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DIGISTART **Electronic starter** **Installation and maintenance manual**

Electronic starter DIGISTART

CONTENTS

	Pages
1 - GENERAL	
1.1 Basic principles	4 - 5
1.2 Description	6
1.3 Circuit diagram	7
1.4 Reference code	8
1.5 Definitions	8
1.6 General specification	9
2 - SELECTION	
2.1 Selection of voltage	10
2.2 Selection of power	10
2.2.1 Rapid selection	10
2.2.2 Detailed selection	11
2.3 Basic features and options	12
2.3.1 Basic features	12
2.3.2 Options	12 to 15
3 - OPERATION - INSTALLATION - CONNECTIONS	
3.1 Inspection on delivery	15
3.2 Unpacking	15
3.3 Precautions on installation	15
3.4 Overall dimensions of DIGISTART 30 A	16
3.5 Overall dimensions of DIGISTART 45 A and 72 A	17
3.6 Overall dimensions of DIGISTART 110 A and 175 A	18
3.7 Overall dimensions of DIGISTART 265 A - 365 A - 500 A and 565 A	19 - 20
3.8 Overall dimensions of DIGISTART 750 A	20
3.9 Connections	21
3.9.1 Important Recommendations	21
3.9.2 General connection diagram	22
3.9.3 Connection diagrams - Special applications	23
3.9.4 Use of terminal block J5	24
4 - OPERATING INSTRUCTIONS FOR THE DIGISTART	
4.1 Programming	25
4.2 Keyboard	26
4.3 Definition of address	27 to 31
4.4 Fault identification	32
4.5 Example	33
5 - COMMISSIONING	
5.1 Introduction	34
5.2 Commissioning via the keyboard using factory preset values	34
5.3 Commissioning via the keyboard including modification of the main parameters	35
5.4 Adapting the DIGISTART to the installation	36 to 39
5.5 Parameter display	40
5.6 Example : Adapting a DEC 3-365 AB to a particular application	41 - 42
6 - FAULT FINDING	
6.1 Possible causes of trip-out	43
6.2 Possible causes of non-operation	44
7 - SPARE PARTS	44
RECAP OF ADDRESSES	45 - 46

Electric starter DIGISTART

1. - GENERAL

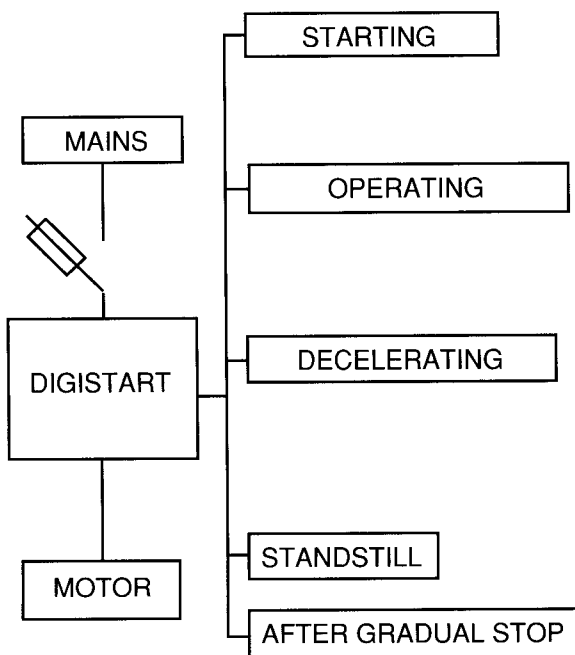
1.1 - Basic principles

- The DIGISTART is a multi-function electronic system controlled by a 16 bit microprocessor designed for use with **ALL THREE PHASE CAGE INDUCTION MOTORS.**

It ensures **progressive** starting with :

- . Reduced starting current
- . Smooth and steady acceleration obtained by monitoring the current absorbed by the motor.

- After start-up, the DIGISTART provides the following **ADDITIONAL FEATURES** :



- **Progressive starting via current ramp with limitation of current** or constant acceleration via tachogenerator feedback (option B).

- **Protection for DIGISTART (1)**

- **Protection for motor (1)**

- **Restart after breaks < 1 sec.**

- **Reactive power control**

- **Power limiting (option A)**

- **Programmable operation of the relays (option A)**

- **Coast stop**

. or gradual stop (option A)

. or braking (option C)

. or constant deceleration via tachogenerator feedback (option B).

- Condensation protection, standstill control (option C).

- Drying of windings (option C).

(1) Protection for motor, DIGISTART and system against the following faults:

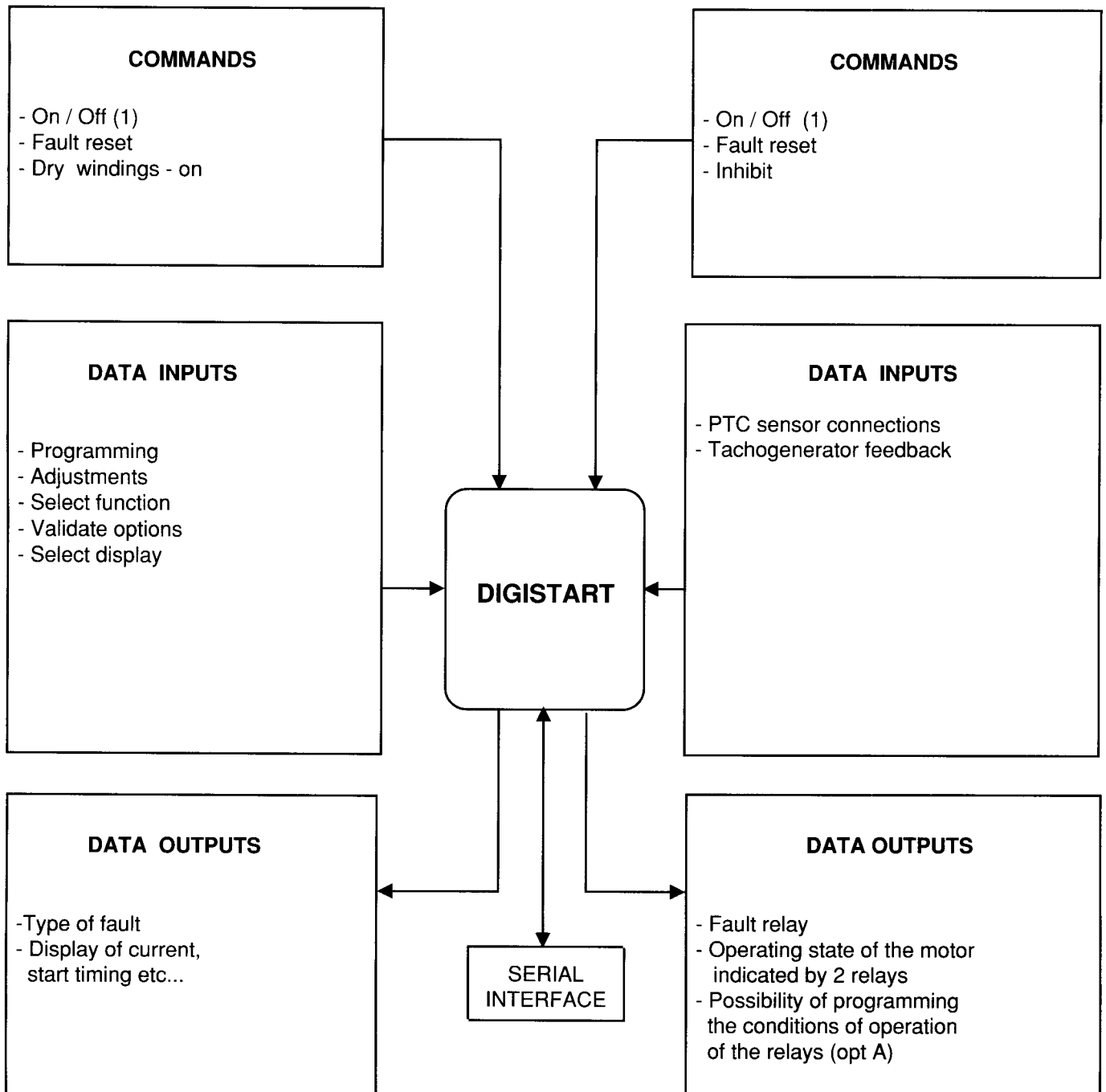
- . Mains undervoltage
- . Motor over temperature (PTC sensors)
- . Phase imbalance
- . Phase loss
- . Overheating of DIGISTART power stages
- . Momentary interruptions to mains supply

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- The DIGISTART communicates:

VIA KEYBOARD AND DIGITAL DISPLAY

VIA TERMINAL BLOCK



(1) Keyboard or terminal block selected via program.

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1.2 - Description

The DIGISTART comprises :

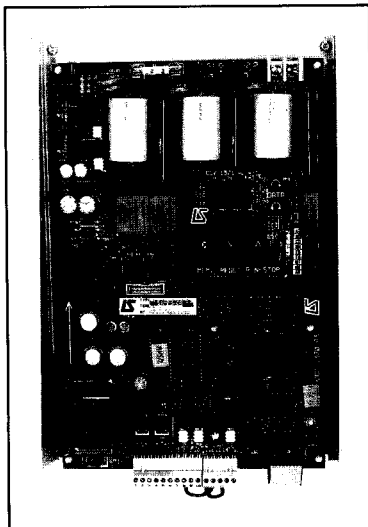
A - POWER STAGE



DEC 3 - 110

- 1 HEATSINK to dissipate excess heat from power thyristors.
 - 3 PAIRS OF THYRISTORS (+ 1 extra thyristor for option C) for current regulation.
 - 1 TEMPERATURE SENSOR fitted to heatsink to protect thyristors (1).
 - 2 CURRENT TRANSFORMERS for protection devices and current regulation.
 - 1 FORCED VENTILATION FAN with power supply (1).
 - 3 HIGH SPEED FUSES for DIGISTART 265 to 750 A.
- (1) Except on DEC 30

B - CONTROL STAGE

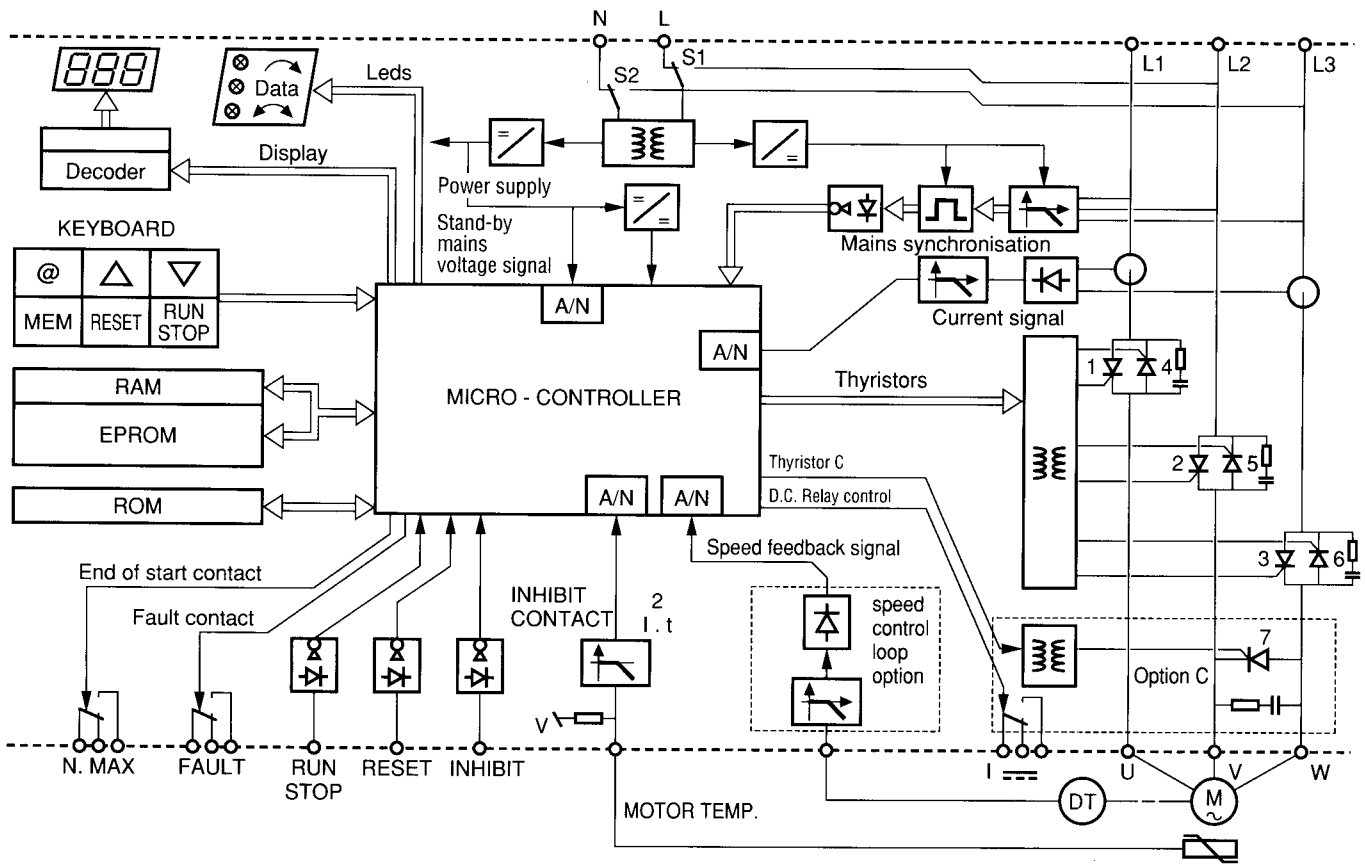


DEC 3 - 110

- 1 PRINTED CIRCUIT BOARD on which is fitted :
 - . remote control terminal block.
 - . supply transformer.
 - . output relays.
 - . microprocessor.
 - . program EPROM.
 - . serial interface.
 - . electronic control circuits.
- . 2 power terminals (used in cases where the PCB is powered by a supply other than that supplying the motors).
- 1 DIGITAL DISPLAY AND KEYBOARD
- 1 OPTIONAL BOARD (option B or C) as required.

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1.3 - Circuit diagram



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1.4 - Reference code

Example : DEC3 - 175 AC

DEC	General reference	DEC : DIGISTART
3	Mains Voltage (50 or 60 Hz)	1 : 208 V 2 : 220 - 240 V 3 : 380 V - 415 V 4 : Not used 5 : 440 - 460 V 6 : 480 - 500 V
175	Nominal output current (I_S)	30 A 45 A 72 A 110 A 175 A 265 A 365 A 500 A 565 A 750 A
AC	Options	A : Gradual stop Power limiting Programmable relays B : Constant acceleration and deceleration via tachogenerator feedback C : Braking/standstill control/condensation protection/Drying

1.5 - Definitions

1.5.1 - The nominal output current of the DIGISTART:
 I_S is the nominal current I_N of the motor, which can be started under the following conditions :

The equivalent thermal current is $3.3 \times I_N$ during the entire starting period

- The maximum number of starts is 20 times/hour.
- The maximum duration of each start is 15 seconds.
- In the case of a LEROY-SOMER 2 or 4 pole motor, this is equivalent to a resistant torque of $0,4 \times M_N$ (M_N = Nominal torque of motor).

- After starting, and for a long period without a further start, the DIGISTART can supply $2 \times I_S$ on a permanent basis.

1.5.2 - The maximum motor current I_N , is always given assuming a maximum number of 20 starts/hour, each not exceeding 15 seconds duration. Where different operational criteria apply, see chapter 2 : "SELECTION".

1.5.3. - No-load starting is defined as starting under a load such that the equivalent thermal starting current I_{THD} does not exceed $2.6 \times I_N$.

e.g. motors fitted with couplings, fans (shutter closed), pumps (valves closed)

1.5.4. - Normal starting is defined as starting under a load such that the equivalent thermal starting current I_{THD} does not exceed $3.3 \times I_N$.

e.g. Machines with inertia (fans, saws, presses), compressors, pumps, empty grinding mills or mixers.

1.5.5. Full-load starting is defined as starting under a load such that the equivalent thermal starting current I_{THD} does not exceed $5.8 \times I_N$.

e.g. Conveyors, loaded grinding mills or mixers.

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1.6 - General specification

Nominal output current I _s (A)		30	45	72	110	175	265	365	500	565	750
VOLTAGE AND FREQUENCY OF THE MAINS SUPPLY		Choice of 5 different voltages - 208V - 220/240V - 380/415V - 440/460V - 480/500V Frequency : 50 or 60 Hz (with no modification to specification or software)									
MAXIMUM MOTOR CURRENT I _N (A)	NO-LOAD STARTING	36	60	85	145	211	322	450	580	710	952
	NORMAL STARTING	30	45	72	110	175	265	365	500	565	750
	FULL-LOAD STARTING	19	29	44	67	104	166	235	330	360	530
HIGH SPEED FUSES RATING IN AMPS (1)		125	160	315	400	630	700	900	1600		
FORCED VENTILATION		YES									
POWER SUPPLY		NO 220V SINGLE PHASE (INTERNAL)									
CONSUMPTION (W)		18		180		150		500			
OUTPUT (m ³ /h) at 50Hz		160		620		1060		3400			
WEIGHT (kg) (UNPACKED)		16	19	29	58	64	97				
PROTECTION CLASS		IP00									
AMBIENT OPERATING TEMPERATURE		-5 °C to + 40 °C Above 40 °C, derate current by 1,2% for each °C up to maximum of 60 °C									
STORAGE TEMPERATURE		from -10 °C to + 70 °C									
ALTITUDE		< 1000 m Above 1000 m, derate current by 0,5% for each 100 m over 1000 m									
TRANSMITTED VIBRATIONS		< 0,3 g									
MAXIMUM RELATIVE HUMIDITY, UNCONDENSED	20 °C	< 95 %									
	40 °C	< 80 %									
	50 °C	< 50 %									

- (1) - On models 30 to 175, high speed fuses are not supplied with the DIGISTART, but are an optional extra.
 - On models 265 to 750, high speed fuses are supplied already fitted to the DIGISTART.

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2. - SELECTION

INTRODUCTION

This chapter enables the user to check that the DIGISTART to be installed is suitable for the application.

The selection of a DIGISTART is based on 3 criteria :

- 1 - Required voltage
- 2 - Nominal current I_N
- 3 - Application and required options

2.1 - Selection of voltage

		CODE
- 5 voltages available	: 208 V	1
	: 220/240 V (1)	2
	: 380/415 V (1)	3
	: 440/460 V (1)	5
	: 480/500 V (1)	6

(1) In the case of dual voltage equipment, the required voltage is adjusted via the software.

MOTORS POWER kW	MAINS 380/415V		
	NO-LOAD STARTING	NORMAL STARTING	FULL-LOAD STARTING
9	DEC 3-30	DEC 3-30	DEC 3-30
11			DEC 3-45
15			
18,5			
22	DEC 3-45	DEC 3-45	DEC 3-72
30			
37	DEC 3-72	DEC 3-72	DEC 3-110
45			
55	DEC 3-110	DEC 3-110	DEC 3-175
75			DEC 3-265
90	DEC 3-175	DEC 3-175	DEC 3-365
110			DEC 3-500
132	DEC 3-265		
160			
180		DEC 3-365	DEC 3-565
200	DEC 3-365		
225			
250		DEC 3-500	DEC 3-750
280	DEC 3-500	DEC 3-565	
315	DEC 3-565		
355			
400		DEC 3-750	
450	DEC 3-750		
500			
550			
			CONTACT US

2.2 - Selection of power

2.2.1. - Rapid selection

To simplify the selection procedure, see the table on the left which is based on common operating conditions using LEROY SOMER LS or P, 1500 or 3000 min⁻¹ motors.

- 380 V threephase supply
- Number of starts/hour < 20
- Duration of start < 15 seconds

- No load starting

I_{THD} up to $2.6 \times I_N$

Resistant torque $\leq 0,15 \times M_N$

e.g. - motors fitted with couplings

- fans (shutters closed),
- pumps (valves closed)

- Normal starting

I_{THD} up to $3,3 \times I_N$

Resistant torque $\leq 0,4 \times M_N$

e.g. - machines with inertia (fans, saws, presses)

- compressors, pumps,
- empty grinding mills or mixers.

- Full load starting

I_{THD} up to $5,8 \times I_N$

Resistant torque $\leq M_N$

e.g. - Conveyors, loaded grinding mills or mixers.

Example of rapid selection

- 30 kW 380 V 4 pole motor.
- 10 starts/hour.
- Duration of start 12 seconds.
- Starting up of a loaded grinding mill.

Selection

Since the starting conditions are within the standard limits detailed above, the rapid selection table can be used.

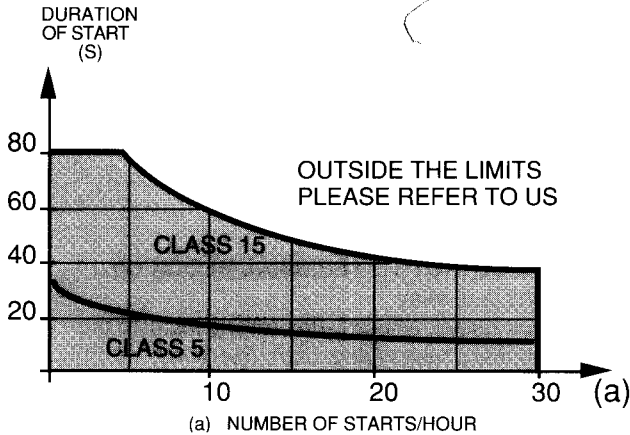
- 380 V mains
- Full-load starting
- 30 kW motor
- Reference code : **DEC 3 - 110**

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2.2.2. - Detailed selection

When the operating conditions differ from those defined for the rapid selection table, the detailed selection table must be used.

Step 1 : Select the starting class (1) according to the following diagram.



(1) The class number is equivalent to the total starting time during one hour, measured in minutes.

Step 2 : Select the starting conditions according to the same criteria as for the rapid selection table :

- No-load starting
- or Normal starting
- or Full-load starting

Step 3 : Using the column in the adjoining table defined by the data obtained in steps 1 and 2, select the current value immediately above the nominal current of the motor to be started. Read off the value for I_s in the right hand column.

Example of detailed selection

- . 45 kW 220 V 6 pole motor : $I_N = 150$ A
- . 20 starts/hour, 35 second starting time

- **Step 1 :**

20 starts/hour of 35 seconds : class 15

- **Step 2 :**

Load : fan
Normal starting

- **Step 3 :**

Using the table above, Normal starting + class 15.

In motor = 150 A \leq 155 : $I_s = 175$ A

Model to be ordered : **DEC 2 - 175**

NO-LOAD STARTING		NORMAL STARTING		FULL-LOAD STARTING		I_s
CLASS 5	CLASS 15	CLASS 5	CLASS 15	CLASS 5	CLASS 15	
36	31	30	26	19	16	30
60	48	45	39	29	24	45
85	73	72	59	44	37	72
145	125	110	100	67	60	110
211	189	175	155	104	92	175
322	283	265	230	166	142	265
450	402	365	325	235	200	365
580	513	500	417	330	257	500
710	559	565	455	360	280	565
952	748	750	590	530	390	750

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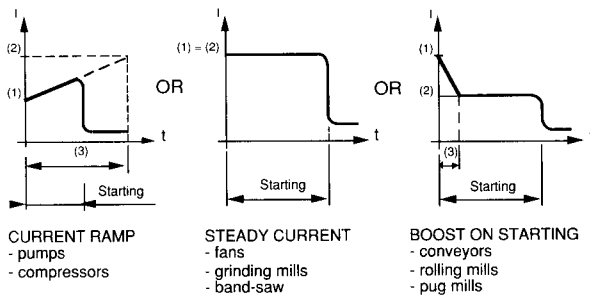
2.3 - Basic features and options

The standard version of the DIGISTART provides a number of basic features covering most requirements. However, certain applications may require additional features which are available as optional extras.

2.3.1 - Basic features

PROGRESSIVE STARTING

- 3 available settings
- (1) Starting current (I starting)
- (2) Current limit (I limit)
- (3) Ramp time (T . ramp)



COAST STOP

- When the stop button is pressed, the motor current drops to zero.
- The time taken to stop depends therefore on the load and the inertia.
- The DIGISTART therefore acts as a static contactor.

MOTOR AND DIGISTART PROTECTION

- As the DIGISTART remains active after starting, it provides protection against the following faults :
 - . mains undervoltage (-20 %, 2 sec.)
 - . motor over temperature (direct control of PTC sensors)
 - . phase imbalance (-50 %)
 - . overheating of DIGISTART (thermal sensor on heatsink (1) and thermal simulation of thyristors)
 - . micro-interruptions (automatic restart after cut off < 1S if wished)
 - . thermal protection of motor (electronic I^2t with adjustable threshold)
- The above faults cause the motor to stop, and the display of the appropriate message.
- After correction of the fault (see §4.4, page 32), the motor will restart either automatically or manually according to the type of fault.

REACTIVE POWER CONTROL

In order to improve the power factor, the DIGISTART can calculate the p.f., and vary the voltage on the motor terminals, as a function of the power at the shaft.

DATA DISPLAY

The DIGISTART includes a digital display of the following data :

- Type of starter (for reference)
- Current absorbed by motor (% of I_N)
- Duration of start (seconds)
- Fault code
- Motor speed (with tachogenerator feedback % of N_N)
- Input power (% of P_N)
- p.f. x 100

SIGNAL OUTPUT TO TERMINAL BLOCK (2)

- General fault relay
- 2 output relays, whose permutations indicate the operational phases (stop, start, operating,...)

- (1) Except on DEC - 30
- (2) See terminal block detail (§ 3.9.4 page 24).

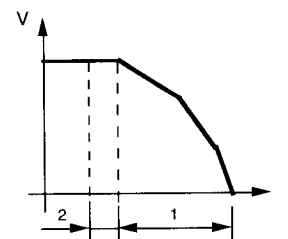
2.3.2 - Options

Option A :

GRADUAL STOP AND POWER LIMITER

A.1 Gradual stop

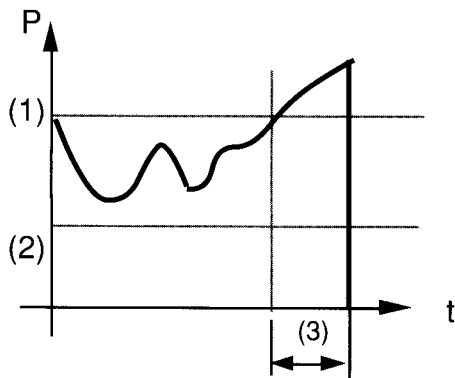
- This function prevents the motor stopping abruptly in cases where the resistant torque is high and the inertia is low.
- The DIGISTART controls the reduction in voltage at the motor terminals until it is stationary : this ensures a gradual slow-down.
- Mains power is required for the gradual stop function
- 2 adjustable parameters :
 - 1 - Deceleration time
 - 2 - Delay time between stop command and start of deceleration.
- Typical applications :
 - . Pumps : To avoid water-hammer
 - . Mechanical handling of fragile loads



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A.2 Power limiter (load control)

- Monitoring of the derived active input power of the motor ($\sqrt{3} \times UI \times \text{pf}$)
- Protection of the load against :
 - . overload (max. limit)
 - . loss of load (min. limit)
- 3 adjustable parameters :
 - 1- Maximum limit
 - 2 - Minimum limit
 - 3 - Timing of trip
- *Typical applications* :
 - . Overload : protection of mechanical equipment (torque limiting)
 - . Loss of load : draining of pumps
transmission failure



A.3 Programmable operation of the relays

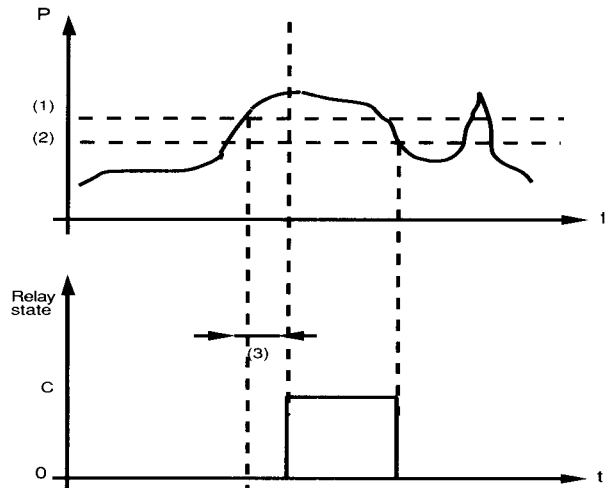
- Each of the 3 output relays (C1, C2, Fault) can have its conditions of operation modified from the original function.
- Each relay can be programmed to operate for :
 - a maximum threshold,
 - a minimum threshold,
 - a specific default.
- Whatever its designated function, each relay keeps the same electrical characteristics which are given by § 3.9-4 page 24.

A.3 - 1 Maximum threshold

- Possible parameters.
 - Absorbed power.
 - Current.
 - Power factor.
 - Speed (opt B).
 - Motor $I^2 t$.
 - Starter $I^2 t$.
 - Starting time.

• Operation.

- For each relay designated to operate for a particular maximum threshold, there are 3 possible settings :
 - 1 - relay closing threshold,
 - 2 - relay opening threshold (Hysteresis),
 - 3 - delay time of relay closing.



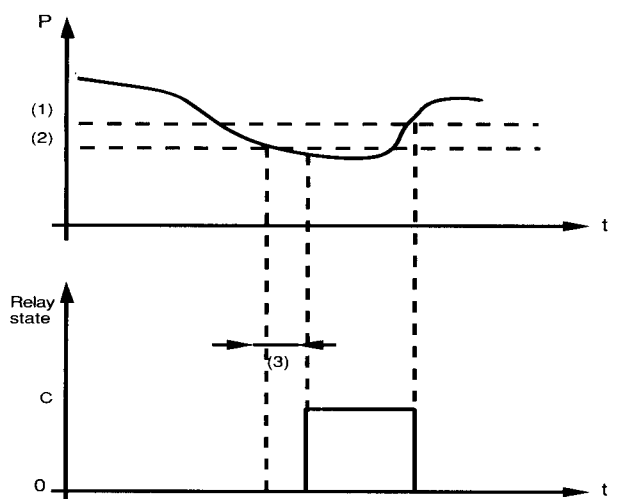
A.3 - 2 Minimum threshold

• Possible parameters.

- Absorbed power.
- Current.
- Power factor.
- Speed (opt B).

• Operation.

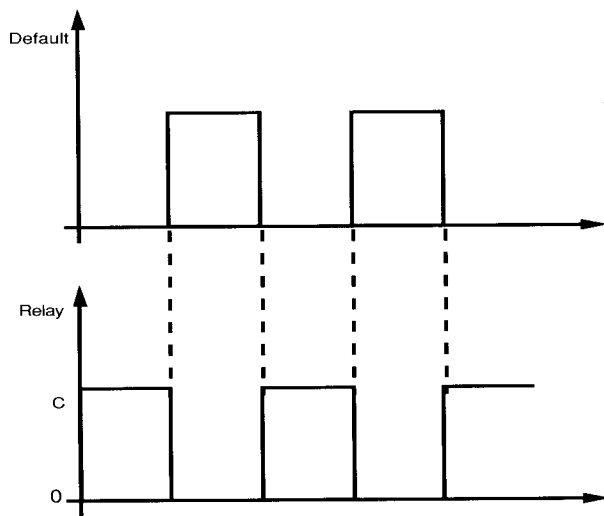
- For each relay designated to operate for a particular minimum threshold, there are 3 possible settings :
 - 1 - relay closing threshold,
 - 2 - relay opening threshold (Hysteresis),
 - 3 - delay time of relay closing.



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A.3 - 3 Specific default

- Possible parameters.
 - Mains under-voltage.
 - Motor overtemperature (PTC).
 - DIGISTART thermal overload.
 - Phase loss/imbalance.
 - Instantaneous power failure.
 - Motor thermal overload.
 - Power overload.
 - Power underload.
 - Phase order (1).
- Operation.
 - There are no settings to be made for relays designated to operate for a specific default.
 - The relay is closed for normal operation and opens when the supply is switched off or when the specific default occurs.

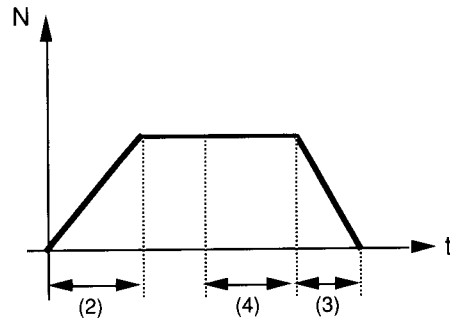


OPTION B CONSTANT ACCELERATION AND DECELERATION

- Provides constant duration starting and/or stopping times independent of load.
- Requires tachogenerator feedback with an output voltage not exceeding 200 Volts D.C. at the rated speed of the motor (not supplied with the DIGISTART).
- Motor accelerates and/or decelerates via a linear speed ramp.
- The current limiting built-in to the basic unit remains active and takes priority.
- 4 adjustable parameters :
 - 1 - Tachometer output voltage at rated speed.
 - 2 - Acceleration ramp time.
 - 3 - Deceleration ramp time.
 - 4 - Delay time between stop command and start of deceleration.

(1) The phase order relay is closed when the DIGISTART is connected counter clockwise and vice versa.

- *Typical applications :*
 - . Machines with variable load
 - . Conveyor belts



CAUTION

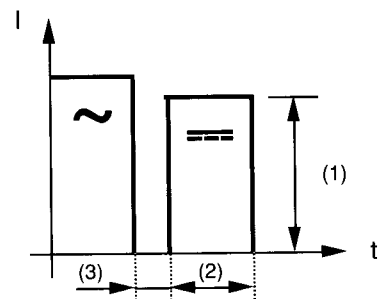
- It is only possible to increase the normal stopping time of the motor.
- Mains power is required for the constant deceleration function.

OPTION C : BRAKING/STANDSTILL CONTROL/CONDENSATION PROTECTION/DRYING

Option C is effected by the injection of D.C into the motor windings.

C.1 Braking

- Enables deceleration time to be reduced in cases where the motor is coupled to a high inertia load.
- Cuts in automatically after stop command and cuts out automatically after time delay.
- 3 adjustable parameters :
 - 1 - Braking effort,
 - 2 - Braking time,
 - 3 - Delay time between stop command and start of braking
- *Typical applications :*
 - . High inertia machines



CAUTION

Take braking into account when selecting the motor size (thermally, 1 deceleration under braking is equivalent to 2 starts).

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C.2 Standstill control

- Enables the motor to be kept practically stationary when the A.C. power is off and the shaft is loaded in the direction of drive. (load torque < 0.1 to $0.2 \times M_N$ according to the motor)
- Cuts in automatically when motor stops and cuts out automatically on restarting.
- **The D.C. amps in standstill mode must not exceed 0.6 times the rated current of the motor.**
- 2 adjustable parameters :
 - 1 - Direct current limit
 - 2 - Time delay between stop command and injection of D.C.
- *Typical applications :*
 - . Fans in airflow

C.3 Condensation protection

- Enables the motor windings to be kept at a temperature slightly above ambient when the motor is stopped, there by avoiding condensation.
- Cuts in automatically when the motor stops and cuts out automatically on restarting.
- **The D.C injected for protection against condensation must not exceed 0.6 times the rated current of the motor.**
- 2 adjustable parameters :
 - 1 - Direct Current value
 - 2 - Time delay between stop command and injection of D.C.
- *Typical applications :*
 - . Installations in humid conditions.

C. 4 Drying

- After a prolonged stop in humid conditions, enables the motor windings to be dried out before restarting.
- This function is switched on and off manually.
- **The D.C. injected for drying must not exceed 0.6 times the rated current of the motor.**
- 1 adjustable parameter :
 - 1 - Direct Current value
- *Typical applications :*
 - . Installations subject to seasonal use in humid conditions.

OPERATIONAL PRECAUTIONS

- The use of PTC sensors in the motor is strongly recommended when option C is in use, since the injection of D.C. causes a rise in temperature which must not exceed the normal operating temperature of the motor in continuous use.
- Mains power is required for the injection of D.C. so Option C will not operate in the case of mains failure.
- Further details on the operation of option C available on request.

3.- INSTALLATION - CONNECTIONS OPERATION

3.1 - Inspection on delivery

Before installation, check :

- 1 - That the equipment has not been damaged in transit (if damage has occurred, inform the carrier accordingly).
- 2 - That the mains supply voltage is compatible with the DIGISTART.

3.2 - Unpacking

- During unpacking, the DIGISTART should never be manoeuvred by means of any items of circuitry, terminal blocks or wiring.
- Handling should always been carried out using the correct equipment (webbing, slings, lifting rings ...)

3.3 Precautions on installation

The DIGISTART is wall mounted.

Install in a vertical position and observe the following precautions :

- When the DIGISTART is installed in a cabinet, particular care should be taken to ensure the airflow necessary for cooling (1).

To achieve this, a space of 100 mm should be left on all sides of the DIGISTART, and particularly around air inlets and outlets.

- Critical areas

- . 30 A : Above and below
- . 45 A to 72 A : Above, below and behind.
- . 110 A to 750 A : Above, below and on both sides

- Before fixing the DIGISTART in place, ensure that the position selected is protected against :

- . dust,
- . corrosive vapour,
- . water splashes,
- . vibration,
- . direct sunlight.

- The installation should be carried out with care.

Distortion or severe jolting could damage parts of the main circuit.

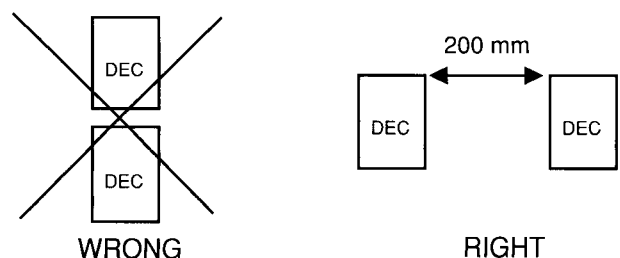
- Leave sufficient access around the DIGISTART to facilitate connection.

- When the DIGISTART is installed in a cabinet, ensure that ventilation is sufficient to remove excess heat. The total thermal losses to be dissipated are approx.

4 Watts/ Amp (e.g. : a DIGISTART drawing 100 A during operation emits 400 W). The DIGISTART can be bypassed after starting to reduce thermal losses. (See § 3.9.3 page 23).

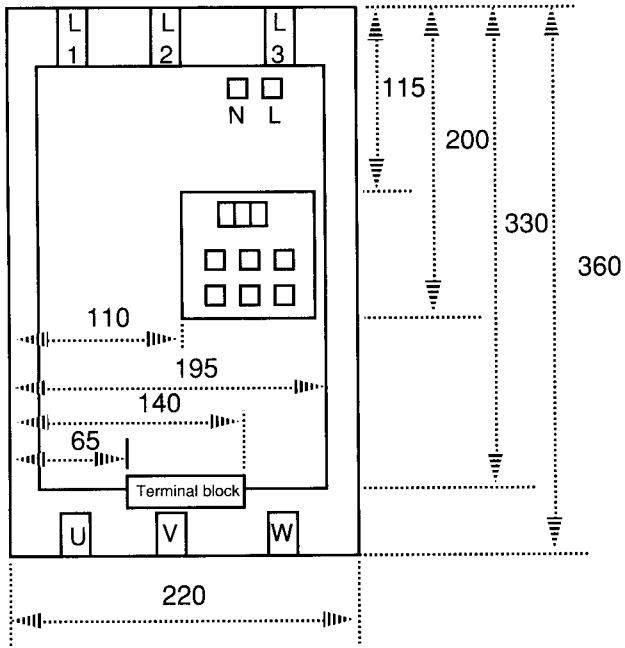
- In cases where several DIGISTARTS are used, these should be mounted side by side to prevent overheating, and with a minimum space of 200 mm between each unit.

(1) See Specification Table (§ 1.6 page 9).

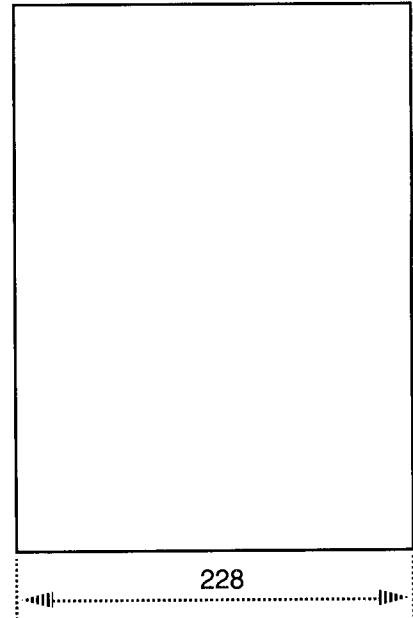


Electronic starter DIGISTART

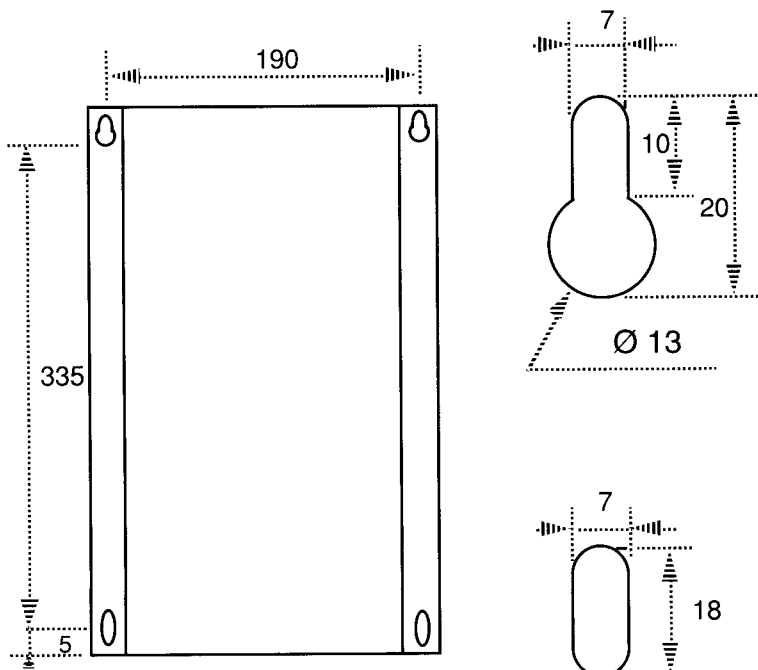
3.4 - Overall dimensions of DIGISTART 30 A



Front view



Side view



Rear view

DIGISTART DEC - 30

Natural convection

WEIGHT : 16 kg

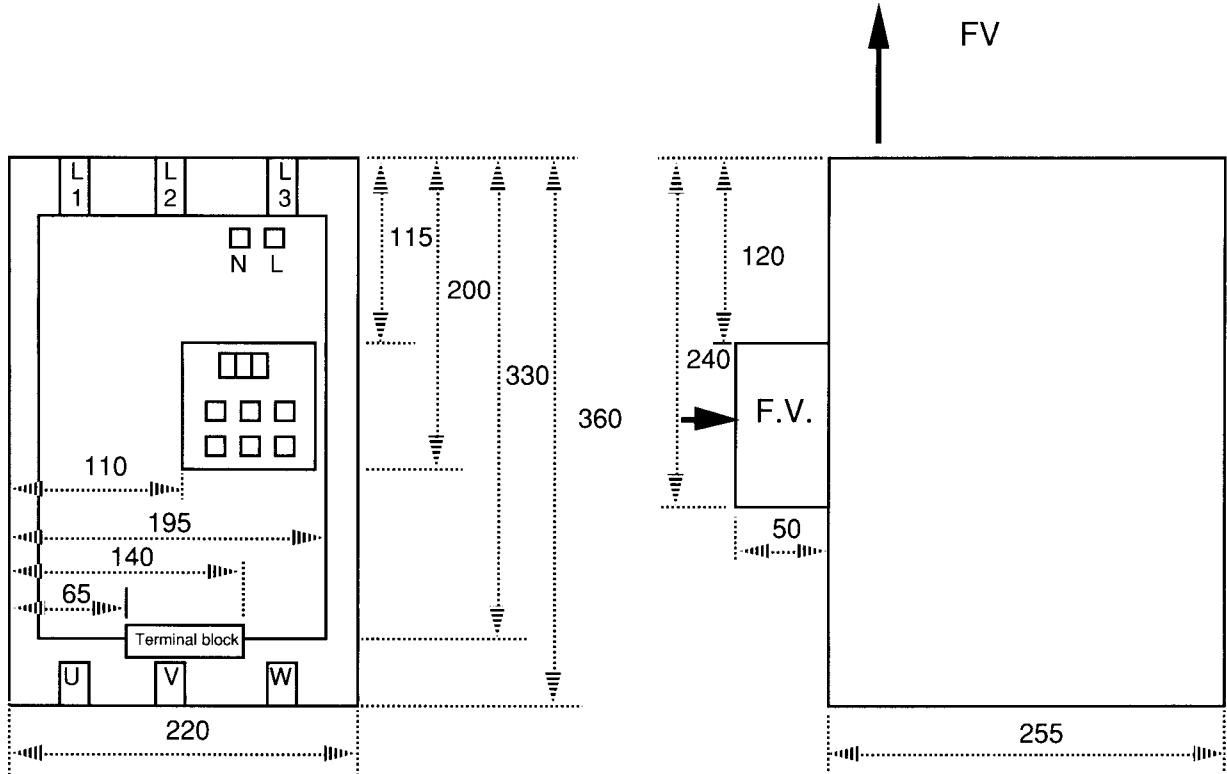
HEAT

DISSIPATION : 4W/A

DIMENSIONS IN mm

Electronic starter DIGISTART

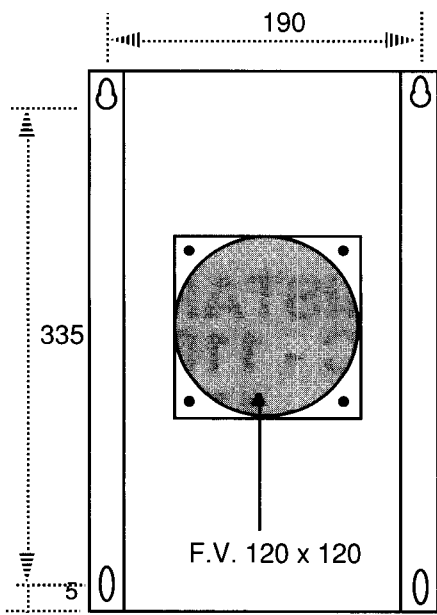
3.5 - Overall dimensions of DIGISTARTS 45 A and 72 A



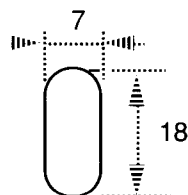
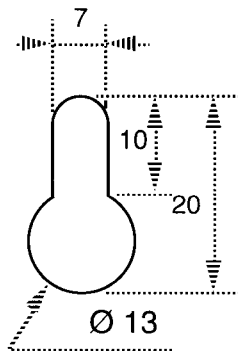
Front view

Side view

FV = Forced ventilation



Rear view

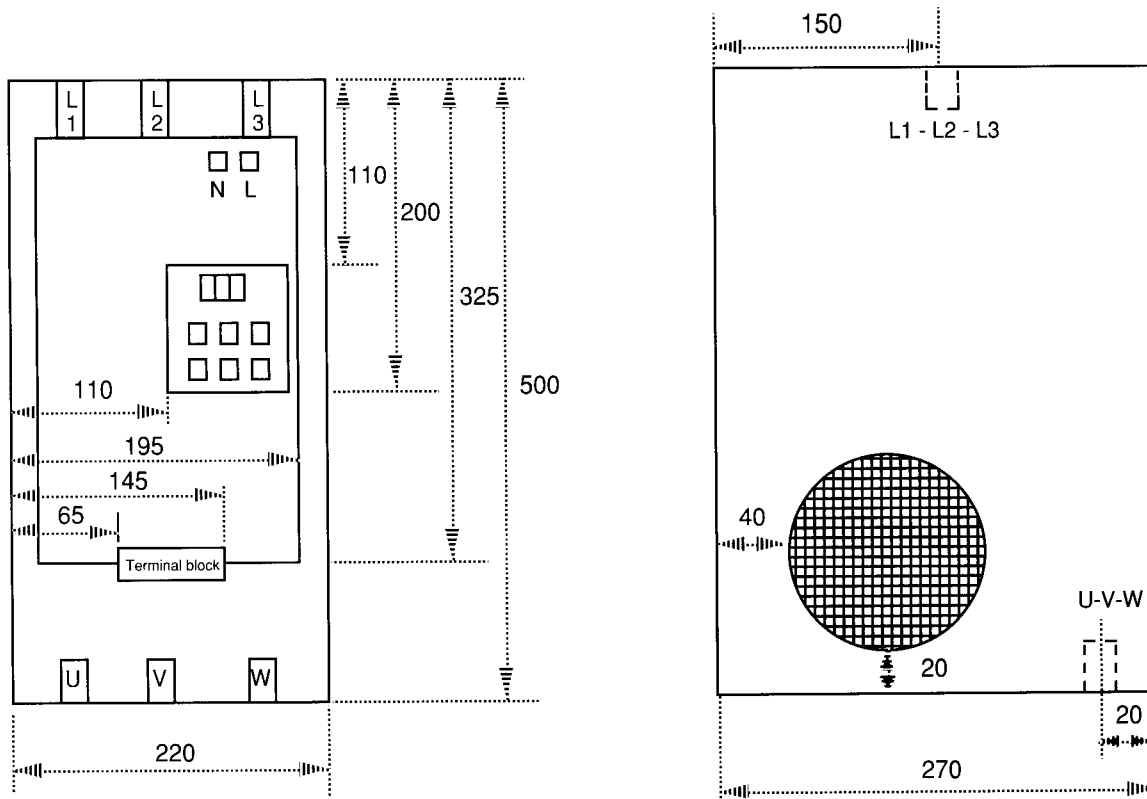


DIGISTART
DEC - 45
DEC - 72

WEIGHT : 19 kg
AIRFLOW FORCED VENTILATION : 160 m³/h at 50 Hz
HEAT DISSIPATION : 4W/A
DIMENSIONS IN mm

Electronic starter DIGISTART

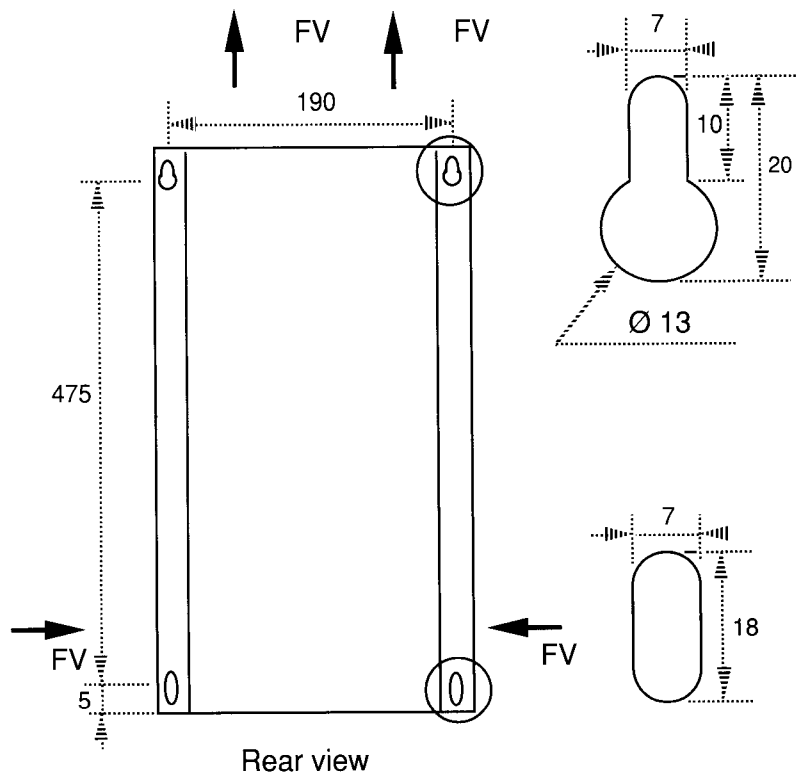
3.6 - Overall dimensions of DIGISTARTS 110 A and 175 A



Front view

Side view

FV = Forced ventilation



Rear view

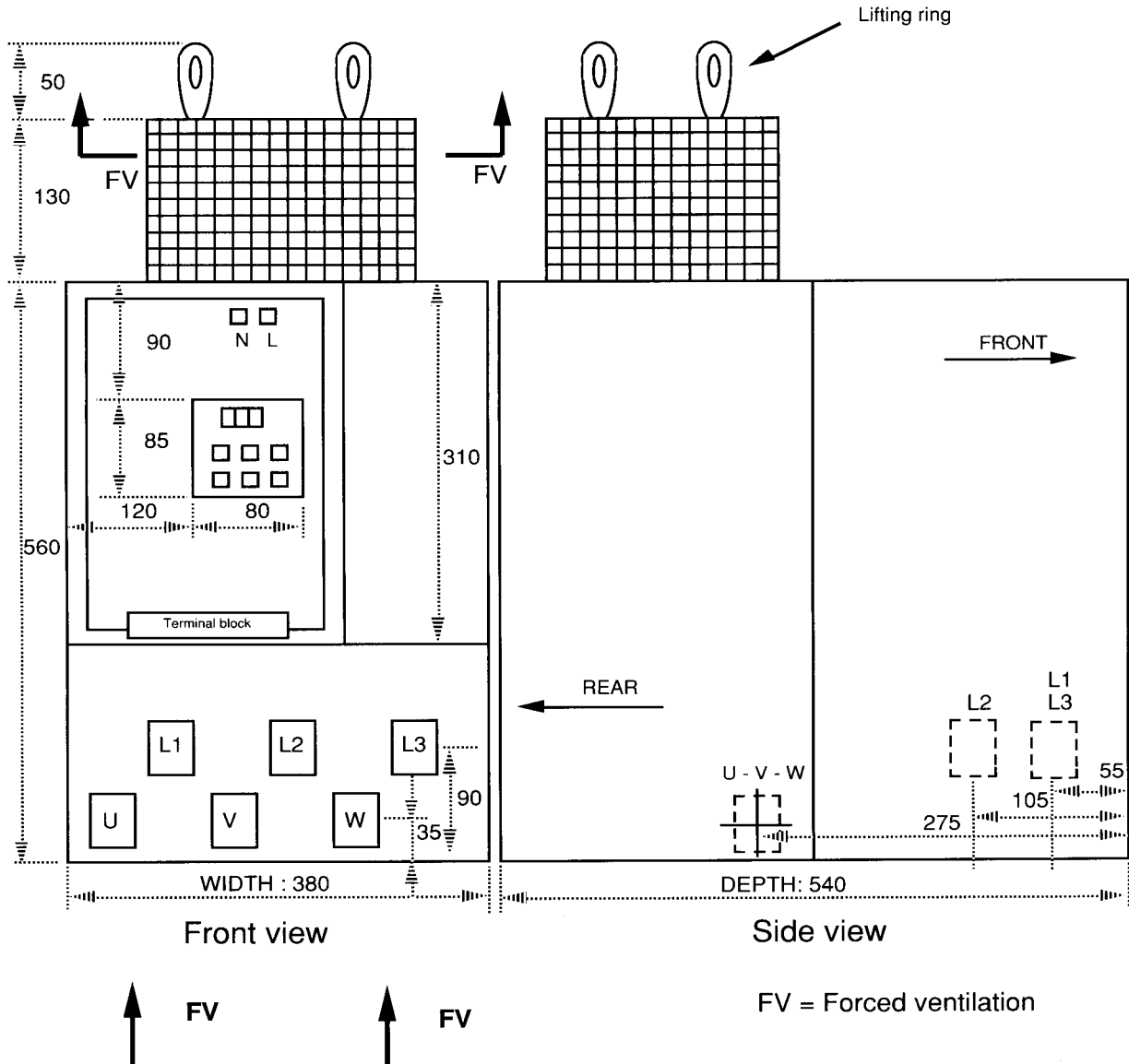
DIGISTART DEC - 110 DEC - 175

WEIGHT : 29 kg
 AIRFLOW FORCED VENTILATION : 620 m³/h at 50 Hz
 HEAT DISSIPATION : 4W/A

DIMENSIONS IN mm

Electronic starter DIGISTART

3.7 - Overall dimensions of DIGISTART 265A - 365A - 500A and 565A



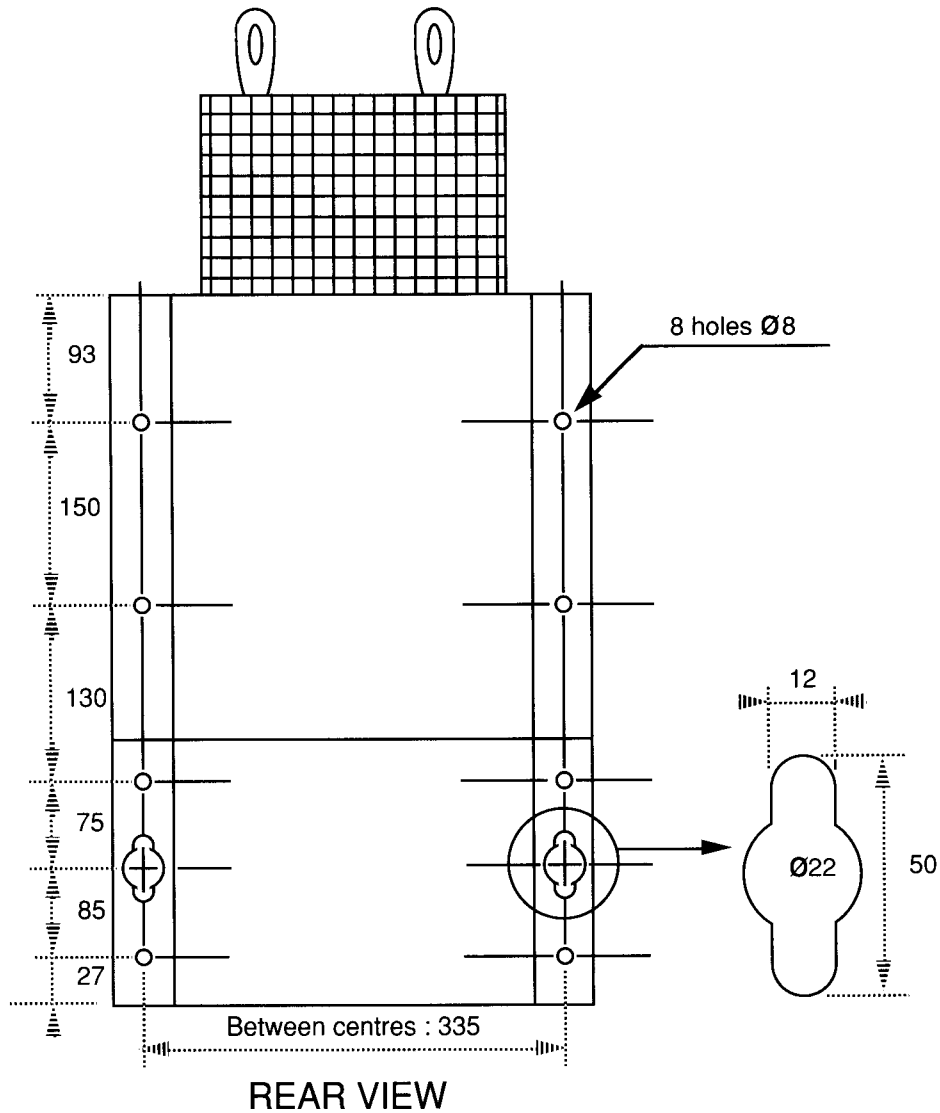
DIGISTART

DEC - 265
DEC - 365
DEC - 500
DEC - 565

WEIGHT DEC 265/365 : 58 kg
 WEIGHT DEC 500/565 : 64 kg
 AIRFLOW FORCED
 VENTILATION : 1060 m³/h at 50 Hz
 HEAT DISSIPATION : 4W/A

DIMENSIONS IN mm

Electronic starter DIGISTART



DIGISTART

DEC - 265

DEC - 365

DEC - 500

DEC - 565

WEIGHT DEC 265/365 : 58 kg
 WEIGHT DEC 500/565 : 64 kg
 AIRFLOW FORCED
 VENTILATION : 1060 m³/h at 50 Hz
 HEAT DISSIPATION : 4W/A

DIMENSIONS IN mm

3.8 - For the overall dimensions of the DIGISTART 750 A (PLEASE CONSULT US)

Electronic starter DIGISTART

3.9 - Connections

3.9.1. - Important recommendations

- DO NOT CONNECT A POWER CAPACITOR BETWEEN THE DIGISTART AND THE MOTOR.

- USE A POWER SUPPLY EQUAL TO AT LEAST TWICE THE POWER OF THE MOTOR.

- THE CONNECTIONS TO TERMINAL BLOCK J5 SHOULD BE MADE USING SCREENED STRANDED CABLE AND THE SCREEN SHOULD BE CONNECTED TO THE EARTH TERMINAL OF THE DIGISTART AT ONE END ONLY.

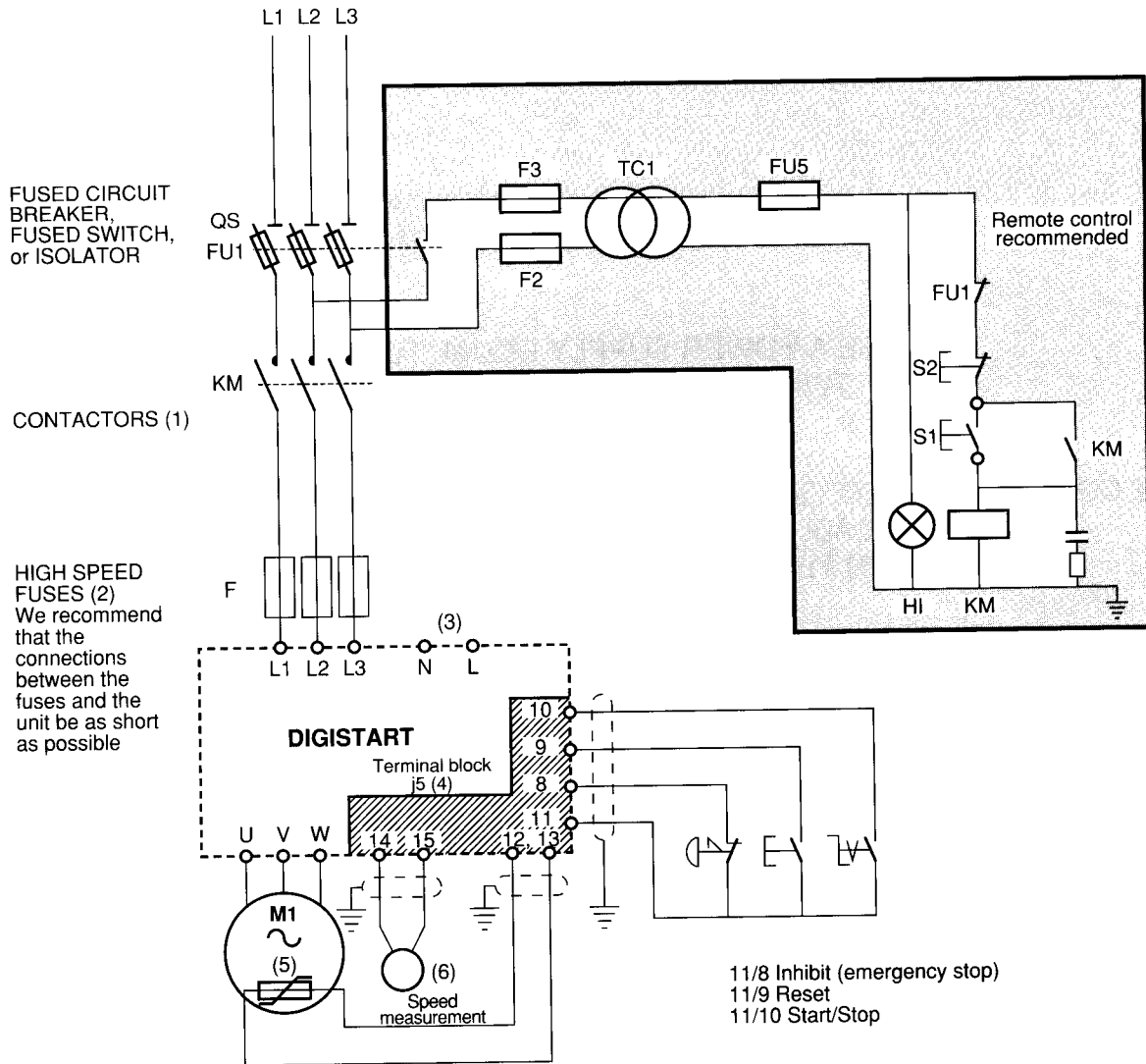
- INSTALL RC CIRCUITS ON THE COILS OF THE RELAYS OR CONTACTORS CONTROLLED BY THE DIGISTART.

- AVOID RUNNING CABLES CONNECTED TO TERMINAL BLOCK J5 NEAR TO POWER CABLES.

FAILURE TO OBSERVE THESE INSTRUCTIONS CAN LEAD TO SERIOUS CONSEQUENCES FOR THIS EQUIPMENT AND FOR THE WHOLE INSTALLATION.

Electronic starter DIGISTART

3.9.2 - General connection diagram



(1) Contactor KM should preferably remain permanently closed (except in the case of emergency). The motor should be controlled via the start/stop terminals on terminal block J5.

(2) Models 265A to 750A are supplied with the appropriate high speed fuses already fitted. High speed fuses for less powerful models should be selected by referring to the Specification Table, § 1.6, on page 9.

(3) Terminals N and L are used in cases where power for the electronics PCB is to be supplied from a different source to that of the motor. In these cases, a power supply of the same voltage as that originally specified for the equipment should be connected to terminals N and L, and jumpers S1 and S2 situated on the left of terminals N and L should be set in position 2.

Typical application for this type of power supply :

It may be necessary to cut the power supply to the DIGISTART at each stop. In such cases, power to the electronics PCB must be maintained in order to retain the volatile memory (e.g. the DIGISTART thermal calculation).

(4) See detail of the J5 terminal block (§ 3.9.4 page 24).

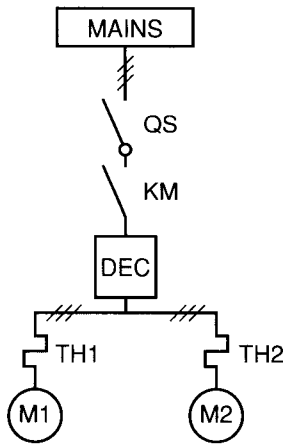
(5) The DIGISTART is supplied with a link fitted between terminals 12 and 13. This link should be replaced by the PTC sensors (if used).

(6) Applies only when option B is used.

Electronic starter DIGISTART

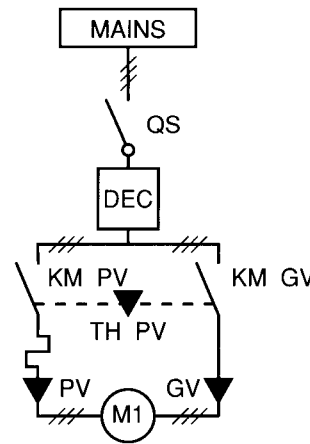
3.9.3 - Connection diagrams - Special applications

- 2 motors supplied by a single Digistart



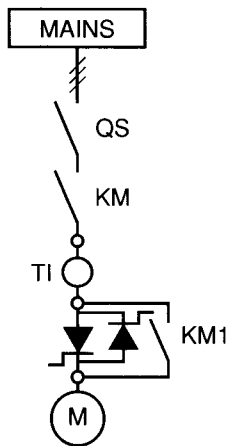
- The Digistart should have a capacity suitable for the total current of the 2 motors.
- Separate thermal protection should be provided for each motor.
- Motors may be of unequal power.

- 2 speed motors : 2 sets of windings



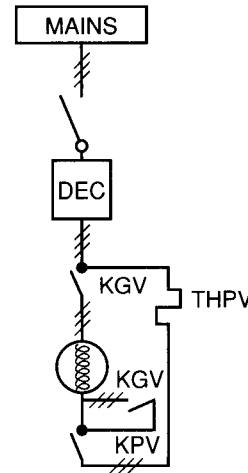
- The start command should not be given until after the contactor has closed.
- The stop command should be given before the contactor opens.
- Thermal protection for high speed operation is provided by the DIGISTART.
- The capacity of the DIGISTART should be suitable for high speed operation.

- By-passing the DIGISTART



- Avoids thermal losses from thyristors during operation.
- To retain DIGISTART protection devices, by-passing should be carried out downstream of the current transformers.
- The "Reactive power control" function is inoperative when KM1 is closed.
- Drive KM1 via C1 and C2 in series.

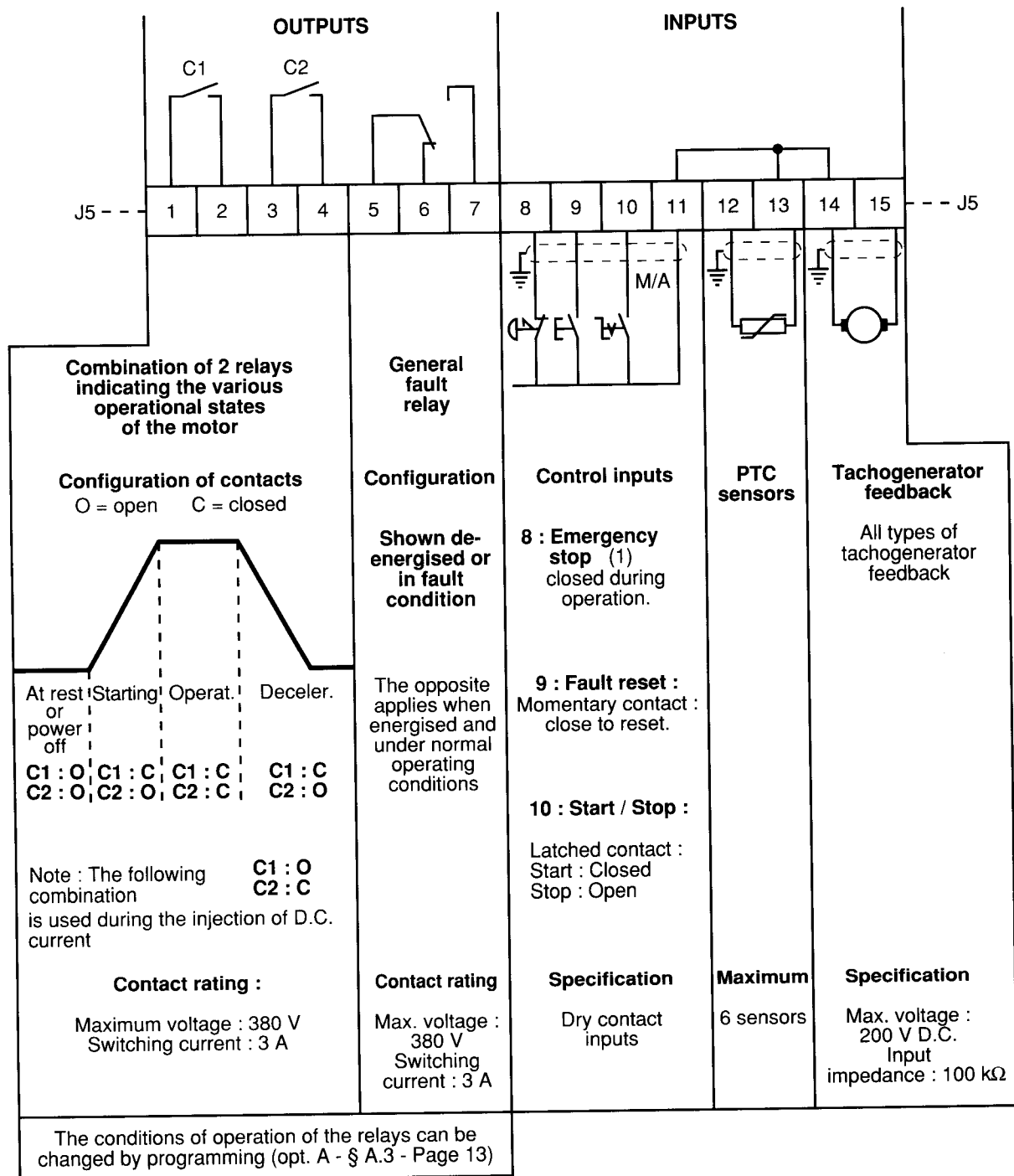
- DAHLANDER wound motor



- The start command should not be given until after the contactors have closed.
- The stop command should be given before the contactors open.
- Due to the difference in power at low speed (PV) and at high speed (GV), a thermal relay is needed for the low speed.
- The DIGISTART should be suitable for high speed operation.

Electronic starter DIGISTART

3.9.4 - Use of terminal block J5



Reminder :

Screened stranded wire must be used.
RC circuits should be fitted to relay coils or contactors connected to the outputs.

Note :

- Terminals have a cross-section of 0.75 mm²
- Terminals 11, 13 and 14 are at the same voltage.

(1) - On models 30 to 175A, terminals 8 and 11 are supplied connected by a jumper.

The jumper can be replaced by an emergency stop.
- On models 265 to 750A, the microswitches of the 3 high speed fuses are connected in series and are wired to terminals 8 and 11. If an emergency stop is fitted, connect in series with the microswitches.

4. - OPERATING INSTRUCTIONS FOR THE DIGISTART

4.1 - Programming

- On the DIGISTART, each function, adjustment parameter or display parameter is allocated to a number called an ADDRESS.

- Each ADDRESS has a CONTENT.

- The ADDRESS is distinguished from the CONTENT by :

- The number of digits illuminated on the display :
 - . 2 for ADDRESS
 - . 3 for CONTENT
- The state of the LED labelled "DATA" :
 - . Off for ADDRESS
 - . On for CONTENT

- The DIGISTART includes 3 types of ADDRESS :

1 - FUNCTION ADDRESSES

- Entering a code in the CONTENT will select the FUNCTION of the machine.

Example :

- . Type of start :
 - Standard (current regulation) —————> Code 0
- . Type of deceleration : braking —————> Code 2

2 - SETTING ADDRESSES

- Entering a VALUE in the CONTENT will adapt the DIGISTART to the required application.

Example :

- . Nominal motor
- . Starting current

3 - DISPLAY ADDRESSES

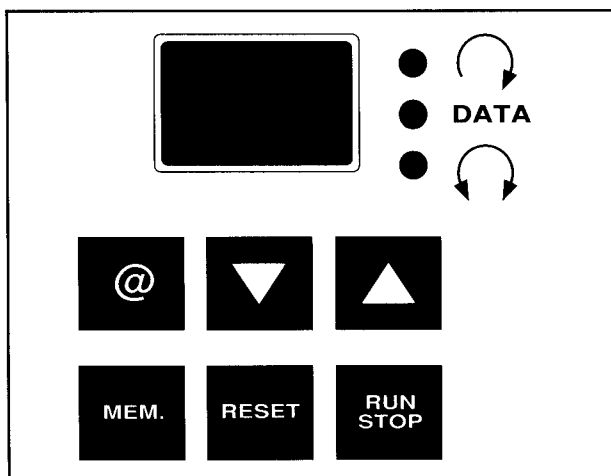
- Will display the data concerning the machine or its operation.

Example :

- . Displays DIGISTART type
- . Display of the current absorbed by the motor
- . The content of this type of ADDRESS cannot be modified

Electronic starter DIGISTART

4.2 - Keyboard



D I S P L A Y		DIGITAL DISPLAY showing ADDRESSES and their CONTENTS
		LED indicating motor condition on : RUN off : STOP
		LED : indicating type of display : - display of ADDRESS : Off - Display of stored CONTENT : On - Display of non-stored CONTENT : Flashing
		LED showing direction of phase rotation upstream of DIGISTART (no effect on operation) - Conventional phase rotation : Off - Opposite direction : On
K E Y S		Select display key. Momentary contact, changeover from address to content and vice versa.
		Decrement key for displayed values (decreases by one unit when pressed once, scrolls when held) (1)
		Increment key for displayed values (increases by one unit when pressed once, scrolls when held) (1)
		Memorise key. Will memorise and update existing contents. If new values are not memorised, after a power cut the contents will revert to the initial values.
		RESET : Fault reset key. Momentary contact, releases the DIGISTART when inhibited by a recorded fault.
		RUN/STOP key. Momentary contact, changes from run to stop and vice versa (2)
<p>(1) These keys do not affect display addresses or unused addresses. (2) This key is inoperative when the DIGISTART is operated from the terminal block.</p>		

Electronic starter DIGISTART

4.3 - Definition of address

ADDRESS	REFERENCE	FUNCTION	UNIT	UNIT SETTING	FACTORY SETTING	LIMITS	
						LOW	HIGH
01	Motor I_N	Program rated current of the motor	AMPS	I Motor on name plate	I_S DIGISTART	*	I @ 40
02	Start I	Initial motor current for progressive start	% I_N	These settings depend on the application and type of start	300 %	0	(1)
03	Limit I	Maximum current limit of DIGISTART	% I_N		400 %	0	(2)
04	Ramp time	Time for current to change from start I to limit I during the start	Sec.		10 s	0	60 s
05	Current display	Display of absorbed motor current	% I_N	Display address No setting	*	*	*
06	Control term. block/keyboard	Selection of the type of DIGISTART control : using the terminal block or the keyboard	CODE	Keyboard : 0 Term. block : 1	0	0	1
07	Motor thermal overload function	Switching on or off of the motor thermal overload protection	CODE	Disable : 0 Enable : 1	1	0	1
08	Motor thermal overload current	Adjustment of the current reference of the thermal protection	% I_N	Ref. current	100 %	50 %	200 %
09	Time delay of thermal overload enable	Disable time of the motor thermal function during the start	Sec.	Set according to total start time	20 s	0	600 s
10	Restart funct. after micro-interruptions	Switching on or off of the automatic restart after micro-interruptions < 1s	CODE	Disable : 0 Enable : 1	1	0	1

Electronic starter DIGISTART

ADDRESS	REFERENCE	FUNCTION	UNIT	UNIT SETTING	FACTORY SETTING	LIMITS	
						LOW	HIGH
11	Low or high volt. select	Adaptation of dual voltage DIGISTART to mains voltage	CODE	220, 400, 440, 480 : 0 240, 415, 460, 500 : 1	0	0	1
16	Type of start selection	Selection of type of regulation during the start	CODE	Current regulation : 0 Speed regulation : 1 (opt. B)	0	0	1
17	Select type of deceleration	Selection of type of deceleration	CODE	Normal (std) : 0 Gradual (opt. A) : 1 Braking (opt. C) : 2 Tacho. feedback (opt. B) : 3	0	0	3
18	Deceleration delay time	Time delay between the order to stop and the beginning of the deceleration	1/10 sec.	Set according to application	5 1/10 sec.	0	250 1/10 sec
19	Reactive power control enable	Switching on or off of the power factor regulation function	CODE	Disable : 0 Enable : 1	0	0	1
20 opt. A	Power limiter enable	Switching on or off of power limitation option	CODE	Disable : 0 Enable : 1	0	0	1

Electronic starter DIGISTART

ADDRESS	REFERENCE	FUNCTION	UNIT	UNIT SETTING	FACTORY SETTING	LIMITS	
						LOW	HIGH
21 opt. A	Set minimum power limit	Adjustment of the minimum trip threshold, provided the power limitation option is switched on	% P _N	Min. trip value	0	0	90 %
22 opt. A	Set maximum power limit	Adjustment of the maximum trip threshold, provided the power limitation option is switched on	% P _N	Max. trip value	150 %	50 %	200 %
23 opt. A	Power limiter delay time	Time delay between fault occurring and trip	1/10 sec.	Trip time	10 1/10 sec.	5 1/10 sec	250 1/10 sec
24 opt. A	Length of gradual stop	Adjustment of the ramp time between full voltage and 0 for a gradual stop (3)	Sec.	Setting according to application	20 s	5 s	60 s
25 opt. C	Braking effort	Adjustment of level of D.C. current injection into windings when braking	No unit	Depends on inertia. Set accord. to machine inertia and decel. time required	50	0	250
26 opt. C	Braking time	Adjustment of the duration of braking	1/10 sec.	Depends on braking effort and inertia	100 1/10 sec.	10 1/10 sec	400 1/10 sec
27 opt. B	Tachometer feedback voltage	Adjustment of the speed feedback voltage	Volts	Set the tachometer feedback voltage and motor synchronous speed	(0,06 x 1500 min ⁻¹) = 90V	20V	220V
28 opt. B	Acceleration ramp time	Adjust. of the ramp time betw. 0 speed and nominal speed when start. with speed feedback	Sec.	According to application	60 s	1s	600 s
29 opt. B	Deceleration ramp time	Adjust. of the ramp time betw. nom. speed and 0 speed when stop. with speed feedback (3)	Sec.	According to application	60 s	0 s	600 s
30 opt. B	Motor speed	Visualisation of motor shaft speed when using tachometer feedback	% N _N	No setting Display address	*	*	*

Electronic starter DIGISTART

ADDRESS	REFERENCE	FUNCTION	UNIT	UNIT SETTING	FACTORY SETTING	LIMITS	
						LOW	HIGH
31 opt. C	Standstill control/ condensation protection/drying	Switching on or off of D.C. current injection at standstill	CODE	Disable : 0 Enable : 1	0	0	1
32 opt. C	D.C. amps level	Adjustment of the level of D.C. current injected into the windings at standstill	No unit	According to application	25	0	80
33 opt. C	Delay time of standstill control/condensation protection/drying	Delay time between stop command and the start of D.C. current injection	Min.	According to application	0 min	0 min	100 min
34 opt. C	Drying function	Switching on or off of the drying function	CODE	Disable : 0 Enable : 1	0	0	1
35	Select number of thermistors	Adaptation of the PTC protection according to the number of thermistors	CODE	1 to 3 sensors : 0 4 to 6 sensors : 1	0	0	1
36	Duration of start	Duration of the last start performed	Sec.	No setting Display address	*	*	*
37	Power factor	Visualisation of the power factor	Power factor x 100	No setting Display address	*	*	*
38	Power	Visualisation of the absorbed power	% P _N	No setting Display address	*	*	*
39	Type of DIGISTART	DIGISTART type-represented by a 3 digit code (4)	CODE	No setting Display address	*	*	*
40	Maximum permanent current limit (except starting)	Maximum permanent current of DIGISTART (excluding starting)	Amps	No setting Display address	*	*	*

Electronic starter DIGISTART

ADDRESS	REFERENCE	FUNCTION	UNIT	UNIT SETTING	FACTORY SETTING	LIMITS	
						LOW	HIGH
50 opt. A	Programming of relay C1	Programming relay C1 for a designated function	CODE	Code from 1 to 23 see table p. 37	1	1	23
51 opt. A ⁽⁵⁾	Closing threshold	Adjustment of the closing threshold of relay C1	(6)				
52 opt. A ⁽⁵⁾	Opening threshold	Creating hysteresis					
53 opt. A ⁽⁵⁾	Delay time of closing	Adjustment of delay time of C1 relay closing	Sec.	Depends on application	0		
54 opt. A	Programming of relay C2	Programming relay C2 for a designated function	CODE	Code from 1 to 23 see table p. 37	2	1	23
55 opt. A ⁽⁵⁾	Closing threshold	Adjustment of the closing threshold of relay C2	(6)				
56 opt. A ⁽⁵⁾	Opening threshold	Creating hysteresis					
57 opt. A ⁽⁵⁾	Delay time of closing	Adjustment of delay time of C2 relay closing	Sec.	Depends on application	0		
58 opt. A	Programming of relay C3	Programming relay C3 for a designated function	CODE	Code from 1 to 23 see table p. 37	3	1	23
59 opt. A ⁽⁵⁾	Closing threshold	Adjustment of the closing threshold of relay C3	(6)				
60 opt. A ⁽⁵⁾	Opening threshold	Creating hysteresis					
61 opt. A ⁽⁵⁾	Delay time of closing	Adjustment of delay time of C3 relay closing	Sec.	Depends on application	0		

(1) 500 % of I_S or 800 % of I_N whichever is smaller

(2) 500 % of I_S or 550 % of I_N whichever is smaller

(3) This function can only prolong deceleration time.
(Braking is necessary to reduce deceleration time).

(4) CODE : See § 5.5 page 40.

(5) These addresses are inaccessible when the relay is programmed to indicate a default or a state.

(6) Depends on the programming of the relay.

NOTE : Addresses corresponding to options are not accessible if the DIGISTART is not equipped with these options.

Electronic starter DIGISTART

4.4 Fault identification

- When in fault mode, the unit indicates the type of fault by displaying a flashing code with one or more digits, on the digital display.

- The 3 digit display can display 3 simultaneous faults.

- According to the type of fault, stopping is either immediate or controlled. A controlled stop is any kind of stop other than a normal stop.

- Faults are memorised or not according to their type. If they are memorised, the inhibit can only be released when the fault has been corrected and when the manual reset has been operated (RESET button or reset via terminal block) (1)

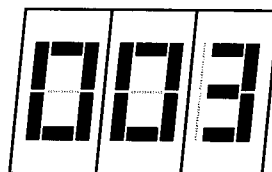
If they are not memorised, the motor restarts after correction of the fault.

NOTE :

- (1) When controlled via the terminal block, the motor will restart immediately after release of the inhibit, provided the start command has not been cancelled.

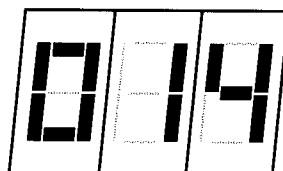
CODE	FAULT	FACTORY SETTINGS	
		STOP	MEMORISED
0	Emergency stop	Immediate	No
1	Mains undervoltage	Immediate	No
2	Motor over temperature - PTC sensors	Controlled	Yes
3	Thermal overload in DIGISTART	Immediate	Yes
4	Phase imbalance/ loss	Immediate	Yes
5	Momentary loss of mains supply	Immediate	Yes
6	Thermal overload in motor	Controlled	Yes
7	Overload	Immediate	Yes
8	Loss of load	Immediate	Yes

EXAMPLE 1 - TEMPERATURE FAULT IN DIGISTART



DISPLAY

EXAMPLE 2 - Simultaneous faults MAINS UNDERVOLTAGE + PHASE IMBALANCE/LOSS



DISPLAY

Electronic starter DIGISTART

4.5 - Example : Display of DIGISTART type information and programming of rated motor current

STEP	KEY IN	DISPLAY	REMARKS
Power on		0 0 0	Switching on automatically activates the CONTENT of ADDRESS 05. (current absorbed by motor)
Change to ADDRESS mode	@	0 5	
Move to ADDRESS 39	▲	3 9	ADDRESS 39 contains the DIGISTART reference No.
Change to CONTENT mode	@	2 6 7 ⁽¹⁾	This 3 digit code designates a particular type of DIGISTART (2)
Change to ADDRESS mode	@	3 9	
Move to ADDRESS 1	▼	0 1	ADDRESS 01 contains rated current of DIGISTART
Change to CONTENT mode	@	3 6 5 ⁽¹⁾	As supplied, the display shows the nominal current of the DIGISTART
Program motor I_N	▼	3 0 9 ⁽¹⁾	Enter nominal motor current taken from rating plate or catalogue
Store in memory	MEM	3 0 9	If storage in memory is not carried out, and power is switched off, ADDRESS content will revert to 365 when power restored.
Change to ADDRESS mode	@	0 1	
Move to ADDRESS 5	▲	0 5	
Change to CONTENT mode	@	0 0 0	Display as at switch-on. Displays absorbed current.

(1) These values are intended as an example. They correspond to a DEC 3.365 ABC supplying a 160 kW motor. ($I_N = 309$ A)

(2) CODE : See §5.5 page 40.


Electronic starter DIGISTART

5. - COMMISSIONING

5.1 - Introduction

The DIGISTART has been programmed at the factory. After checking that installation and connections have been carried out according to the recommendations contained in previous chapters, and having completed the examples in § 4.5 on page 33 (Programming of rated motor current), commissioning of the installation can proceed.

5.2 - Commissioning via the keyboard using factory preset values

STEP	KEY IN	DISPLAY	REMARKS
Power on		0 0 0	Switching on automatically activates the CONTENT of ADDRESS 05. (current absorbed by motor)
Change to ADDRESS mode	@	0 5	
Move to ADDRESS 1	▼	0 1	Check that displayed current corresponds to rated current on name plate ; if not then modify (2).
Change to CONTENT mode	@	3 0 9 (1)	
Change to ADDRESS mode	@	0 1	
Move to ADDRESS 5	▲	0 5	
Change to CONTENT mode	@	0 0 0	
Start motor		3 0 0	Current climbs to 300 % of I_N and then increases progressively to 400 % or until the motor has completed starting.

(1) This value is intended as an example.
It corresponds to a 160 kW motor, $I_N = 309A$

(2) See procedure in example (§ 4.5 on page 33).

If starting is not satisfactory using the factory preset values, the equipment can be adapted by modifying the main parameters.

Electronic starter DIGISTART

5.3 - Commissioning via the keyboard including modification of the main parameters

The 3 main parameters which affect smooth starting are :

- 1 - Current threshold : address 2 (% of I_N),
- 2 - Current limit : address 3 (% of I_N),
- 3 - Ramp time : address 4 (Seconds).

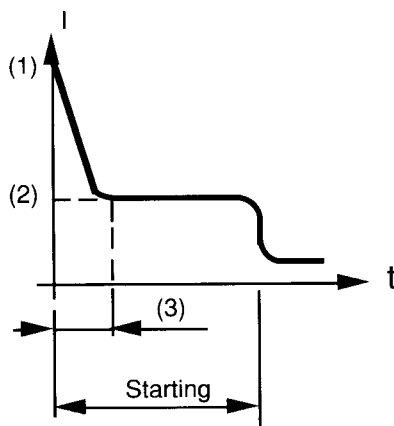
Adjustment of these 3 parameters :

- 1 - Current threshold (@ 2)
 - Reduce this if the motor accelerates too sharply
 - Increase this if the motor does not start or if there is a delay between the start command and the start of rotation of the motor. In the latter case, carry out a further trial using the factory preset values and note (display @ 5) at what current level the motor starts to turn. Then reprogram current threshold accordingly.
- 2 - Current limit (@ 3)
 - Reduce if the application permits (maximum current level sufficient to ensure starting under all conditions) and if the capacity of the electrical installation is limited.
 - Increase if the load does not start fully
- 3 - Ramp time (@ 4)
 - Once the 2 other adjustments have been made, this can be used to set the acceleration rate.

Special cases :

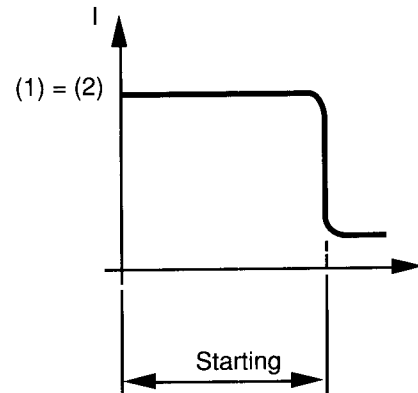
HIGH TORQUE (Sticking or binding)

- In cases where the load is difficult to start and resistant torque decreases after starting, it is possible to set the threshold current to a level above the current limit, then instead of an increasing current ramp, there will be a decreasing ramp (boost starting).



HIGH INERTIA

- In cases where the inertia is high and start duration is long, the threshold current and the current limit can be set to the same value. In such cases, starting takes place with a constant current and ramp time becomes inoperative. The duration of starting will then depend mainly on the inertia.



Note :

Smooth starting is achieved using the three settings previously described. The current ramp will therefore be the same from one start to another. The load can change however. For this reason it is important to ensure that the adjustments carried out will allow starting even in the severest conditions.

This commissioning procedure assumes the use of a basic DIGISTART with factory preset functions.

Identify these setting values in the following tables so that :

- Factory preset values can be either confirmed or modified in every case.
- Units supplied with options fitted can be adapted for the particular application by either confirming or modifying factory preset values.

Electronic starter DIGISTART

5.4 - Adapting the DIGISTART to the installation.

FUNCTION	@	DEFINITION	UNIT	SETTING	FACTORY SETTING	SETTING LIMITS
ADAPTING DIGISTART TO MOTOR						
	01	Motor I_N	Amps	Motor current on nameplate	I_s DIGISTART	I @40
SELECTION OF CONTROL MODE						
	06	Control terminal block / keyboard	CODE	Keyboard : 0 Term. block : 1	0	1
SELECTION OF BASIC FUNCTION						
MOTOR THERMAL OVERLOAD FUNCTION	07	Motor thermal overload function	CODE	Disable : 0 Enable : 1	1	1
	08	Thermal O / L current	% I_N	Reference current	100%	200%
	09	Time delay enable	Sec.	Set according to total starting time	20 sec.	600 sec.
MOMENTARY POWER CUTS	10	Restart after momentary power failure	CODE	Disable : 0 Enable : 1	1	1
DUAL VOLTAGE MACHINES : ADAPTS TO MAINS VOLTAGE	11	Low or High voltage	CODE	Low voltage : 0 High voltage : 1	0	1
POWER FACTOR CONTROL	19	Power factor control function	CODE	Disable : 0 Enable : 1	0	1
POWER PROTECTION (OPTION A)	20	Power limiter function	CODE	Disable : 0 Enable : 1	0	1
	21	Minimum power limit	% P_N	Minimum trip value	0%	90%
	22	Maximum power limit	% P_N	Maximum trip value	50%	200%
	23	Power limiter delay time	1/10 Sec.	According to application	10 1/10 Sec.	250 1/10 Sec.

Electronic starter DIGISTART

FUNCTION	@	DEFINITION	UNIT	SETTING	FACTORY SETTING	SETTING LIMITS
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RELAY PROGRAMMING (OPTION A)

C1 RELAY PROGRAMMING	50	C1 relay programming	CODE	Depends on the desired function see table below	1	23
	51 ⁽⁴⁾	Closing threshold	(5)			
	52 ⁽⁴⁾	Opening threshold	(5)			
	53 ⁽⁴⁾	Delay time	Sec.	Depends on application	0	

C2 RELAY PROGRAMMING	54	C2 relay programming	CODE	Depends on the desired function see table below	2	23
	55 ⁽⁴⁾	Closing threshold	(5)			
	56 ⁽⁴⁾	Opening threshold	(5)			
	57 ⁽⁴⁾	Delay time	Sec.	Depends on application	0	

C3 RELAY PROGRAMMING	58	C3 relay programming	CODE	Depends on the desired function see table below	3	23
	59 ⁽⁴⁾	Closing threshold	(5)			
	60 ⁽⁴⁾	Opening threshold	(5)			
	61 ⁽⁴⁾	Delay time	Sec.	Depends on application	0	

Function	Code	Adjustment limits	Note
Beginning of start	001	/	
End of start	002	/	
General default	003	/	
Mains under-voltage default	004	/	
Motor over-temperature default (PTC)	005	/	
Starter thermal overload default	006	/	
Phase loss/imbalance default	007	/	
Instantaneous power failure default	008	/	
Motor thermal overload default	009	/	
Power overload default	010	/	
Power underload default	011	/	
Phase order	012	/	
Absorbed power upper threshold	013	0 to 150 % Pn	(7)
Absorbed power lower threshold	014	0 to 150 % Pn	(7)
Current upper threshold	015	0 to 550 % In	(6)
Current lower threshold	016	0 to 550 % In	(6)
Power factor upper threshold	017	0 to 100	(7)
Power factor lower threshold	018	0 to 100	(7)
Speed upper threshold (opt B)	019	0 to 120 to Nn	(6)
Speed lower threshold (opt B)	020	0 to 120 to Nn	(6)
Motor I ² t upper threshold	021	0 to 100	(6)
DIGISTART I ² t upper threshold	022	0 to 100	(6)
Starting time threshold	023	0 to 600 s	(8)

Electronic starter DIGISTART

FUNCTION	@	DEFINITION	UNIT	SETTING	FACTORY SETTING	SETTING LIMITS
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STARTING

TYPE OF STARTING	16	Selection of type of power control	CODE	Normal start : 0 Start on speed feedback : 1	0	1
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STANDARD STARTING BY ADJUSTABLE CURRENT CONTROL	02	Starting current I_b	% I_N	These settings depend on the application and the choice of starting	300%	(1)
	03	Current limit I_L	% I_N		400%	(2)
	04	Ramp time	Sec.		10 Sec.	60 Sec.
CONSTANT STARTING BY SPEED FEEDBACK (OPTION B)	27	Speed feedback	VOLTS D.C.	Speed feedback voltage at rated speed of motor	$90V = (0,06V \times 1500 \text{ min}^{-1})$	200V
	28	Acceleration time	Sec.	According to application	60 Sec.	600 Sec.

DECELERATION

TYPE OF DECELERATION	17	Selection of type of deceleration	CODE	Normal stop: 0 Gradual stop: 1 Braking: 2 Decel. on speed feedback: 3	0	3
DELAY TIME OF DECEL.	18	Delay time of deceleration	1/10 Sec	Depends on the application	5 1/10 Sec	250 1/10 Sec
NORMAL STOP	No setting: When the stop button is pressed, the motor current drops to zero.					
GRADUAL STOP (OPTION A)	24	Gradual deceleration time	Sec.	Depends on the application	5 Sec.	60 Sec.
BRAKING (OPTION C)(3)	25	Braking effort	NO UNIT	Depends on inertia and braking time needed	50	250
	26	Injection time of D.C. during braking	1/10 Sec.	Depends on braking effort and braking time needed	100 1/10 Sec	400 1/10 Sec
CONSTANT DECEL. BY SPEED FEEDBACK (OPTION B)	27	Speed feedback	VOLTS	Speed feedback voltage at rated speed of motor	$90V = (0,06V \times 1500 \text{ min}^{-1})$	200V
	29	Deceleration time	Sec.	According to application	60 Sec.	600 Sec.

Electronic starter DIGISTART

FUNCTION	@	DEFINITION	UNIT	SETTING	FACTORY SETTING	SETTING LIMITS
STOP						
VALIDATION OF D.C. INJECT. FUNCTION WHEN MOTOR IS STOPPED (OPTION C) (3)	31	Standstill control/ condensation protection/drying	CODE	Disable : 0 Enable : 1	1	1
CONDENSATION PROTECTION/ STANDSTILL CONTROL	32	Direct current level	NO UNIT	According to motor and application	25	90
	33	Time	MINUTES	According to application	0	
DRYING (3)	32	Direct current level	NO UNIT	According to motor	25	80
	33	Time delay	MINUTES	According to application		
	34	Manual control	CODE	Disable : 0 Enable : 1	0	1

(1) - 500% of I_s or 800% of I_N , whichever is the smaller

(2) - 500% of I_s or 550% of I_N , whichever is the smaller

(3) - Option C involves the injection of D.C., which causes heating of the motor. It should therefore be used with care.

(4) - These addresses are inaccessible when the relay is programmed to indicate a default or a state.

(5) - Depends on the programming of the relay.

(6) - The indication will occur whatever the running mode of the motor (acceleration, steady state, deceleration).

(7) - The indication is only active in steady state (excluding acceleration, deceleration or stopping phases).

(8) - The starting time is automatically reset to zero every time the motor is stopped.

Electronic starter DIGISTART

5.5 - Parameter display

FUNCTION	@	DEFINITION	UNIT	REMARKS	
CURRENT	05	Permanent measurement of current absorbed by motor	% I _N	Measured by current transformer	
SPEED	30	Display of motor speed	% I _N	Measured by speed feedback	
DURATION OF START	36	Display of duration of last start	Sec.		
TYPE OF DIGISTART	39	3 digit code indicates DIGISTART type			CODE
		1st DIGIT.	2nd DIGIT	3rd DIGIT	
		VOLTAGE(V)	I _s	OPTION	
		0 : 208	0 : 30	0 : None	
		1 : 220/240	1 : 45	1 : A	
		2 : 380/415	2 : 72	2 : B	
		3 : None	3 : 110	3 : C	
		4 : 440/460	4 : 175	4 : AB	
5 : 480/500	5 : 265	5 : AC			
	6 : 365	6 : BC			
	7 : 500	7 : ABC			
	8 : 565				
		9 : 750			
MAX. PERMANENT CURRENT LEVEL (EXCEPT FOR STARTING)	40	Maximum permanent current accepted by starter	Amps		

Electronic starter DIGISTART

5.6 - Example: adapting a DEC3-365 AB to a particular application

- 1 - Programming rated motor current of a P 315S 160 kW 4p. $I_N=309$ A
- 2 - DIGISTART control via terminal block
- 3 - Power limiter operational
- 4 - Starting with a 20 sec. acceleration ramp ; speed feedback using a tachogenerator 20 V / 1000 rpm
- 5 - Coast stop

STEP	KEY IN	DISPLAY	REMARKS
1- POWER ON		0 0 0	Switching on automatically calls up the CONTENT of ADDRESS 05
Change to ADDRESS mode	@	0 5	
Move to ADDRESS 1	▼	0 1	
Change to CONTENT mode	@	3 6 5	As supplied, the content of address 1 corresponds to the rated current of the DIGISTART
Program rated current of motor	▼	3 0 9	Enter current specified on motor nameplate
Store in memory	MEM	3 0 9	Failure to store will result in loss of data if a power cut occurs
2- Change to ADDRESS mode	@	0 1	
Move to ADDRESS 6	▲	0 6	
Change to CONTENT mode	@	0 0 0	As supplied, unit is programmed for keyboard control
Program terminal block control	▲	0 0 1	Code for control via terminal block is 1
Store in memory	MEM	0 0 1	
3- Change to ADDRESS mode	@	0 6	
Move to ADDRESS 20	▲	2 0	
Change to CONTENT mode	@	0 0 0	Unit is originally supplied with current limiter disabled (code 0)
Enable power limiter	▲	0 0 1	Code for current limiter enable is 1
Store in memory	MEM	0 0 1	

Electronic starter DIGISTART

STEP	KEY IN	DISPLAY	REMARKS
4- Change to ADDRESS mode	@	2 0	
Move to ADDRESS 16	▼	1 6	
Change to CONTENT mode	@	0 0 0	As supplied, the unit is programmed for standard starting
Select speed feedback starting	▲	0 0 1	Code for speed feedback starting is 1
Store in memory	MEM.	0 0 1	Unit must now be adjusted to speed feedback
Change to ADDRESS mode	@	1 6	
Move to ADDRESS 27	▲	2 7	
Change to CONTENT mode	@	0 9 0	As supplied, unit is programmed for speed feedback 60 v/1000 rpm, thus : 90v at 1500 rpm
Program speed feedback voltage	▼	0 3 0	T.G. 20 v/1000 rpm is used on 4 p. motor at 1500 rpm. T.G.. voltage is 30 v at 1500 rpm
Store in memory	MEM.	0 3 0	
Change to ADDRESS mode	@	2 7	Now select required acceleration time
Move to ADDRESS 28	▲	2 8	
Change to CONTENT mode	@	0 6 0	Unit is supplied with acceleration time using speed feedback set at 60 sec.
Program acceleration time	▼	0 2 0	
Store in memory	MEM.	0 2 0	
5- The unit is supplied set for coast stop. Therefore it is not necessary to alter this setting. However, if required, this can be checked by moving to address 17 and ensuring that the content is set at 0 (code for coast stop).			

Having completed the above example, you can move to any ADDRESS without affecting operation. You may choose to move to ADDRESS 5 : display of current absorbed by the motor.

Electronic starter DIGISTART

6. - FAULT FINDING

6.1 - Possible causes of trip-out

FAULT CODE	FAULT	PROBABLE CAUSE	REMEDY
1	MAINS Undervoltage	Drop in mains voltage exceeding 20 % of nominal voltage for more than 2 sec.	- Wait for restoration of mains and restart motor
2	Motor over-temperature	Overheating of motor windings	- Check load - Check ventilation - Check ambient temperature - Check operation of option C, if applicable
3	Starter thermal overload	Thyristors over-temperature	- Check operation of forced ventilation - Check DIGISTART cooling - Check ambient temperature - Decrease the number of starts/hour - Decrease duration of start by modifying setting parameters
4	Phase loss/ imbalance	Loss of one phase or imbalance in voltage or current exceeding 50 %	- Check wiring and fuses between mains supply and motor
5	Momentary power cut	Momentary interruption to mains supply < 1 sec	- Restart motor after RESET
6	Motor thermal overload	Motor over-temperature	- Check overload setting - Check timer setting not less than duration of start - Check load
7	Overload	Torque on motor shaft above max. limit	- Check load - Check mechanical condition of machine
8	Loss of load	Torque on motor shaft below min. limit	- Check load condition of transmission - Check load

Electronic starter DIGISTART

6.2 - Possible causes of non-operation

6.2.1 - Digital display not illuminated :

- check supply L1 - L2 - L3 or auxiliary supply,
- check position of links,
- check fuses.

6.2.2 Motor will not start :

- check supply L1 - L2 - L3,
- check motor connections,
- check fault trips,
- check start command LED,
- check DIGISTART proceeding to threshold current,
- check threshold current high enough.

With tacho feedback :

- check tachogenerator feedback and programming of tachogenerator voltage.

6.2.3 - Motor will not accelerate :

- check current limit is high enough for starting,
- check programming of tachogenerator voltage if starting is via tachogenerator feedback.

7. - SPARE PARTS

The following list of spare parts is intended for DIGISTART operating on 380V.

Other voltages on application.

	DEC 3-30	DEC 3-45	DEC 3-72	DEC 3-110	DEC 3-175	DEC 3-265	DEC 3-365	DEC 3-500	DEC 3-565	DEC 750
Control panel	CCD1570A2 42-1-3	CCD1570A2 42-6-3	CCD1570A2 42-2-3	CCD1570A2 42-7-3	CCD1570A2 42-3-3	CCD1570A2 42-8-3	CCD1570A2 42-4-3	CCD1570A2 42-5-3	CCD1570A2 42-5-3	CCD1570A2 42-9-3
Keyboard/ display PCB	CCD1577A1 42-0	CCD1577A1 42-0	CCD1577A1 42-0	CCD1577A1 42-0	CCD1577A1 42-0	CCD1577A1 42-0	CCD1577A1 42-0	CCD1577A1 42-0	CCD1577A1 42-0	CCD1577A1 42-0
PCB option B or C	CFV1578A1 42-30	CFV1578A1 42-30	CFV1578A1 42-30	CFV1578A1 42-30	CFV1578A1 42-30	CFV1578A1 42-90	CFV1578A1 42-90	CFV1578A1 42-90	CFV1578A1 42-90	CFV1578A1 42-90
Thyristor	SKKT56/14 D or E	SKKT71/14 D or E	SKKT132/14 D or E	SKKT162/14 D or E	SKKT210/14 D or E	SKT491/14 D or E	SKT600/14 D or E	SKT1200/14 D or E	SKT1200/14 D or E	SKT1200/14 D or E
Thyristor option C	SKKT56/14 D or E	SKKT71/14 D or E	SKKT132/14 D or E	SKKT162/14 D or E	SKKT210/14 D or E	SKT491/14 D or E	SKT600/14 D or E	SKT1200/14 D or E	SKT1200/14 D or E	SKT1200/14 D or E
High speed fuse	(1) *	(1) *	(1) *	(1) *	(1) *	BOD 700 A	BOD 900 A	BOD 1600 A	BOD 1600 A	BOD 1600 A
Control panel fuse	6 X 32 160 mA SA	6 X 32 160 mA SA	6 X 32 160 mA SA	6 X 32 160 mA SA	6 X 32 160 mA SA	6 X 32 160 mA SA	6 X 32 160 mA SA	6 X 32 160 mA SA	6 X 32 160 mA SA	6 X 32 160 mA SA
Forced venti- lation fuse		10 x 38 1 A aM	10 x 38 1 A aM	10 x 38 1 A aM	10 x 38 1 A aM	10 x 38 1 A aM	10 x 38 1 A aM	10 x 38 1 A aM	10 x 38 1 A aM	10 x 38 16 A aM

(1) DIGISTART models supplied without high speed fuses.

For fuse sizes, see specification table (§ 1.6 on page 9).

Electronic starter DIGISTART

RECAP OF ADDRESS

 DIGISTART REF.

 N°

 UNIT REF.

ADDRESS	REFERENCE	UNIT	UNIT SETTING	FACTORY SETTING	LIMITS		YOUR SETTING
					LOW	HIGH	
01	Motor I_N	AMPS	I Motor on name plate	I_s DIGISTART	*	I @ 40	
02	Start I	% I_N	These settings depend on the application and type of start	300 %	0	(1)	
03	Limit I	% I_N		400 %	0	(2)	
04	Ramp time	Sec.		10 s	0	60 s	
05	Current display	% I_N	Display address No setting	*	*	*	
06	Control term. block/keyboard	CODE	Keyboard : 0 Term. block : 1	0	0	1	
07	Motor thermal overload function	CODE	Disable : 0 Enable : 1	1	0	1	
08	Motor thermal overload current	% I_N	Ref. current	100 %	50 %	200 %	
09	Time delay of thermal overload enable	Sec.	Set according to total start time	20 s	0	600 s	
10	Restart funct. after micro-interruptions	CODE	Disable : 0 Enable : 1	1	0	1	
11	Low or high volt. select	CODE	220, 400, 440, 480 : 0 240, 415, 460, 500 : 1	0	0	1	
16	Type of start selection	CODE	Current regulation : 0 Speed regulation : 1 (option B)	0	0	1	
17	Select type of deceleration	CODE	Normal (std) : 0 Gradual (opt. A) : 1 Braking (opt. C) : 2 Tacho. feedback (opt. B) : 3	0	0	3	
18	Deceleration delay time	1/10 sec.	Set according to application	5 1/10 sec.	0	250 1/10 sec	
19	Reactive power control enable	CODE	Disable : 0 Enable : 1	0	0	1	
20 opt. A	Power limiter enable	CODE	Disable : 0 Enable : 1	0	0	1	
21 opt. A	Set minimum power limit	% P_N	Min. trip value	0	0	90 %	
22 opt. A	Set maximum power limit	% P_N	Max. trip value	150 %	50 %	200 %	

Electronic starter DIGISTART

ADDRESS	REFERENCE	UNIT	UNIT SETTING	FACTORY SETTING	LIMITS		YOUR SETTING
					LOW	HIGH	
23 opt. A	Power limiter delay time	1/10 sec.	Trip time	10 1/10 sec.	5 1/10 sec	250 1/10 sec	
24 opt. A	Length of gradual stop	Sec.	Setting according to application	20 s	5 s	60 s	
25 opt. C	Braking effort	No unit	Depends on inertia. Set according to machine inertia and decel. time required	50	0	250	
26 opt. C	Braking time	1/10 sec.	Depends on braking effort and inertia	100 1/10 sec.	10 1/10 sec	400 1/10 sec	
27 opt. B	Tachometer feedback voltage	Volts	Set the tachometer feedback voltage and motor synchronous speed	$(0,06 \times 1500 \text{min}^{-1}) = 90\text{V}$	20V	220V	
28 opt. B	Acceleration ramp time	Sec.	According to application	60 s	1s	600 s	
29 opt. B	Deceleration ramp time	Sec.	According to application	60 s	0 s	600 s	
30 opt. B	Motor speed	% N_N	No setting Display address	*	*	*	
31 opt. C	Standstill control/ condensation protection/drying	CODE	Disable : 0 Enable : 1	0	0	1	
32 opt. C	D.C. amps level	No unit	According to application	25	0	90	
33 opt. C	Delay time of standstill control/condensation protection/drying	Min.	According to application	0 min	0 min	100 min	
34 opt. C	Drying function	CODE	Disable : 0 Enable : 1	0	0	1	

OUTPUT RELAYS (OPTION A)

	FUNCTION	CLOSING THRESHOLD	OPENING THRESHOLD	DELAY TIME
C1				
C2				
C3				

(1) 500 % of I_S or 800 % of I_N , whichever is the smaller

(2) 500 % of I_S or 550 % of I_N , whichever is the smaller

(3) This function can only prolong deceleration time. (Braking is necessary to reduce deceleration time).

(4) CODE : See § 5.5 page 37



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