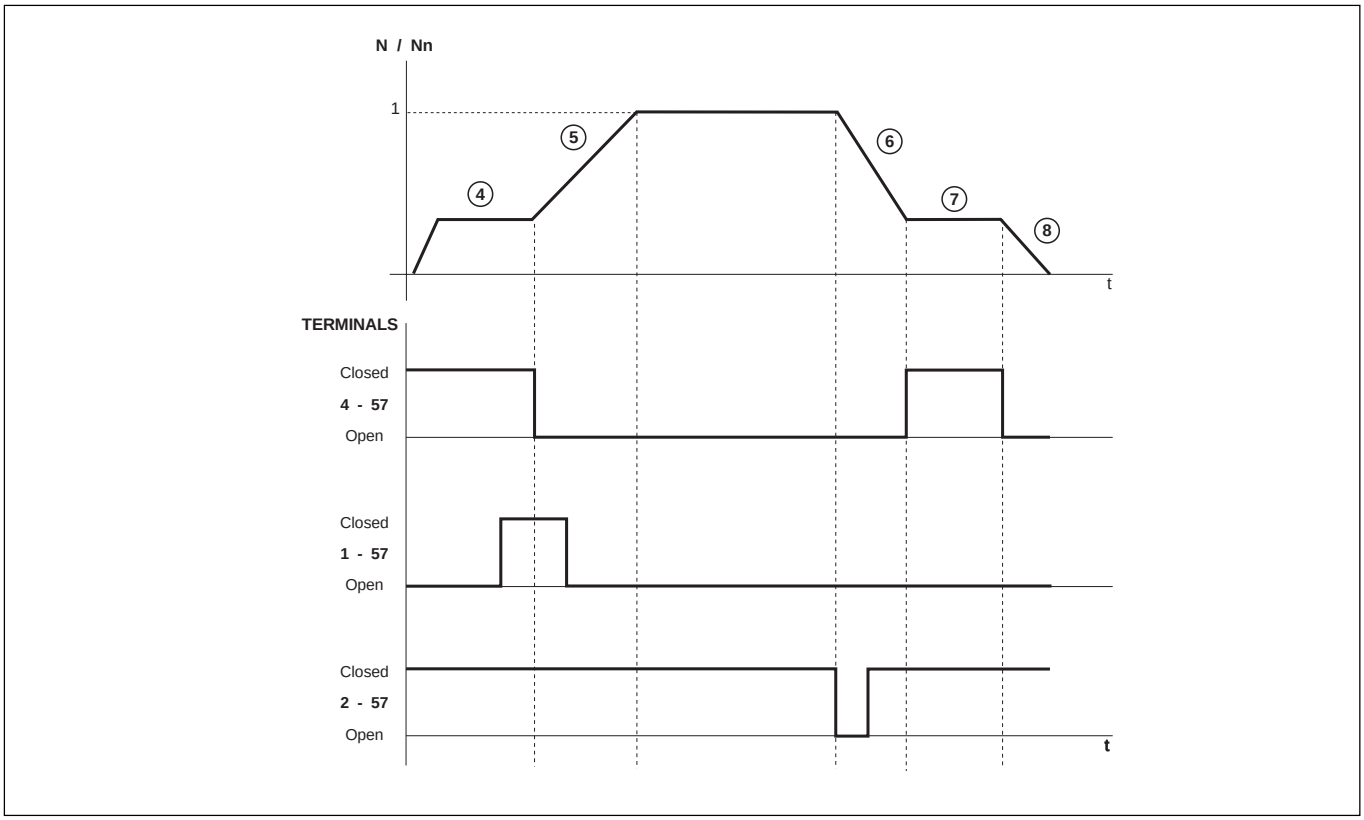
### Linear ramp with T.G. feedback




### Slow speed. Basic diagram

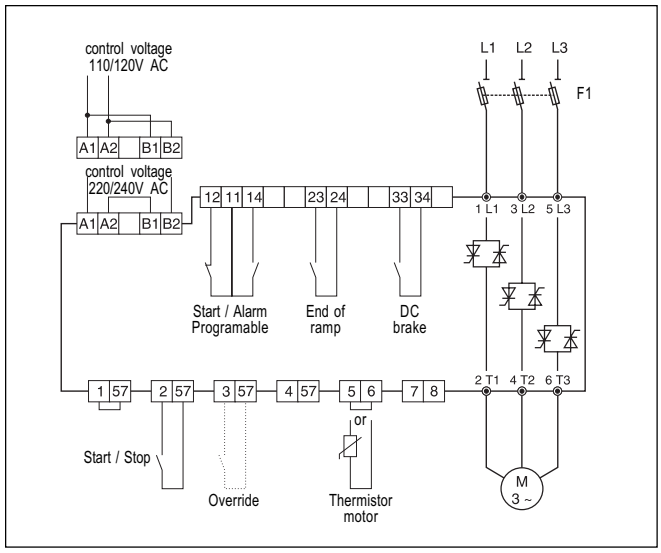



### Slow speed. Full diagram

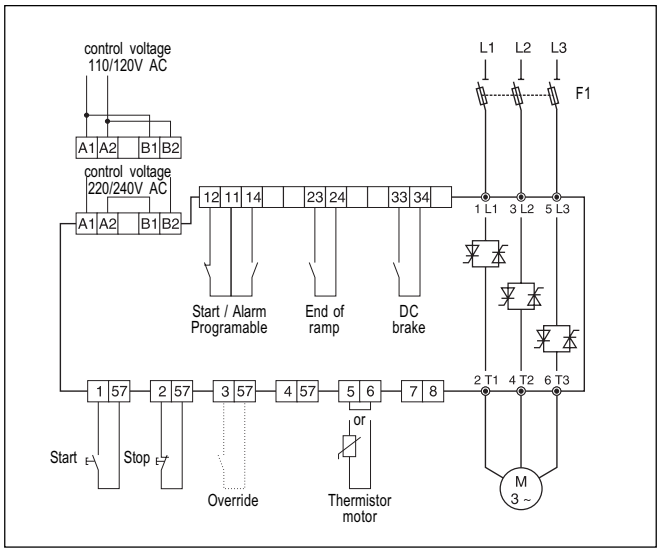


## 3-5. Recommended diagrams

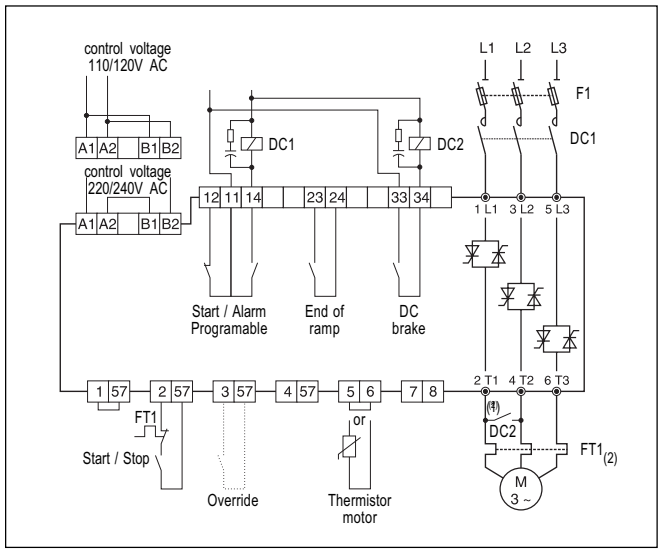
### Basic. Permanent command



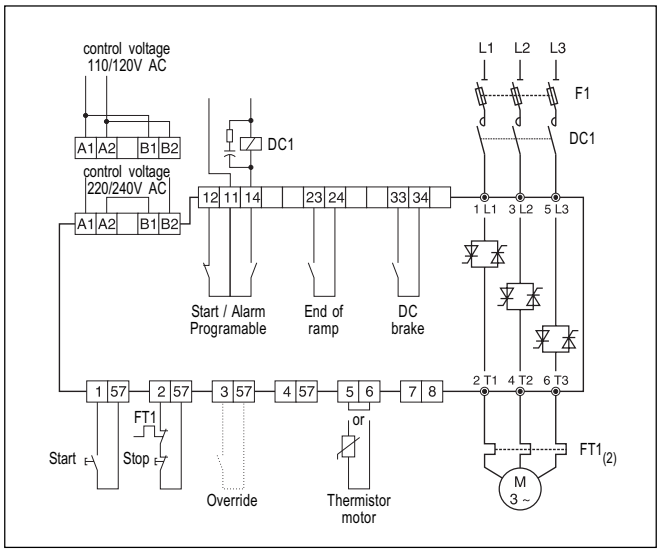

### Basic. Command by push buttons




### Permanent command and DC brake




### Operation by push buttons




(1) The 3 contacts of DC2 must be connected in parallel. Mandatory between 2T1 and 4T2 phases, otherwise a shorcircuit can occur.

(2) Use thermal relay if required by local rules, selecting it according to motor current.

NOTES : The output relays (DC brake, End of ramp and Start/alarm) allow for direct action on contactors up to type CL10 at 220V ac. See usage characteristics for determining the need for an auxiliary relay.

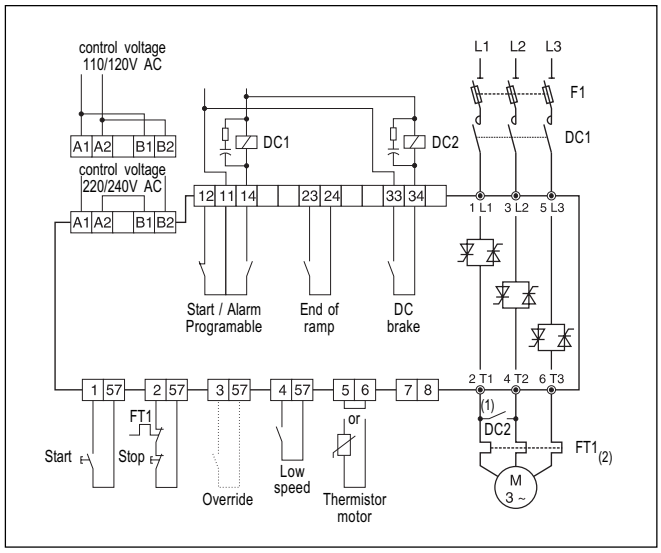
The Programable Run/Alarm relay, only available in ASTAT-CD.
Only RUN relay in ASTAT-C

Motor Thermistor Protection, only available in ASTAT-CD.

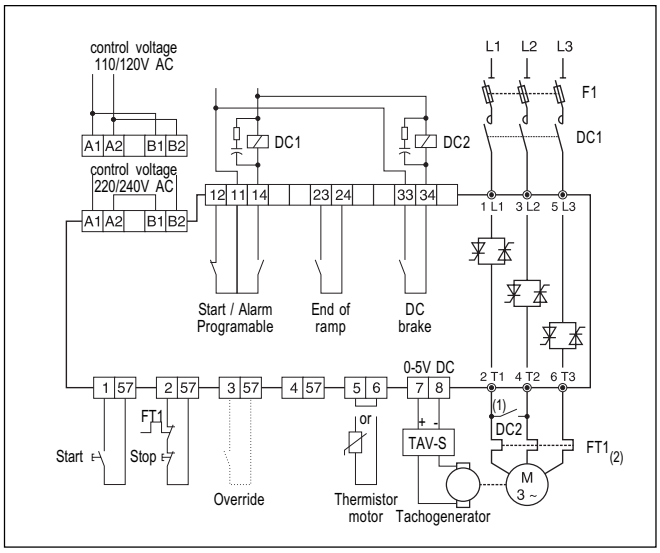
Linear ramp and Slow speed options, only available in ASTAT-CD

## 3-5. Recommended diagrams

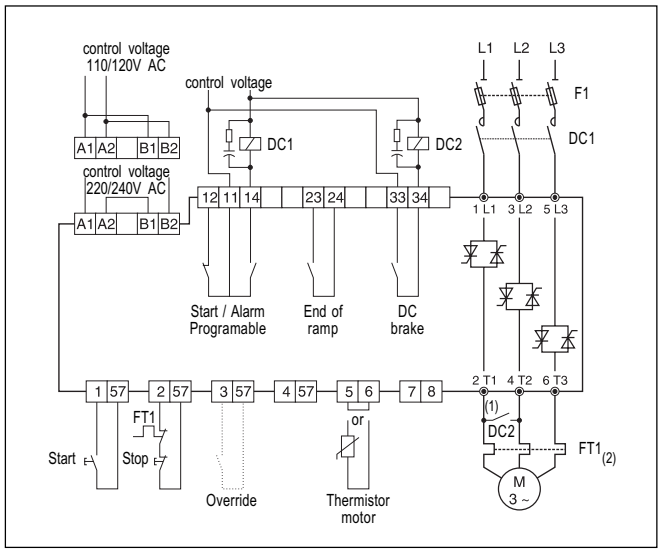
### Operation by push buttons, DC brake and low speed



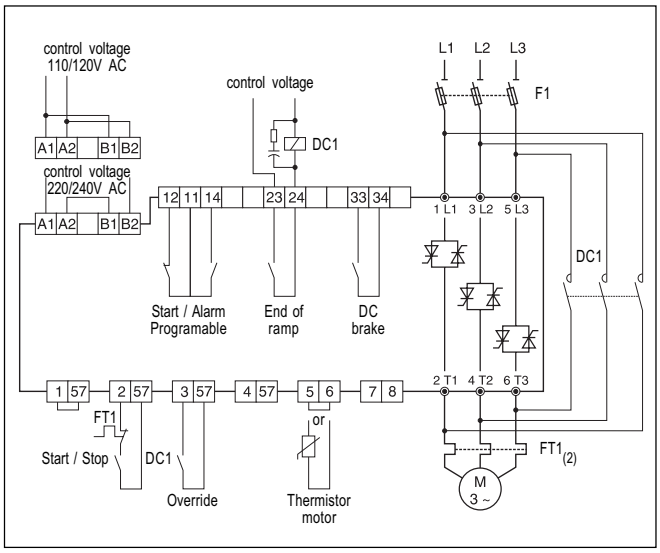

### Operation by push buttons, DC brake and linear ramp




### Operation by push buttons and DC brake




### By-pass with contactor




(1) The 3 contacts of DC2 must be connected in parallel. Mandatory between 2T1 and 4T2 phases, otherwise a shorcircuit can occur.

(2) Use thermal relay if required by local rules, selecting it according to motor current.

NOTES : The output relays (DC brake, End of ramp and Start/alarm) allow for direct action on contactors up to type CL10 at 220V ac. See usage characteristics for determining the need for an auxiliary relay.

The Programable Run/Alarm relay, only available in ASTAT-CD.
Only RUN relay in ASTAT-C

Motor Thermistor Protection, only available in ASTAT-CD.

Linear ramp and Slow speed options, only available in ASTAT-CD

## 3-6. Fuses, contactors and supply wiring

| TYPE | In A | Total losses 100% In W | Fuses aM (F1) A | Fuses FERRAZ type (XX=according mech. design) | Fuses BUSSMANN type (Typower Sicu 660V~) Size | In | Control voltage Fuse A | Consumpt. VA | Contactor DC 1 | Contactor DC 2 (2) | Conductor section mm² |
|---|---|---|---|---|---|---|---|---|---|---|---|
| QC _ F - _ A | 14 | 56 | 20 | 6,600 CP URC 14.51/40 | 00 | 40 | 1 | 18 | CL01 | CL01 | 4 |
| QC _ G - _ A | 17 | 65 | 25 | 6,6 URD 30 XX 0063 | 00 | 50 | 1 | 18 | CL02 | CL02 | 4 |
| QC _ H - _ A | 22 | 74 | 32 | 6,6 URD 30 XX 0080 | 00 | 80 | 1 | 18 | CL03 | CL03 | 4 |
| QC _ I - _ A | 34 | 105 | 63 | 6,6 URD 30 XX 0100 | 00 | 100 | 1 | 18 | CL04 | CL04 | 6 |
| QC _ J - _ A | 48 | 178 | 80 | 6,6 URD 30 XX 0125 | 00 | 125 | 2 | 55 | CL06 | CL04 | 10 |
| QC _ K - _ A | 63 | 236 | 80 | 6,6 URD 30 XX 0160 | 00 | 160 | 2 | 55 | CL07 | CL04 | 16 |
| QC _ L - _ A | 72 | 257 | 100 | 6,6 URD 30 XX 0160 | 00 | 200 | 2 | 55 | CL07 | CL06 | 25 |
| QC _ M - _ A | 105 | 325 | 160 | 6,6 URD 30 XX 0250 | 00 | 250 | 2 | 55 | CL07 | CL06 | 35 |
| QC _ N - _ A | 156 | 591 | 200 | 6,6 URD 30 XX 0315 | 00 | 315 | 2 | 78 | CK75 | CL07 | 50 |
| QC _ Q - _ A | 240 | 901 | 315 | 6,6 URD 31 XX 0500 | 2 | 550 | 2 | 78 | CK85 | CK75 | Bus bar (1) |
| QC _ R - _ A | 315 | 1063 | 400 | 6,6 URD 31 XX 0630 | 2 | 630 | 4 | 118 | CK95 | CK85 | Bus bar (1) |
| QC _ S - _ A | 370 | 1136 | 500 | 6,6 URD 32 XX 0800 | 2 | 800 | 4 | 118 | CK10 | CK85 | Bus bar (1) |
| QC _ T - _ A | 500 | 1816 | 630 | 6,6 URD 33 XX 1000 | 3 | 1000 | 4 | 118 | CK11 | CK95 | Bus bar (1) |
| QC _ U - _ A | 630 | 2015 | 800 | 6,6 URD 33 XX 1250 | 3 | 1250 | 4 | 248 | CK12 | CK10 | Bus bar (1) |
| QC _ V - _ A | 850 | 2491 | 1000 | 6,6 URD 233 XX 2000 | - | - | 4 | 248 | CK13 | CK10 | Bus bar (1) |
| QC _ X - _ A | 1180 | 3493 | 1250 | 6,6 URD 233 XX 2000 | - | - | 4 | 248 | CK13 | CK12 | Bus bar (1) |

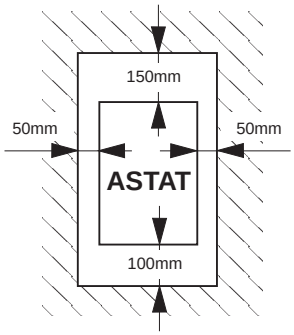
(1) As per IEC 947 (2) The 3 contacts of DC2 must be connected in parallel

## 3-7. Equipment installation

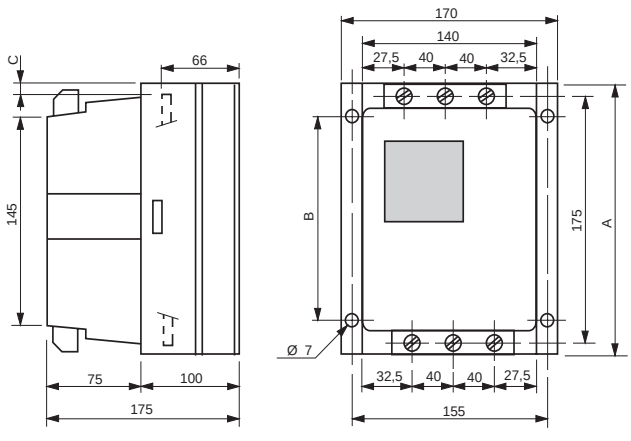
When installing equipment, keep the following points in mind :

- The equipment should be installed vertically and hang over a platform or bars. The vertical position is essential for proper cool air circulation
- Environmental conditions are in accordance with the following ranges and maximum values :
  - Operating temperature : 0ºC to +55ºC
  - Relative humidity (without condensation) : 95%
  - Maximum altitude : 3000m

  Reduce usage intensity by 1.5% / ºC from 45ºC and 1% / 100m from 1000m
- Do not install equipment in environments containing explosive or flammable gases, or near important heat sources
- Equipment should be well ventilated, at least keeping clearances as indicated in the following illustration.
- When equipment is to be mounted on a platform subject to strong vibrations, there should be an elastic base to protect the equipment.

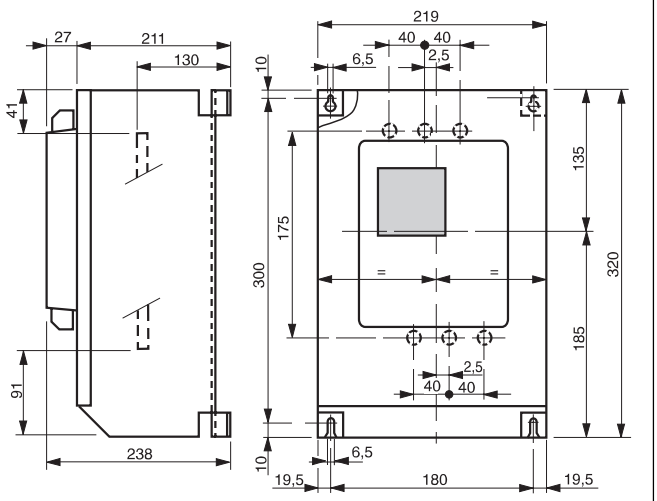



## 3-8. Dimensions

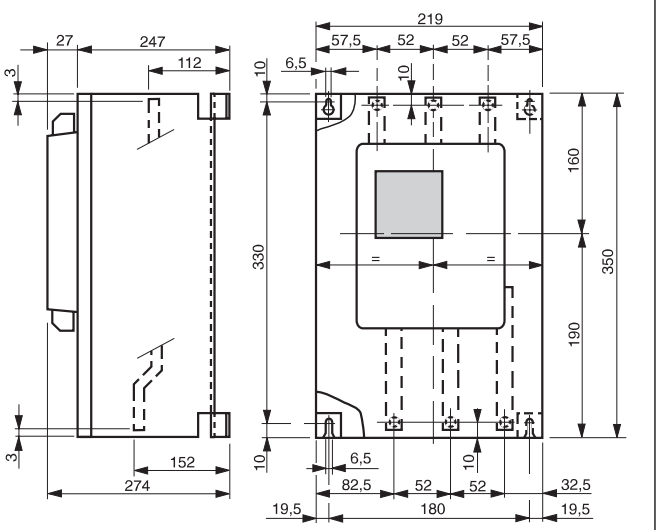



| | A | B | C |
|---|---|---|---|
| QC_F-_A | 200 | 160 | 6 |
| QC_G-_A | 200 | 160 | 6 |
| QC_H-_A | 200 | 160 | 6 |
| QC_I-_A | 250 | 200 | 31 |

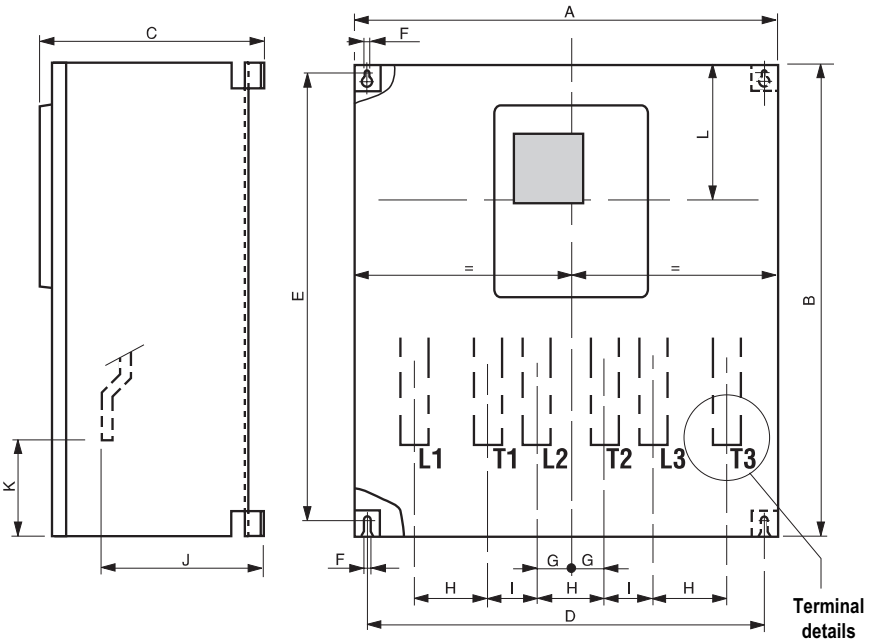
## 3-8. Dimensions



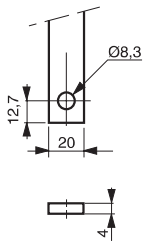

QC _ J - _ A , QC _ K - _ A



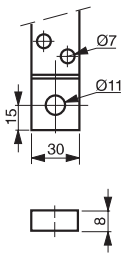

QC _ L - _ A , QC _ M - _ A



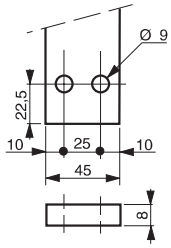

**Terminal detail**



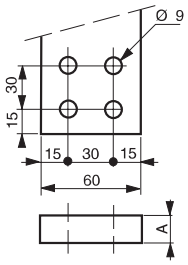

QC _ N - _ A
QC _ Q - _ A




QC _ R - _ A
QC _ S - _ A

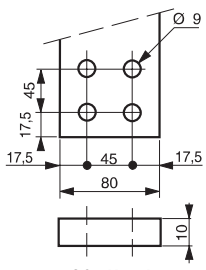



QC _ T - _ A




| | A |
|---|---|
| QC _ U - _ A | 6 |
| QC _ V - _ A | 10 |

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| QC_N-_A | 510 | 490 | 305 | 460 | 465 | 9 | 53 | 106 | 54 | 259 | 70 | 168 |
| QC_Q-_A | 510 | 490 | 305 | 460 | 465 | 9 | 53 | 106 | 54 | 259 | 70 | 168 |
| QC_R-_A | 550 | 540 | 317 | 480 | 495 | 9 | 59 | 118 | 54 | 275 | 78 | 168 |
| QC_S-_A | 550 | 540 | 317 | 480 | 495 | 9 | 59 | 118 | 54 | 275 | 78 | 168 |
| QC_T-_A | 590 | 685 | 317 | 520 | 640 | 9 | 59 | 118 | 64,5 | 270 | 100 | 168 |
| QC_U-_A | 790 | 850 | 402 | 700 | 805 | 11 | 60 | 120 | 120 | 352 | 120 | 175 |
| QC_V-_A | 790 | 850 | 402 | 700 | 805 | 11 | 60 | 120 | 120 | 352 | 120 | 175 |
| QC_X-_A | 810 | 1000 | 407 | 720 | 955 | 11 | 70 | 140 | 110 | 357 | 120 | 175 |




QC _ X - _ A

# 4. Start-up. ASTAT-C and ASTAT-CD

## 4-1. Equipment installation

**CAUTION!** DISCONNECT POWER BEFORE INSTALLING OR SERVICING

ONLY SPECIALIZED PERSONNEL SHOULD INSTALL THE EQUIPMENT AND ONLY AFTER HAVING READ THIS USER'S GUIDE.

THE USER ITSELF IS RESPONSIBLE FOR ANY PHYSICAL INJURY OR MATERIAL DAMAGE RESULTING FROM MISHANDLING THE EQUIPMENT.

IF YOU HAVE ANY DOUBTS ABOUT ANY PROCEDURE, PLEASE CONTACT YOUR DEALER.

## 4-2. Remarks

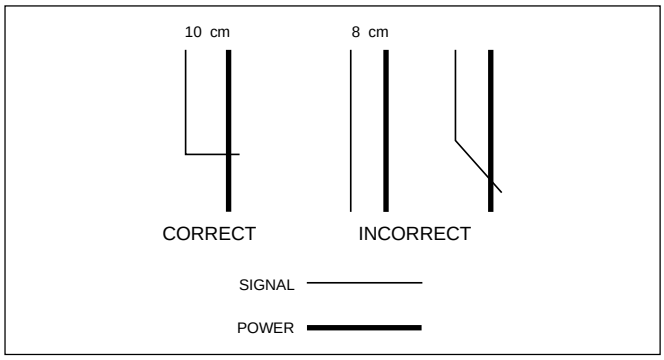
Supply wire conductors should have the same section as direct starters. As an indication, **Vd** voltage drop in wires should not be more than 2%.

$$Vd = \frac{\sqrt{3} \times R \times L \times In}{1000}$$

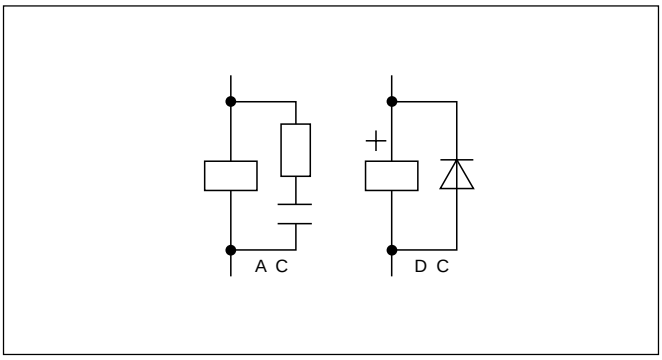
R = conductor resistance (mΩ / m)
L = conductor length (m)
In = motor rated current (A)

| Conductor section ($mm^2$) | 2,5 | 4 | 6 | 10 | 16 | 25 | 35 | 50 | 100 | 150 |
|---|---|---|---|---|---|---|---|---|---|---|
| Resistance R (Cu) 20ºC (mΩ / m) | 7,5 | 4,55 | 3,05 | 1,85 | 1,13 | 0,725 | 0,528 | 0,254 | 0,183 | 0,122 |
| Resistance R (Al) 20ºC (mΩ / m) | | | | | 1,86 | 1,188 | 0,868 | 0,416 | 0,3 | 0,2 |

Signal wiring should be no longer than 50cm, and should be separate from power wires (line, motor, command relays, etc.) by at least 10cm, and if they cross, they should do so at a 90º angle




Relays and contactors located in the same housing as the equipment should have an RC suppressor parallel to the coil (or a reverse diode, if controled by DC).



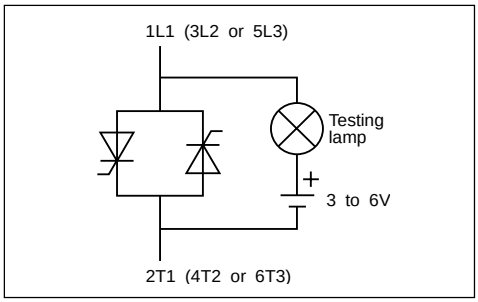

Do not install capacitors to correct the power factor between equipment output and motor

If the equipment is fed by a line transformer, its rated power should be at least 1.5 times, but less than 10 times, higher than equipment supply.

## 4-3. Thyristor check

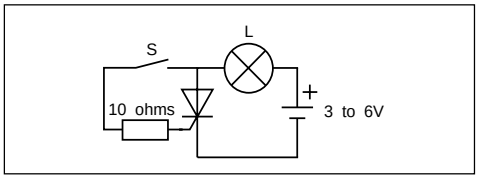
**Shortcircuit**

Use a testing lamp to check the defective power module between input and output phases.
If the lamp goes on, at least one of the thyristors has a shorcircuit.
Check with a tester the value or the R resistance between input and output of the same phase (connector B on main PCB must be previously removed)
If R < 500KΩ, at least one of the thyristor is defective

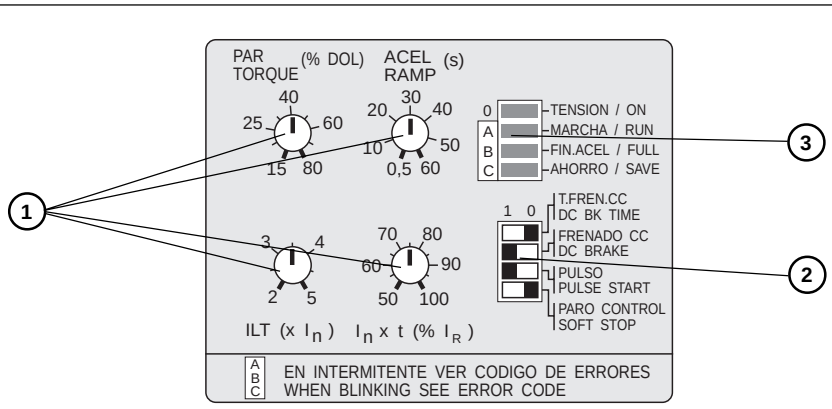



**Open thyristor**

With the simple assembling shown here, the lamp should light when the S switch is closed and remain lighting when open.
If not, the thyristor is defective.



## 4-4. Analog control panel description (ASTAT-C)




### Potentiometers (1)

| | |
|---|---|
| **PAR / TORQUE (% DOL)** | Starting torque in % referring to direct starting torque |
| **ACEL / RAMP** | Acceleration ramp time (in seconds) ($t_{ramp}$) |
| **In x t** | Nominal current In of motor in reference to nominal current Ir of equipment, in %. |
| **ILT** | Current limit in acceleration condition, in reference to nominal current In of motor. |

### Dip-Switches (2)

| | Position | Function |
|---|---|---|
| **T FREN CC DC BK TIME** | **1** | Select DC brake time = $t_{ramp}$/3 |
| | **0** | Select DC brake time = 5 seconds |
| **FRENADO CC DC BRAKE** | **1** | DC brake function ON. When equipment finishes the stop state (soft stop or power cut-off), DC is generated by 4T2 and 6T3 phases for duration set up by the **DC BK TIME** Dip- Switch. |
| | **0** | DC brake OFF. |
| **PULSO PULSE START** | **1** | Pulse start function ON. When started, equipment generates a 0.9 Un voltage pulse for 400ms duration and later continues with the preselected starting torque and ramp time. |
| | **0** | Pulse start function OFF. |
| **PARO CONTROL SOFT STOP** | **1** | Soft stop. Upon receiving stop command, equipment stops by decreasing voltage ramp in a time frame that depends upon the energy savings state selected by stop command (max. 2 x $t_{ramp}$). |
| | **0** | No soft stop. Equipment stops by power cut-off by receiving stop command. |

### LED's (3)

○ OFF
● ON
⊗ ON / OFF
◐ BLINKING

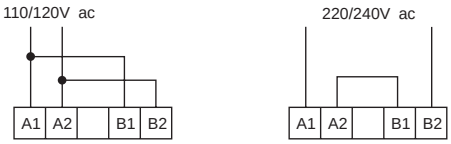
| 0 | A | B | C | OPERATION CODE |
|---|---|---|---|---|
| ● | ⊗ | ⊗ | ⊗ | Equipment is connected to main supply |
| ● | ● | ⊗ | ⊗ | Run |
| ● | ● | ● | ⊗ | End of acceleration |
| ● | ● | ● | ● | Effective energy saving |

| 0 | A | B | C | ERROR CODE |
|---|---|---|---|---|
| ● | ○ | ◐ | ○ | Stop order |
| ● | ● | ◐ | ○ | Frequency out of range |
| ● | ○ | ◐ | ● | Overload trip |
| ● | ● | ◐ | ● | Phase sequence lost |
| ● | ◐ | ○ | ○ | Loss of synchronism |
| ● | ◐ | ● | ○ | U phase scr |
| ● | ◐ | ○ | ● | V phase scr |
| ● | ◐ | ● | ● | W phase scr |
| ● | ○ | ○ | ◐ | Heatsink overtemperature |
| ● | ● | ○ | ◐ | Phase U lost |
| ● | ○ | ● | ◐ | Phase V lost |
| ● | ● | ● | ◐ | Phase W lost |
| ● | ○ | ◐ | ◐ | Stalled rotor |
| ● | ● | ◐ | ◐ | Internal error |

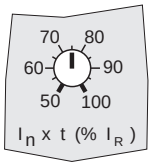
## 4-5. Start-up

- Make sure equipment wiring corresponds to one of the recommended routing diagrams or equivalent

- Make sure the control wire harness corresponds to the control voltage used.

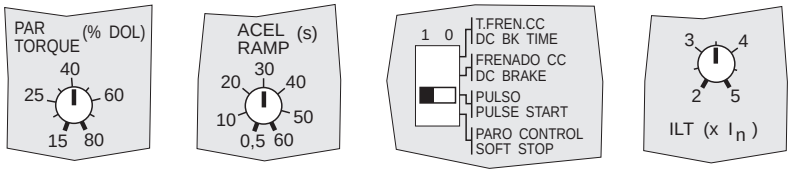



- Adapt equipment rated current to motor, with In x t




$$(In \times t) = \frac{In\ (motor)}{Ir\ (unit)} \times 100$$

- Set starting parameters as needed :



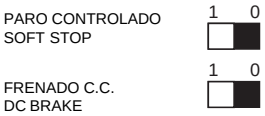

Starting torque | Ramp time | Pulse start | Current limit

$$ILT = \frac{Im\ (start)}{In\ (motor)}$$

- Set braking parameters as needed :

  Power cut-off / Soft stop

  DC injection brake




- Send run command to equipment and make sure that operation is correct.

## 4-6. Error detection

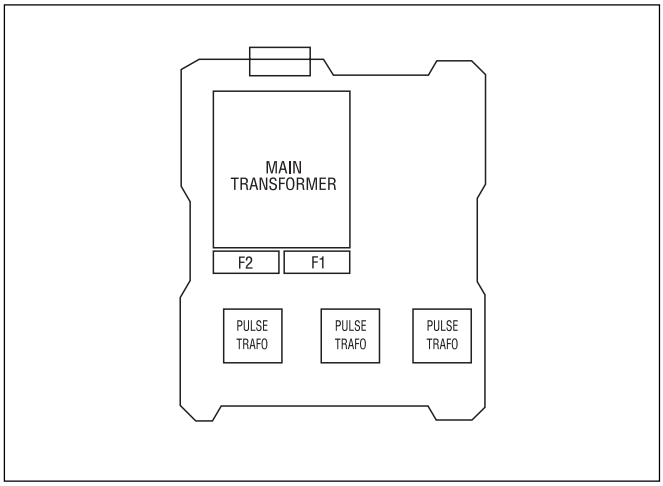
| Symptom or Error | Possible Cause | Measures to be taken |
|---|---|---|
| **LED "0" off** | No control voltage | Check wire harness and control voltage |
| | F1 fuse blown on power supply PCB | Check and change |
| | Bad connection of flat wire joining power supply PCB to control PCB | Verify connectors |
| **Equipment does not respond to STOP / START controls** | F2 fuse blown on power supply PCB | Check and change |
| **Frequency error (admits 48Hz ≤ f main ≤ 62Hz)** | No **1L1** phase or frequence is out of range | Check **1L1** phase and/or mains frequence |

## 4-6. Error detection

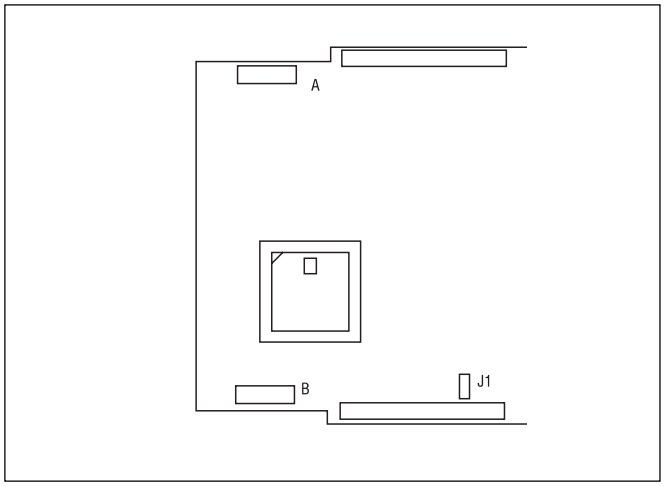
| Symptom or Error | Possible Cause | Measures to be taken |
|---|---|---|
| **Overload trip** | Equipment overload higher than 125% In | Verify overload conditions during starting time and steady stade.<br>Increases In x t if necessary |
| **Phase sequence loss** | Disturbance in mains supply | Check notches or dropouts in power line |
| | Defective thyristor | Check thyristors |
| | No input phases | Check **1L1, 3L2** and **5L3** phases |
| **Synchronism loss** | Phase **1L1** lost | Check **1L1** phase |
| **Phase U, V, W thyristor** | Shortcircuited thyristor | Check thyristor module |
| | No output phases | Check **2T1, 4T2** and **6T3** phases |
| **Heatsink thyristor** | Heatsink thermostat released by overheating or defective | Check thermostat and wire harness |
| | J1 jumper not connected in main PCB | Check and connect |
| **No phase U, V, W conduction** | No input / output phases | Check power wire harness for **1L1, 3L2, 5L3, 2T1, 4T2** and **6T3** |
| | Defective thyristor or bad wire harness | Verify gate and cathode wire harness.<br>Verify thyristors |
| **Stalled rotor** | Equipment detected stalled motor rotor | Restart equipment and check for an appreciable loss in motor speed at any time (i.e. when the motor is loaded. In this case, try jumping the bypass terminals **3-57** at the end of acceleration ramp). |
| **Internal failure** | Microcontroller malfunction | Check IC1 and IC2 are correctly inserted in their sockets |

### 4-7. P.C.B. 's

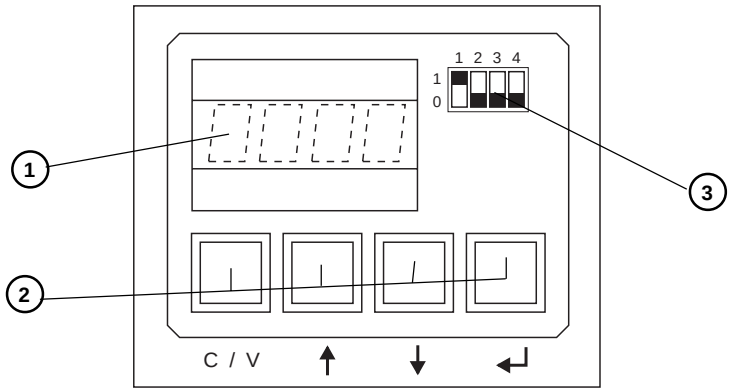
**Supply**



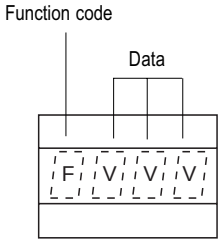

**Control**



## 4-8. Digital control panel description (ASTAT-CD)




### Display (1)




| F V V V | Running code |
|---|---|
| O N | Equipment is connected to main supply (equipment is ON) |
| S T O P | Stop |
| L O C K | Remote stop |
| P U L S | Kick start |
| R A M P | Acceleration ramp |
| F U L L | Full conduction |
| S A V E | Energy saving |
| S O F T | Soft stop |
| P U M P | Pump control |
| D C B K | DC braking |
| F U L L | Override (full voltage) |
| I N C H | Inching / slow speed |
| T A C H | Linear ramp (tacho) |

| F V V V | Error code |
|---|---|
| E 0 1 0 | Frequency out of range |
| E 0 1 1 | Overload trip |
| E 0 1 2 | Phase sequence lost |
| E 0 1 3 | Loss of synchronism |
| E 0 1 4 | Phase U scr |
| E 0 1 5 | Phase V scr |
| E 0 1 6 | Phase W scr |
| E 0 1 7 | Heatsink overtemperature |
| E 0 1 8 | Motor thermistor |
| E 0 1 9 | Phase U lost |
| E 0 2 0 | Phase V lost |
| E 0 2 1 | Phase W lost |
| E 0 2 2 | Stalled rotor |
| E 0 2 3 | Internal error |
| E 0 2 4 | No motor load |
| E 0 2 5 | Long start time |
| E 0 2 6 | Long slow speed time |

### Pushbuttons (2)

C / V — Use with ↑ or ↓ to select the parameter or function code to be displayed and/or modified

↓ — Decreases the value of the selected parameter

↑ — Increases the value of the selected parameter

↵ — - Introduces the new parameter value into memory
- Updates the selected parameter value with the displayed value

### Dip-Switch (3)

| DS | Position | Function |
|---|---|---|
| 1 | 1 | Selects REMOTE mode. In this position, equipment control is performed through communication RS-422/485 |
| | 0 | Selects LOCAL mode. Equipment control is performed locally with terminals 1, 2, 3, 4, 7, 8 and 57 |
| 2 | 1 | No load motor detection |
| | 0 | Disabled |
| 3 | 1 | Linear ramp with tachogenerator feedback option (if DS4 = 0) / Low slow speed selection (14%) (if DS4 = 1) |
| | 0 | Standard voltage ramp (if DS4 = 0) / High slow spped slection (7%) (if DS4 = 1) |
| 4 | 1 | Inching / Slow speed option. Control with terminals 4 - 57 |
| | 0 | Disabled |

## 4-9. Display functions description

| Function | Display | Description |
|---|---|---|
| Status | S L P R F S S P D I T — O T O U A U A O U C N A — N O C L M L V F M B C C — P K S P L E T P K H H | Working condition displayed |
| Error | E 0 x x | Error code displayed x x = 10 - 26 |
| Trace errors<br>(last four errors can be displayed using<br>key ↑ or ↓ at ON, STOP or LOCK status) | e y x x | y = 0 - 3, error number<br>x x = 10 - 26, error code |
| Motor current | M x x x | x x x = % In (read only) |
| Nominal motor current (In) | N x x x | x x x = 40 - 100 % Ir (rated ASTAT current) |
| Current limit | L x x x | x x x = 100 - 500 % In |
| Starting torque | T _ x x | x x = 10 - 90 % DOL |
| Acceleration ramp time | a x x x | x x x = 1 - 999 seconds |
| Deceleration ramp time | d x x x | x x x = 1 - 999 seconds |
| Kick start time (1) | p x x x | x x x = 0 - 999 miliseconds |
| DC braking time (1) | b _ x x | x x = 0 - 99 seconds |
| DC braking current (1) | I x x x | x x x = 50 - 250 % In |
| Soft stop | S x x x | x x x = ON (standard soft stop if C = OFF)<br>(Pump control if C = ON)<br>(Linear ramp if DS3 = ON. It needs option)<br>x x x = OFF (free ramp stop) |
| Pump control (1) | C x x x | x x x = ON / OFF |
| Kick - start | P x x x | x x x = ON / OFF |
| Override | F x x x | x x x = ON / OFF (read only)<br>(full voltage output / Energy saving) |

(1) If Pump Control is enabled (C = ON), the "Kick Start" and "DC Brake" functions are automatically disabled, so the parameters "p", "b" and "I" are now used to set the PID Pump Control algorithm.

| | | | |
|---|---|---|---|
| Load detection | p x x x | x x x = 0 - 25 | (default = 0 in 50Hz P. Source)<br>(default = 15 in 60Hz P. Source) |
| Proportional control | b x x x | x x x = 0 - 20 | (default = 10) |
| Integral time control | I x x x | x x x = 50 - 75 | (default = 50) |

## 4-9. Display functions description

| Function | Display | Description |
|---|---|---|
| Override | **F x x x** | x x x = ON / OFF (read only)<br>(full voltage output / Energy saving) |
| DC injection brake | **B x x x** | x x x = ON / OFF |
| Run/Alarm relay (2) | **r x x x** | x x x = ON (alarm relay output)<br>OFF (run relay output) |
| Overload trip curve (3) | **o l x x** | x x = SD ; standard duty curve<br>HD ; heavy duty curve (4) |
| EEPROM programming keyword | **K x x x** | x x x = 000 - 999<br>= ON (ON = 69 + ↵) |
| EEPROM programming | **W x x x** | x x x = ON (writting = ON + ↵)<br>= OFF |
| EEPROM reading | **R x x x** | x x x = ON (ON + ↵ restore EEPROM to RAM)<br>OFF |
| EEPROM w/operations | **x x x x** | x x x x = Number of writtings (x10) |
| Soft version | **V (x1) (x2)** | X 1 = ASTAT soft version<br>X 2 = ASTAT option |

(2) RUN mode : The contact 11-14 closes when the RUN order is given, and opens either if the STOP order is given or an error is found.
ALARM mode : The contact 11-14 closes as soon as control power is applied, and only opens if a fault is produced.

(3) See figure on page E/S

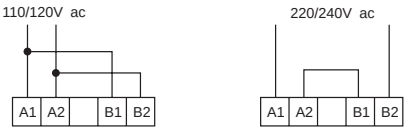
(4) CAUTION ! : When selecting the heavy duty curve, make sure the power of motor is less or equal to maximum power rating, according to the table on pageE/S

## 4-10. Start-up

- Make sure equipment wiring corresponds to one of the recommended routing diagrams or equivalent

- If the motor does not have thermal protection sensor, a link must be set beetwen terminals 5 and 6

- Make sure the control wire harness corresponds to the control voltage used.




- Adapt equipment rated current to motor, setting the motor current In

$$N\,x\,x\,x\,;\ x\,x\,x = \frac{In\ (motor)}{Ir\ (unit)} \times 100$$

**Factory setting**

N 1 0 0

- Set overload trip curve as needed

o l x x ; x x SD = standard duty
HD = heavy duty

**Factory setting**

o l S D

- Set starting parameters as needed :

$$L\,x\,x\,x = \frac{Im\ (start)}{In\ (motor)} \times 100$$

| | | **Factory setting** |
|---|---|---|
| Starting torque | T _ x x | T _ 1 5 |
| Acceleration ramp time | a x x x | a _ 2 0 |
| Kickstart | P ON/OFF | P OFF |
| Kickstart time | p x x x (if P ON) | P 1 0 0 |
| Current limit | L x x x | L 3 0 0 |

- Set braking parameters as needed :

| | | **Factory setting** |
|---|---|---|
| Soft stop | S ON/OFF | S OFF |
| Decceleration ramp time | d x x x | d _ 2 0 |
| DC injection brake | B ON/OFF | B OFF |
| DC braking time | b _ x x (if B ON) | b _ _ 5 |
| DC braking current | I x x x (if B ON) | I 1 5 0 |

If do you wish to keep this configuration, write the parameters in EEPROM as follows :

- Set parameter K to ON (ON = 69 + ↵ )
- Set parameter W to ON
- Press ↵ (parameter W is set to OFF automatically)

- Send run command to equipment and make sure that operation is correct.

## 4-11. Error detection

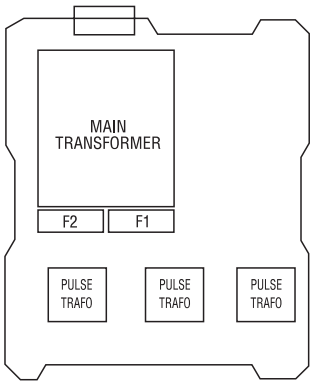
| Symptom or Error | Possible Cause | Measures to be taken |
|---|---|---|
| **Display OFF** | No control voltage | Check wire harness and control voltage |
| | F1 fuse blown on power supply PCB | Check and change |
| | Bad connection of flat wire joining power supply PCB to control PCB | Verify connectors |
| **Equipment does not respond to STOP / START controls** | F2 fuse blown on power supply PCB | Check and change |
| **Frequency error (admits 48Hz ≤ f main ≤ 62Hz)** | No **1L1** phase or frequence is out of range | Check **1L1** phase and/or mains frequence |
| **Overload trip** | Equipment overload higher than 125% In | Verify overload conditions during starting time and steady stade.<br>Increase N parameter if necessary |

## 4-11. Error detection

| Symptom or Error | Possible Cause | Measures to be taken |
|---|---|---|
| **Phase sequence loss** | Disturbance in power line | Check notches or dropouts in power line |
| | Defective thyristor | Check thyristors |
| | No input phases | Check **1L1**, **3L2** and **5L3** phases |
| **Synchronism loss** | Phase **1L1** lost | Check **1L1** phase |
| **Phase U, V, W thyristor** | Shortcircuited thyristor | Check thyristor module |
| | No output phases | Check **2T1**, **4T2** and **6T3** phases |
| **Heatsink thermostat** | Heatsink thermostat tripped by overheating or defective | Check thermostat and wiring |
| **Motor thermistor** | Motor thermistor tripped by overheating or defective | Check thermistor and wiring |
| **Phase U, V, W loss** | No input / output phases | Check power wire harness for **1L1**, **3L2**, **5L3**, **2T1**, **4T2** and **6T3** |
| | Defective thyristor or bad wire harness | Verify gate and cathode wire harness. Verify thyristors |
| **Stalled rotor** | Equipment detected stalled motor rotor | Restart equipment and check for an appreciable loss in motor speed at any time (i.e. when the motor is loaded. In this case, try jumping the bypass terminals **3-57** at the end of acceleration ramp). |
| **Internal error** | Microcontroller malfunction | Check IC1 and IC8 are correctly inserted in their sockets |
| **No motor load** | Motor running at no load condition and dip-switch 2 is set at 1 position | Check no load condition. Jumping the bypass terminals 3 - 57, the no load detection is disabled. |
| **Long start time** | Current limit condition present more than 2 x ta sec. or 240 sec. (ta = acceleration ramp time) | Increase current limit and / or acceleration ramp time |
| **Long slow speed time** | Equipment has been in slow speed mode more than 120 sec. | Avoid this condition |

### 4-12. P.C.B. 's

**Supply**




**Control**