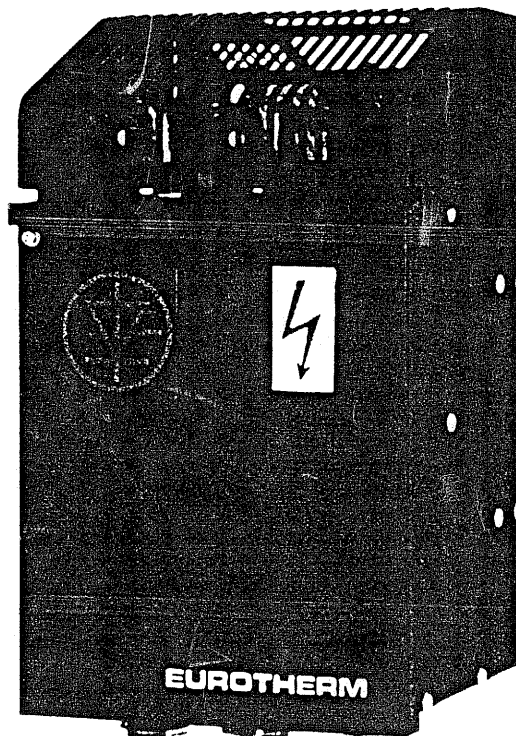*Neu* *07/87*

THREE PHASES COMPACT

MICROPROCESSOR BASED THYRISTOR STACK

(TC 3000)

OPERATOR MANUAL

EUROTHERM

This instrument must be configured to its application before turn on.

W A R N I N G

PLEASE READ THIS OPERATING MANUAL CAREFULLY. IT CONTAINS INFORMATION
CONCERNING THE DIFFERENT THYRISTOR STACK OPERATING MODES.

THIS MANUAL WILL USEFULLY PROVIDE YOU ALL THE SPECIFICATIONS AND
ADDITIONAL POSSIBILITIES AVAILABLE ON THE STANDARD MODEL.

NEVER TURN ON THE STACK WITHOUT COMPLYING WITH THE PROCEDURE
DESCRIBED CHAPTER V.

CONTENTS

I SPECIFICATIONS

I.1 Introduction

The TC 3000 power unit is a microprocessor based thyristor unit designed for 3 phase system control.

The use of microprocessor allows :

- Automatic frequency configuration (50 - 60Hz)
- Automatic phase rotation sensing (connection sequence unimportant)
- Analog signals are reduced to synchronization and input signals only.

I.2 General features

Working temperature : 0 to 50°C (unit in vertical position)
Storage temperature : - 10°C to + 70°C
Driver module main supply   110-120V   + 10 % - 15 %
                            220-240V

I.3 Electrical specifications

Load current rating :

25A - 40A - 60A - 75A - 100A - 150A - 250A - 300A* - 400A* - 500A*
(*) These units will be available shortly.

Note	Fuses fitted to Eurotherm Thyristor Units are for protection of the internal commponents only. They are not intended to replace normal line fuses. Each output circuit and installation using Eurotherm Thyristor Units must be equipped with line fuses or automatic circuit breakers of appropriate ratings.

Nominal line to line voltage rating :
120 - 240 - 277 -   - 440 - 500 - 660V

Input signals :

DC voltage   0 - 5V   )
              1 - 5V   )   With digital
              0 - 10V   )   filter
              2 - 10V   )
Current :   0 - 20mA   )
              4 - 20mA   )
Logic : thyristor stack ON for voltage > 2.5V

Fuse indicator :

A fuse indicator, installed on each *Fuse, stands out* when the fuse is opened. (Stop of the unit for lack of synchronization signal)

FUSES TYPES TABLE OF TC 3000 SERIE

NOMINAL	MAX VOLTAGE	REF. EUROTHERM	REFERENCE FERRAZ	REFERENCE LKNES	NUMBER OF FUSES PER UNITS
25 A	440 V	CH 172 143	6 BodKC3 URGL 30 Ttc/40 (P 78 627)		3
	660 V	CH 172 317	6,6 BodK CAURB 31 Ttc/50 (W 78 620)		3
40 A	440 V	CH 172 143	6 BodK C3 URGL 30Ttc/50 (Q 78 628)		3
	660 V	CH 172 137		170L 4956	3
60 A	440 V	CH 172 130	6 Bod KC3 URGL 30Ttc/80 (L 87 088)		3
	660V	CH 172 137		170L 4956	3
75 A	440V	CH 172 132	6 Bod KC3 URGL 30Ttc/100 (R 82 125)		3
	660V	CH 172 138		170L 4957	3
100 A	440V	CH 172 140	6 Bod KC3 URGK 30Ttc/125 (Y 78 980)		3
	660V	CH 172 139		170L 4958	3
150 A	660 V	CH 172 135		170L 4960	3
250 A	440 V	CH 172 141	6 BodKC3 URGG 31Ttc/315 (V 78 977)		3
	660V	CH 172 142		170 L 5555	3
300 A	440V	CH 172 309	6,6BodK CAURGD 32Ttc/400 (W 87 488)		3
	660V	CH 172 310	6,6 BodK URB 32 Ttc/400 (L 79 222)	170 L 8495	3
400 A	660V	CH 172 311	6,6 BodK CAURGD Ttc/500 (P 87 551)	170 L 8497	3
500 A	660V	CH 172 310		170 L 7036	3

TC 3000 :
THYRISTOR COMPACT STACK MICROPROCESSOR BASED
SERIES 3000
25 TO 500 A

CODING

BASIC PRODUCT	APPLICATION	NUMBER OF CONTROLLED PHASES	LOAD CURRENT	VOLTAGE	AUXILIARY POWER SUPPLY	FEEDBACK MODE	INPUT	FIRING MODE	WIRING CONFIGURATION	LOAD	OUTPUT LIMIT	RAMP	OPTION	
— 1	— ?	— 3	— 4	— 5	— 6	— 7	— 8	— 9	— 10	— 11	— 12	— 13	— 14	00

The coding can be complete with all the fields (1 to 13) or a short
code can be used with only fields 1 to 7. In this case other
configurations are made by the customer and the product is delivered
as follow :

8/ 4-20mA input
9/ Phase angle firing mode
10/ Star without neutral wiring
11/ Inductive load
12/ Threshold V2 output limit
13/ Ramp

                              CODE

1/ BASIC PRODUCT   :   TC 3040 : 25 to 150 Amps
                                TC 3045 : 250 Amps
                                TC 3050 : 300 to 500 Amps (*)

2/ APPLICATION   :   AC   : AC power unit

3/ NUMBER OF CONTROLLED   :   02   : Two phases of a three
   PHASES   phases system
                                03   : Three phases of a three
                                                phases system

(*) : Not available at present time.

```
4/ LOAD CURRENT          :       25A        : 25 Amps
                                 40A        : 40 Amps
                                 60A        : 60 Amps
                                 75A        : 75 Amps
                                100A        : 100 Amps
                                150A        : 150 Amps
                                250A        : 250 Amps
                                300A (*)    : 300 Amps
                                400A (*)    : 400 Amps
                                500A (*)    : 500 Amps


5/ LINE TO LINE VOLTAGE  : 120V            : 120 Volts
                           240V            : 240 Volts
                           277V            : 277 Volts
                           440V            : 440 Volts
                           500V            : 500 Volts
                           660V            : 660 Volts


6/ AUXILIARY POWER SUPPLY: 110V120         : 110 to 120 Volts
                           220V240         : 220 to 240 Volts


7/ FEEDBACK MODE         : Standard (without current limit)
                           V2OL            : V2 control (open loop)

                           Model with current limit
                           V2IL            : V2 control (open loop)   ⎤ Phase
                                             with I2 limit            ⎥ angle
                           I2CL            : I2 control (closed loop) ⎦ only


8/ INPUT                 : 0V5             : 0-5 Volts
                           1V5             : 1-5 Volts
                           0V10            : 0-10 Volts
                           2V10            : 2-10 Volts
                           0mA20           : 0-20mA
                           4mA20           : 4-20mA


9/ FIRING MODE           : LGC             : Logic mode
                           PA              : Phase angle mode
                           FC1             : Single cycle
                           FC8             : Fast cycle (8 cycles)
                           FC64            : Fast cycle (64 cycles)
                           FC255           : Fast cycle (255 cycles)
                           SFC8            : Fast cycle (8 cycles) with soft
                                             start
                           SFC64           : Fast cycle (64 cycles) with
                                             soft start
                           SFC255          : Fast cycle (255 cycles) with
                                             soft start

(*) : Not available at present time.
```

10/ WIRING CONFIGURATION: 3D   : Three wire delta
                               3S   : Three wire star
                               4S   : Four wire star with neutral
                               6D   : Six wire open delta

11/ LOAD   :   IND   : Inductive load Zündung verzögernd
                               RES   : Resistive load

12/ OUTPUT LIMIT   :   LV2   : Linear V2 limit
                               TV2   : Threshold V2 limit :

13/ RAMP   :   RP   : Ramp
                               NRP   : No ramp

14/ OPTIONS   :   PROTEC   : Protection covers
                               NO FUSE : Without internal fuses
                               FTR   : Fungicid treatment
                               FUMS   : Fuse micro-switches

CODING EXAMPLE :

A thyristor compact serie 3000, three controlled phases 150A per
phase, 440V load supply. Driver supply 240V, Input 0-20mA. Phase
angle firing mode, with current limit and ramp. Star without neutral
wiring with inductive load. Output limit by threshold. Protection
covers fitted.

FULLY CODED :

TC 3040/AC/03/150A/440V/220V240/V2IL/0mA20/PA/3S/IND/TV2/RP/PROTEC/00

SHORT CODE :

TC 3040/AC/03/150A/440A/220V240/V2IL/PROTEC/00

II CONFIGURATION

II.1 General design

The unit design is based upon the motorola 6805 R3 microprocessor whose main fuctions are :

- zero of voltage and phase polarity recognition

- input signal conversion : by means of 5 jumpers, 1 type of input signal can be selected among the 6 possible.

- triggering : independant control of each of the 6 triggers (triggering can be directly clamped by an external signal)

- watchdog which monitors :
    . the correct microprocessor activity and resets it in case of failure.
    . the supply voltage and inhibits the power in case of voltage drop (< 70% of nominal value).

- a special algorithm discrimates the false zero-crossing

- an alarm output indicates any failure of each of the 3 phases

- a set of 10 jumpers enables selection of firing mode and operating mode

- current limit option :
    . either V2 signal with I2 limit (by threshold) and V2 limit (by threshold or variable gain)
    . or I2 control with I2 and V2 limit (by threshold or variable gain)

Good protection against noise and interferences with the use of adequate filters

Fig. 3 : Schematic diagramm of driver board
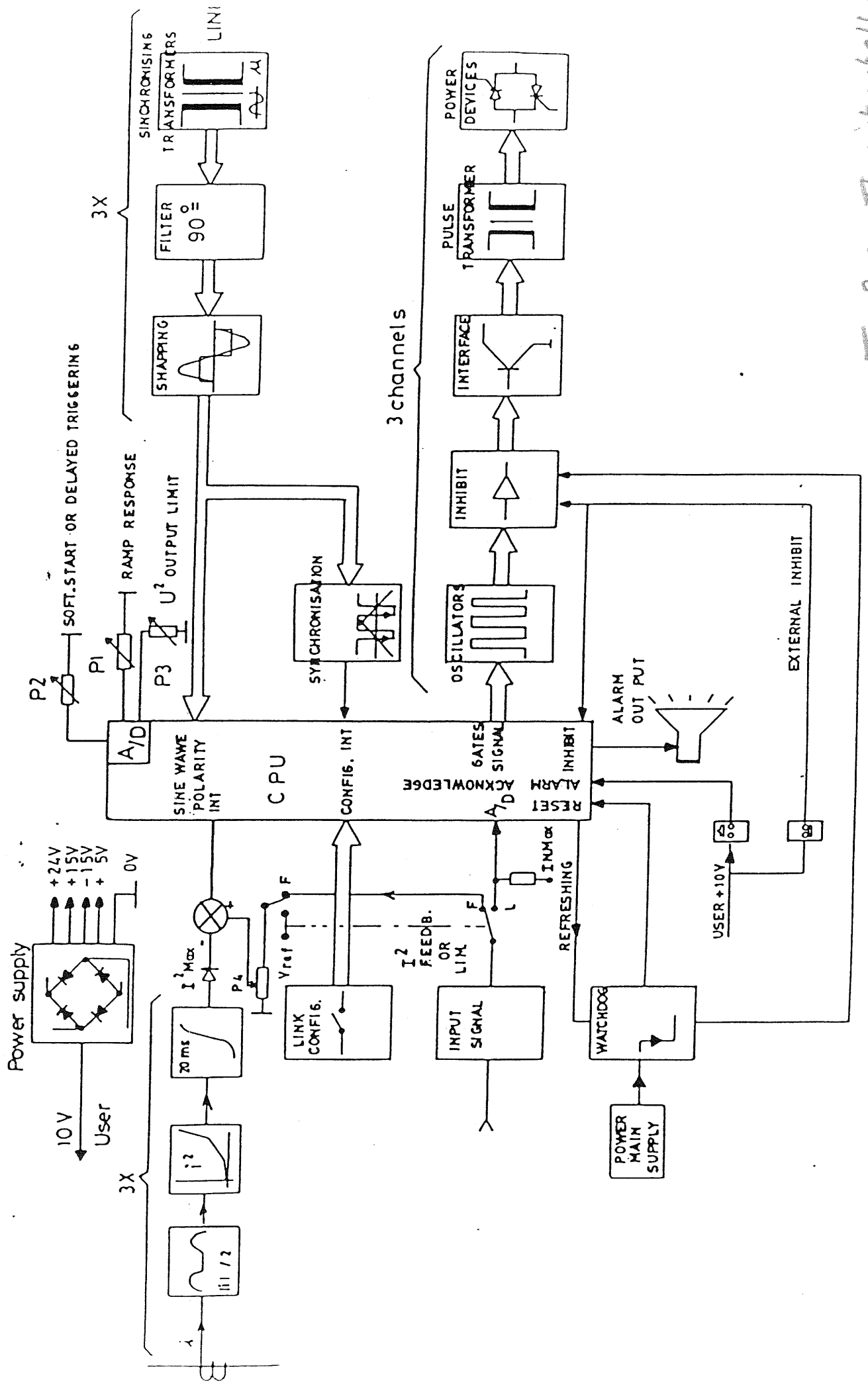
TC 3000 Thyristorsteller

8

II.2. Driver main supply configuration :

3 soldered links enable driver main supply configuration
in 110-120V ac or 220-240V ac

	LK3	LK4	LK5	
110 - 120 V	—	X	X	X : Wired
220 - 240 V	X	—	—	— : Not installe

AC 172 010

LK 3
LK 4
LK 5

User connector
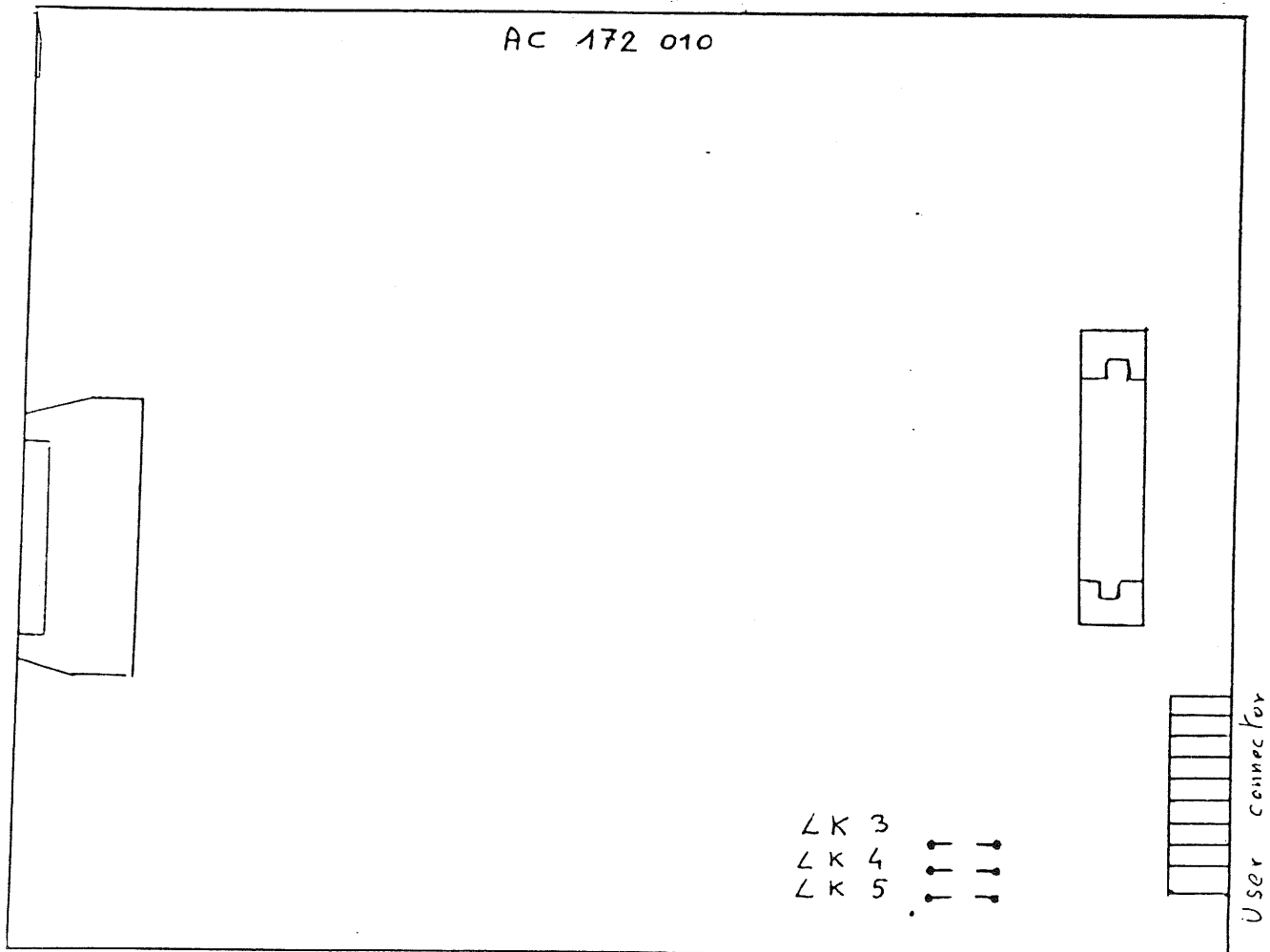
II.3 Input signal configuration

5 removable links allow to select the type of input.

Voltage input :   0 - 5V
                  1 - 5V
                  0 - 10V
                  2 - 10V

Current input :   0 - 20mA
                  4 - 20MA

Link

SCALE	J0	J1	J2	J3	J4
0-5V	0	0	0	0	0
1-5V	0	1	0	1	0
0-10V	0	0	1	0	0
2-10V	0	1	1	1	1
0-20mA	1	0	0	0	0
4-20mA	1	1	0	1	0

Voltage inputs (rows 0-5V through 2-10V)

Current inputs (rows 0-20mA through 4-20mA)

Links position

J0   J1   J2   J3   J4

1

0

LINKS LOCATION FOR SIGNAL INPUT CONFIGURATION

AC 172 010

J0 J2 J4

1/ON
0/OFF

J1 J3

User connector
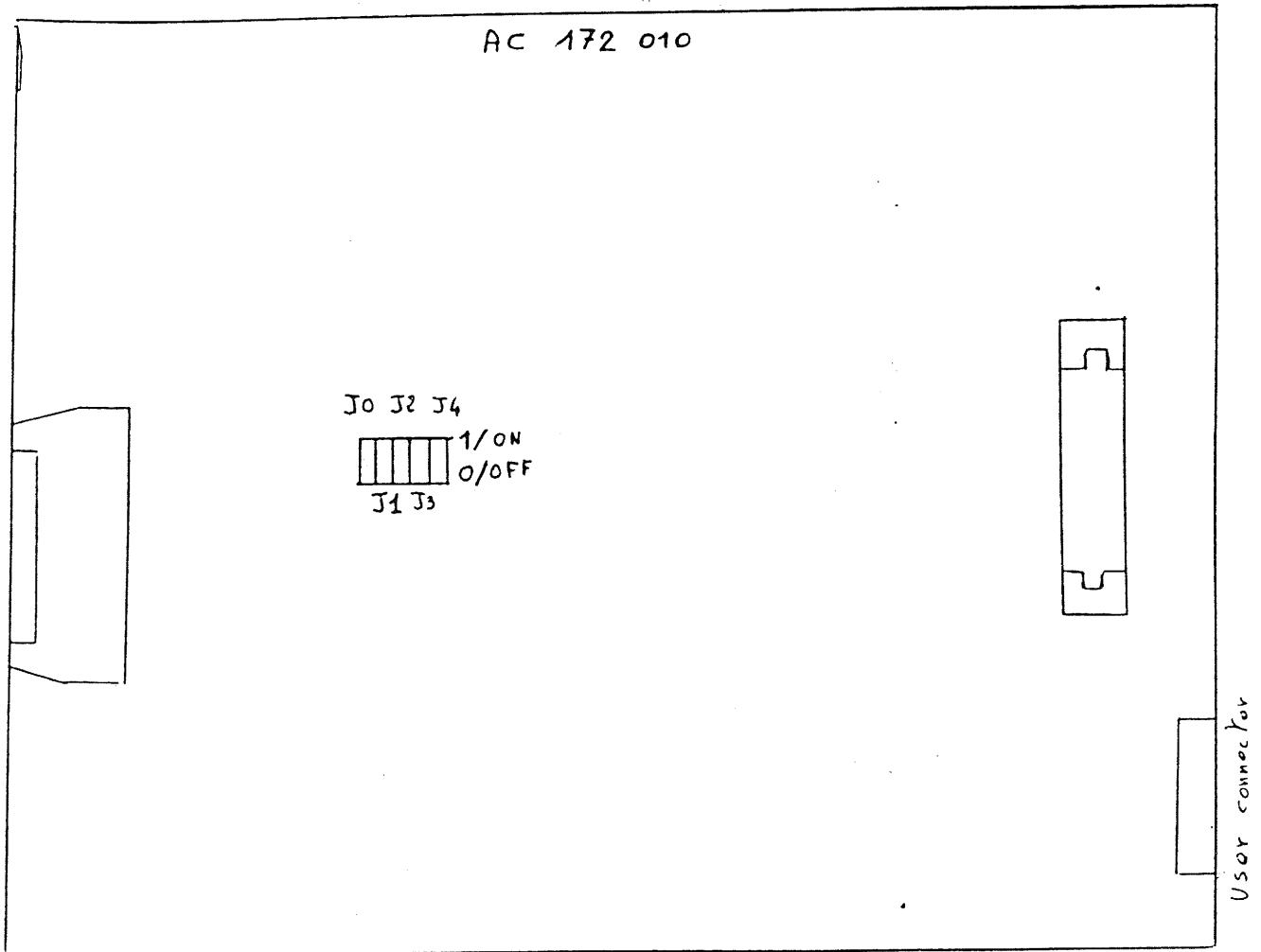
	Scale	J0	J1	J2	J3	J4
Voltage Inputs	0- 5 V	0	0	0	0	0
	1- 5 V	0	1	0	1	0
	0-10 V	0	0	1	0	0
	2-10 V	0	1	1	1	1
Current Inputs	0-20 mA	1	0	0	0	0
	4-20 mA	1	1	0	1	0

II.4. Synchronization

Synchronization on each phase is set with a transformer (galvanic isolation). For each of the 3 phases, the circuit give to the microprocessor :

- one pulse of zero crossing
- the sign of the phase (polarity)

II.5 Triggering circuit

II.5.1 Control

For each of the 3 phases an astable multivibrator (555) ensures pulses production (oscillations frequency is 20 Khz)

The start of the astable is synchronized with the control of the gate.

Besides triggering can be clamped :

- by the remote input ENABLE
- directly by the microprocessor in case of failure (lack of a phase for example)
- in case of main voltage drop

Open collector outputs provide the gate pulses to the power modules (pull up resistor is on the power side to obtain a better signal/noise ratio)

II.5.2 Power

Isolation, amplification and adaptation of impedance are made by a pulses transformer.

AC 172 010

K0 K2 K4 K6 K8
1/ON
0/OFF
K1 K3 K5 K7 K9

User Connector
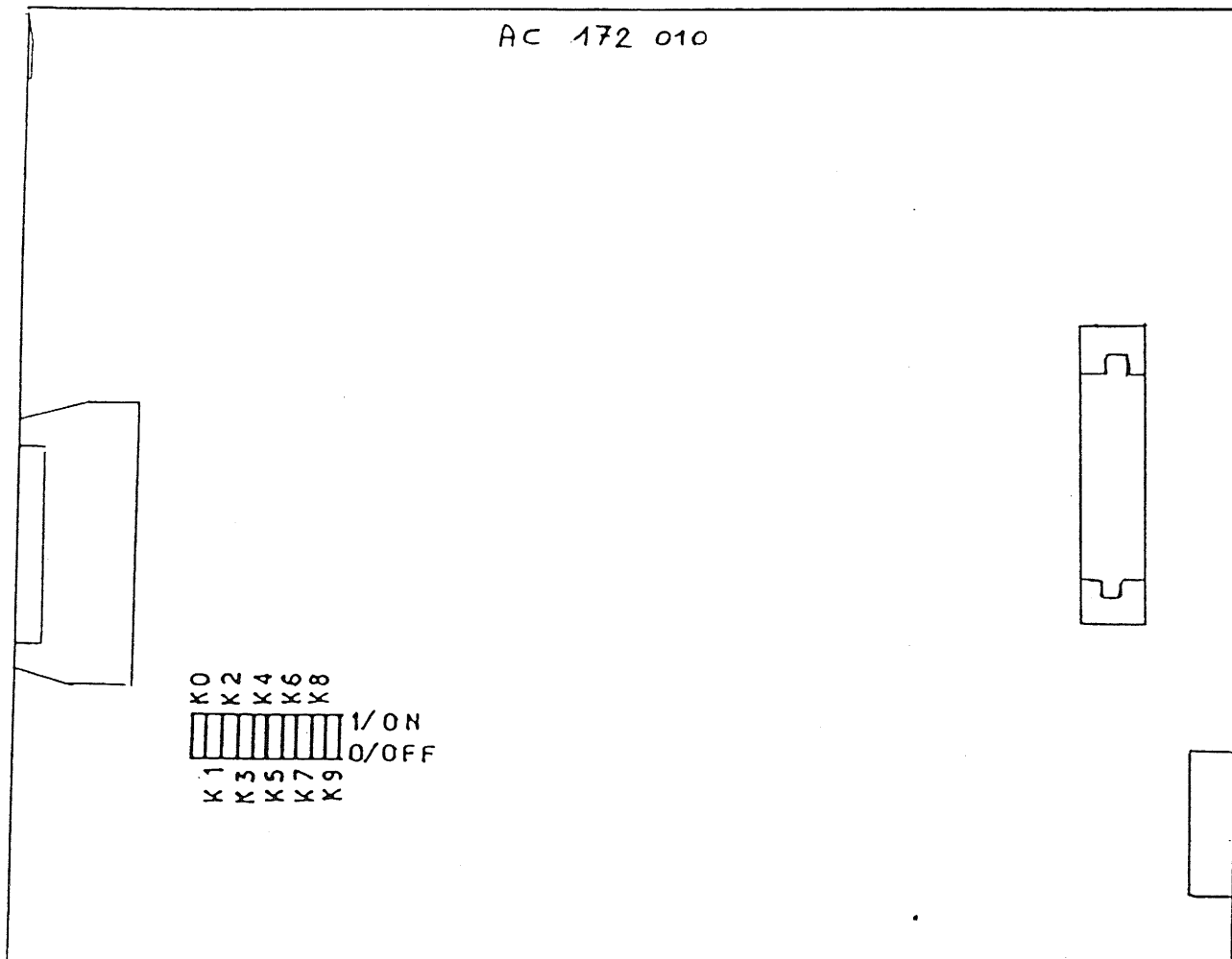
LINKS LOCATION FOR OPERATING MODES CONFIGURATION

II.6 Firing mode configuration

The removable K links are used to select all the different operating modes of the thyristor stack.

K0	K1	K2	K3	K4	K5	K6	K7	K8	K9	Position
0	0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0	0	0

- Firing mode :

K0	K1		
0	0	....	Logic
1	0	....	Phase angle
0	1	....	Fast cycle
1	1	....	Soft start fast cycle (soft start not allowed in single cycle firing mode)

0 = OFF
1 = ON

- Number of periods in fast cycle mode :

K2	K3		
0	0	....	1 (single cycle)
1	0	....	8 periods
0	1	....	64 periods
1	1	....	255 periods

Type of load configuration

K4		
0	....	Resistive load
1	....	Inductive load

Number of phase controlled configuration

       K5

       0   .... 3 phases
       1   .... 2 phases

Type of output response to a step command configuration

       K6

       0   .... Step response
       1   .... Ramp response

Type of voltage output limit configuration

       K7

       0   .... Threshold
       1   .... Variable gain

Load wiring configuration

       K8 K9

       0   0   .... Star
       0   1   .... Delta
       1   0   .... Star plus neutral
       1   1   .... Open delta

Nota : See operating mode and firing mode in chapter III

TC 3000 Thyristor controller

load wiring (K9 K8)
- 00 Star
- 01 Delta
- 10 star + neutral
- 11 open delta

K7 — voltage output limit
- 0 clamp — No output limit with logic input
- 1 variable gain — Clamping threshold or slope adjusted by fascia pot P3

K6 — type of response in phase angle
- 0 step
- 1 ramp — Slope of ramp adjusted by fascia pot P1

K5 — number of controlled phase
- 0 3 phases
- 1 2 phases — Delayed triggering 0 to 60° adjusted by P2

K4 — type of load
- 0 resistive
- 1 inductive

K3 K2 — number of cycle at 50% output
- 00 1
- 10 8
- 01 64
- 11 255 — L = 1 cycle, not allowed in soft start

K1 K0 — firing mode
- 00 logic
- 10 phase angle — not allowed in 2 phase control mode
- 01 fast cycle — L = 1, 8, 64, 255 cycles
- 11 soft start fast cycle — L = 8, 64, 255

Soft start length
L = 8   d = 0 to 7
L = 64   d = 0 to 15   } adjustable by fascia pot P2
L = 255 d = 0 to 31

II.7 Watchdog

The watchdog role is to insure that :

- the microprocessor program and the microprocessor itself function properly

- the main supply is within its allowable tolerances (measured on phase 1)

If the above conditions are not met, the RESET input of the microprocessor is activated within 30ms. The RESET is also activated for a short period of time just after TURN ON.

Monitoring of the microprocessor defaults is made by a monostable oscillator which is retriggered regulary by the program.

A second monostable oscillator is retriggered if main voltage supply is correct.

If one of the 2 monostables falls, the RESET of the microprocessor is activated and the triggering of the thyristor device is inhibited until the reset command disappears (watchdog action is immediate in case of supply failure and within 30ms in case of microprocessor default).

Once RESET command disappears, there is a complete re-initialisation procedure before the thyristor stack goes back to normal operation

The initialisation procedure consists of :

- phase rotation reading

- main frequency reading

- configuration switches reading

II.8. ENABLE input

An ENABLE input allows the unit operation (high state) or its immediate stop (low state).

If not used, ENABLE terminal must be connected to the 10V terminal

When the ENABLE input is not connected, the unit operation is inhibited.

II.9. Driver module diagnostic connectors

The driver module has diagnostic connector, which can be connected to a diagnostic box EUROTHERM type 260 equipped with a 20 positions rotary switch.

II.9.1 Driver module signals (Meter readings)

Diagnostic points	Signals
1	+ 5V
2	+ 5V Ref.
3	+ 15V
4	+ 10V user
5	- 15V
6	+ 20V
7	Input (0-5V analog) 0V ⟶ 4 % 5V ⟶ 84 % of signal
8	I2 limit threshold (0-5V with P4 use) 5V : 100 % of In 0V : 0 % of In
9	V2 limit threshold (0-5V with P3) 5V : 100 % of V 0V : 0 % of V
10	Soft start (0-5V with P2)
11	Ramp (P1 action) 0V : 1s 5V : 1 hour
12	Oscillator phase 3 (0-5V logic 20 Khz)
13	Oscillator phase 2 (0-5V logic 20 Khz)
14	Oscillator phase 1 (0-5V logic 20 Khz)
15	INT : Interrupt at zero crossing (0-5V logic)
16	RESET Microprocessor (0-5V logic) RESET = 5V
17	INH Signal (INHIBIT = 5V, NORMAL = 0V)
18	Common : 0V
19	Phase 1 monitoring (when Phase 1 ⟶ 3.8V)
20	DC driver module supplies monitoring. 5V = normal

Test points 12 - 13 - 14
Oscillator 20 Khz (0 - 5V logic) Phase 1, 2, 3
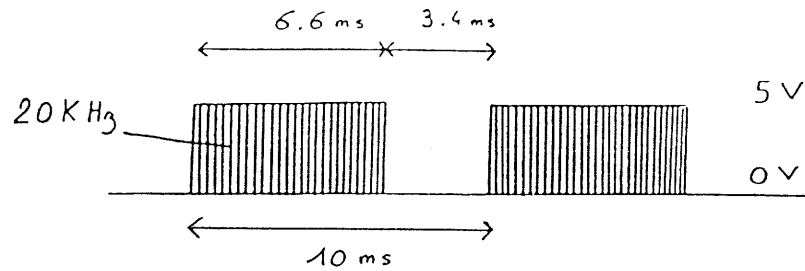
Test point 15
Interrupt at zero crossing (0 - 5V logic)
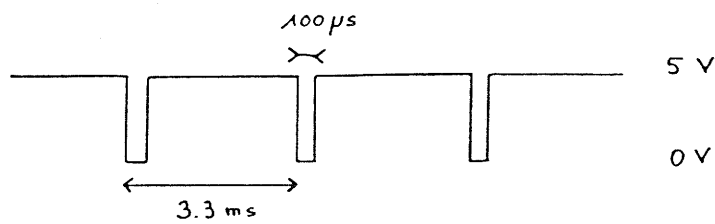
Test point 19
Phase 1 monitoring (mean value 3,8V when phase 1)
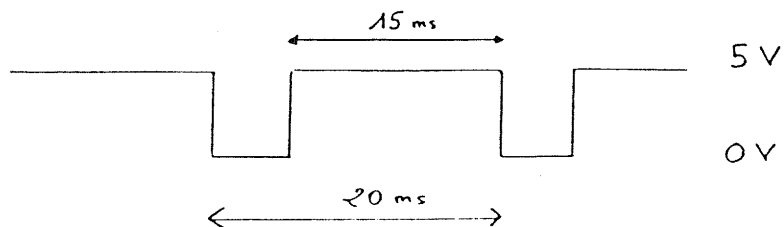
II.10. Supply

+ 15V/1,5VA
- 15V/1,5VA   DC Driver module supply
+ 5V/3VA

+ 24V/3VA   Triggering supply

+ 10V/20mA   User purpose

III. OPERATION

III.1 Operating mode

III.1.1 User potentiometers functions

Four potentiometers are situated on the left upper side of the driver board, accessible when access door is opened. The potentiometer are located as follow :
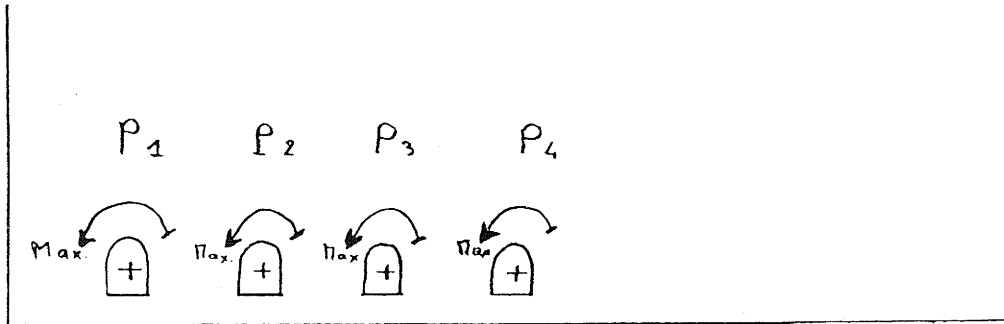
P1 Function

With K6 = 1 (ramp response to a step command configuration) P1 adjusts the duration of the ramp by means of 16 available steps (P 23).

P2 Functions

. with K4 = 0 } Resistive loads, P2 adjusts the soft start time of cycle firing mode (K0 = 1 K1 = 1).

. with K0 K1   or   K0 K1
       0 1   0 0   Fast cycle firing mode and logic firing mode

       K4 = 1 ↦ Inductive load

P2 adjusts the delayed triggering of the first period from 0 to 60°

. with K0 K1
       1 1 } Soft start fast cycle firing mode

       K4 = 1 ↦ Inductive load

P2 adjusts the length of soft start (see chap III.2.4)

. with K0 K1
       1 0 } Phase angle firing mode

       K4 = 1 ↦ Inductive load

P2 adjusts the time constant of the input digital filter

P3 Functions

P3 limits the voltage output as follow :

with K7 = 0   with K7 = 1

V^2 Output V^2 Output
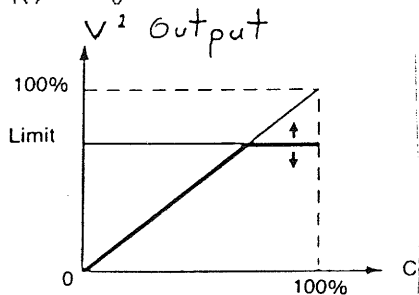
Threshold   Variable Gain
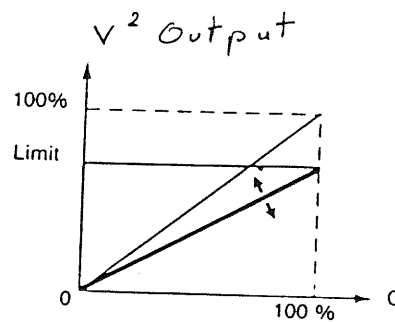
Voltage output limit is **not active** with logic input configuration.
P3 action is described chap III.1.2.4

P4 Functions

S1 = 1 | V2 control with I2 limit
S2 = 1 |

P4 allows to set the current limit from zero to the stack current rating.

S1 = 0 | I2 control with V2 output limit
S2 = 0 |

III.1.2. K4 to K9 setting

III.1.2.1. Inductive loads : transformers

K4 jumper enables type of load configuration

K4

0   Resistive load
1   Inductive load

This jumper directly enables the firing mode selection and activates the different P2 functions

III.1.2.2. Two phases or three phases control mode

K5 jumper indicates to the CPU that only 2 phases are controlled, the third one is directly connected to the load

K5

0   3 phases
1   2 phases

III.1.2.3   Ramp action (K6 = 1)

K6 jumper enables ramp action which can be adjusted by P1. The scale
value of potentiometer P1 is a logarithmic one i.e for an angle
rotation α of P1 with $0 < \alpha < 100$ %

Tr is : $Tr = e^{0.0819 \alpha}$
with Tr in second and α in %

Tr : From 0 to 100%
      of o/p power
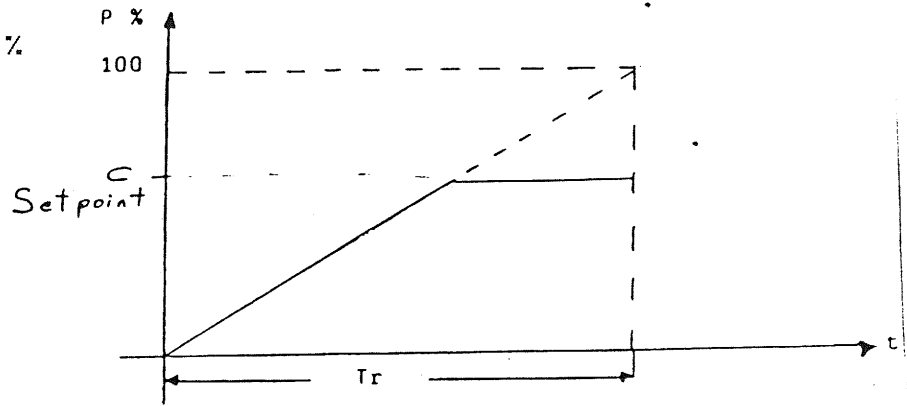
Tr is the time for the output to increase from 0 to 100 % of power.
Ramp action is finished when output reachs the setpoint C.

Tr can be adjusted from 1s to 1 hour in 16 steps (fig 1)
The value of Tr can be modified while the output is ramping up. The
ramp is active only when the power demand is going up. When the
power demand is coming down, the output follows the input without
ramp as shown below.

— Setpoint
— Output
  Response
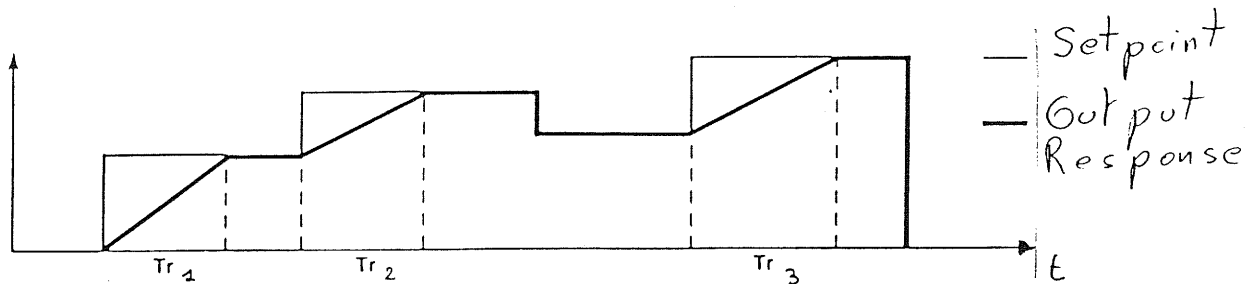
The ramp is automatically active when power is applied to the stack
or after a micropocessor reset and for an increase of output power.
Ramp is also active after an open circuit has been made between
ENABLE terminal and +10V terminal.

. The value of P1 read by the microprocessor is set from a logarithmic range.

. 16 steps are fixed. They can be recognized with their voltage value read on point 11 of diagnostic box EUROTHERM 260

Time

$$t \text{ ramp} = e^{0,082\,\alpha}$$
α = pourcentage de la plage totale de variation de P1
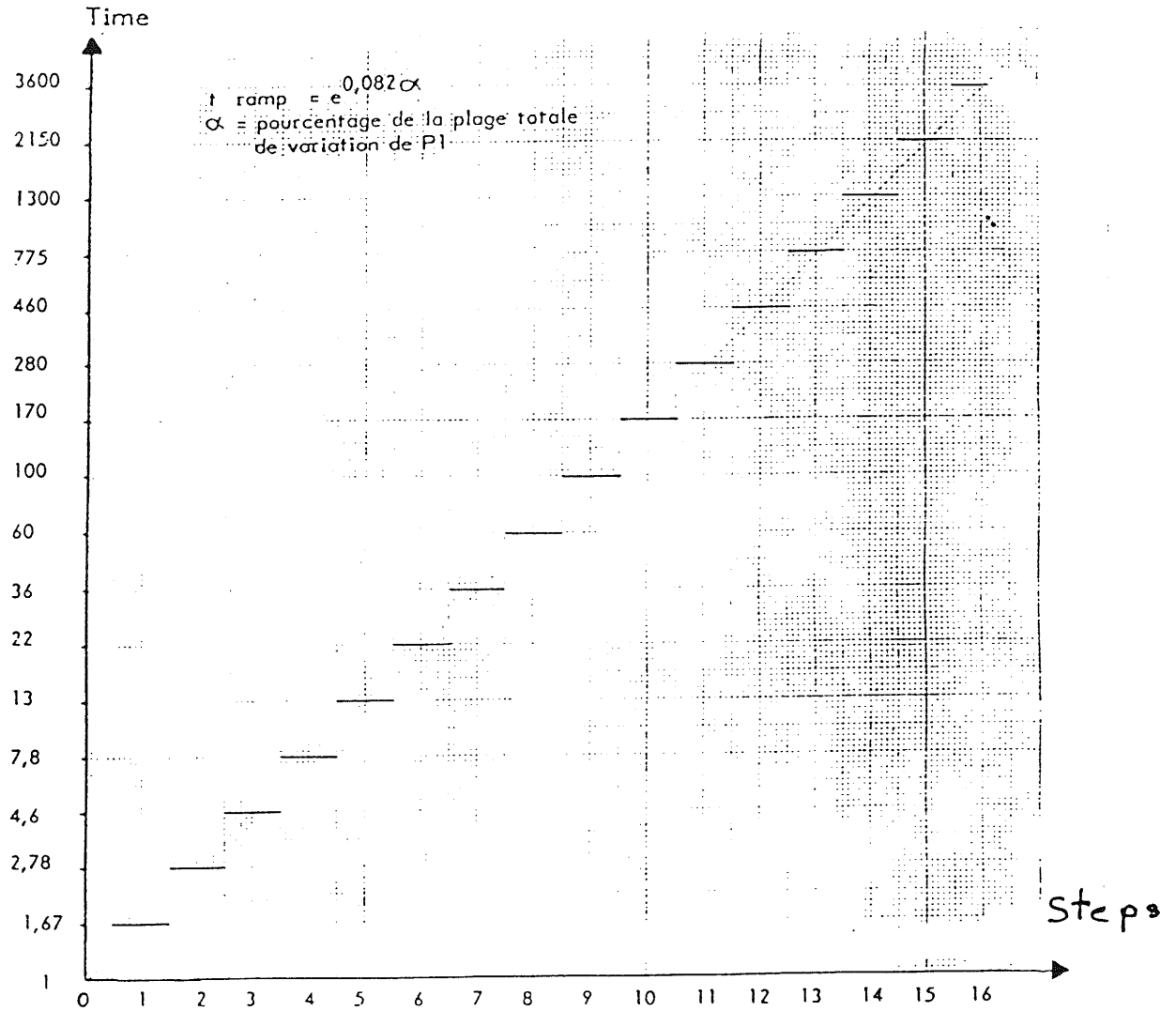
Steps

Voltage values on diagnostic point 11 for each step

Steps	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Volts	0,31	0,63	0,94	1,25	1,56	1,88	2,19	2,5	2,8	3,13	3,44	3,76	4,06	4,38	4,69	5

III.1.2.4. Voltage output limit (V2 limit)

K7 jumper selects the type of voltage output limit

P3 potentiometer is always active and is used to set a limit of V2

For P3 = 100 % (fullyCCW), there is no limit.

Curve P = f (c) without limit

P = Output power

C = Setpoint
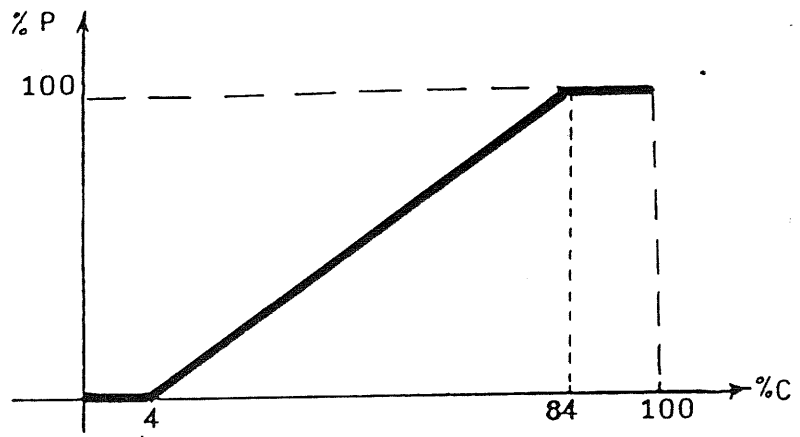
For P3 ≠ 100%   two types of limitation are available.

K7 = 0
Threshold limit
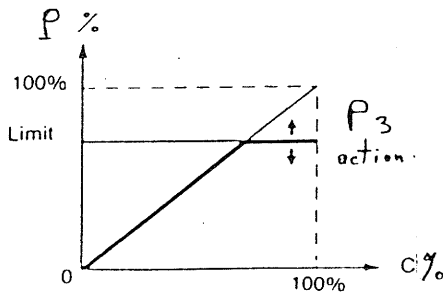
K7 = 1
limit by linearisation

Output clamp
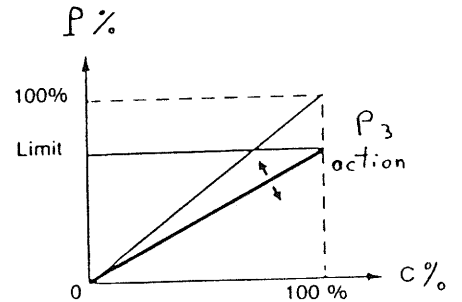
Variable gain

Voltage output limit is not active in logic firing mode

III.2 Firing modes and wiring configuration

KO to K3 jumpers enable the firing mode configuration (see chap II.5)

III.2.1 Logic firing mode

Triggering threshold is set to 25 % of full input range (ex : 2.5V for a 0-10V input signal)

Triggering is synchronized ie phase 1 and phase 2 are triggered at the same time on a zero crossing (phase 1 with an increase of voltage) and phase 3 triggering is delayed by 90°.

For inductive load (K4 = 1) there is a delayed triggering which can be adjusted to value φ of the cos φ power factor. This delay set with the potentiometer P2, prevents inruch surge currents on voltage switching of inductive loads.

In this case after a reset sequence, the first triggering will be a soft start as described below.

Soft start o 32 cycles
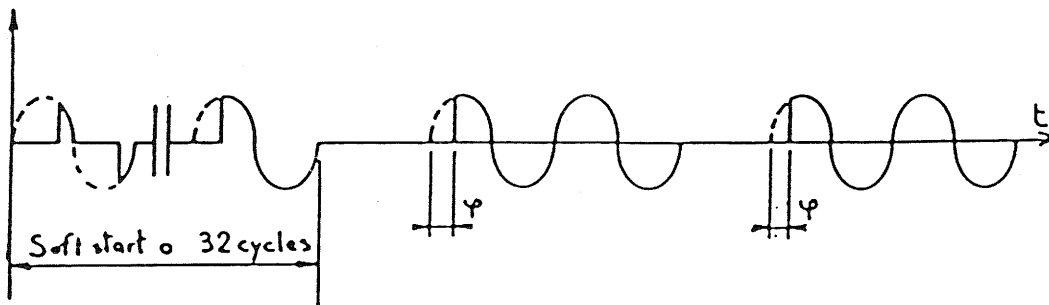
III.2.2 Phase angle firing mode

In phase angle firing mode, the input signal is linearized according to V2

On transformer loads (select K4 = 1),keep in mind that phase angle firing mode increases hysteretic losses and Foucault currents. In this mode ramp action can be selected (K6 = 1).

In this firing mode, setpoint changes to an increase of output power follow a ramp if K6 = 1. Setpoint changes to decrease the output power are instantaneous. (see chap III.1.2.3)

III.2.3. Wiring configuration

Two jumpers K8 and K9 enable configuration of the type of wiring of the load. The V2 linearization may be different according to the configuration chosen as in one case it can result in 3 single phase stacks.

```
K8  K9
0   0   ───────►  Star
0   1   ───────►  Delta
1   0   ───────►  Star + neutral
1   1   ───────►  Open delta
```

III.2.4. Cycle proportioning mode

Triggering is synchronized :
two phases are triggered at zero voltage and the third one is
triggered 90° later in order to avoid great di/dt on switching.

Four types of cycle proportioning firing modes are available
selectable with jumpers K2 and K3

        Single cycle - - - -1 period
        Fast cycle   - - - -8 periods
        Mean cycle   - - - 64 periods
        Slow cycle   - - 255 periods

For inductive load (K4 = 1), on switching the first cycle begins in
phase angle mode during 32 cycles. This soft start allows the
primary of a transformer in unknown magnetic state to magnetise
itself without overcurrent due to magnetic material saturation.
This soft start is active for every type of cycle proportioning mode
and also for the logic firing mode (see chap III.2.1)
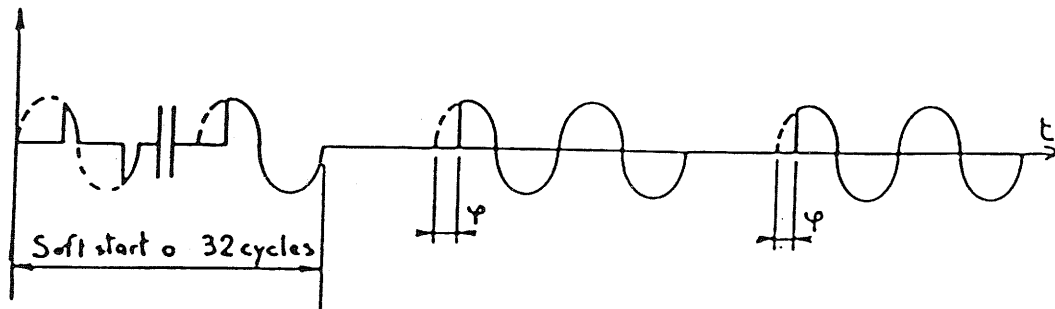
Besides a delayed triggering can be adjusted with P2 according to
the value of the power factor (cos φ) in order to minimize the
transient current.

III.2.5. Soft start fast cycle mode (K0 = 1)
(K1 = 1)

In this case, triggering is the same than for cycle proportioning mode but each cycle can begin in phase angle mode and then continues in the cycle proportioning mode previously selected.

P2 adjusts the length of soft start as follow :

Cycle base	Number of period of soft start selectables
8 ──────────────►	0 to 7
64 ─────────────►	0 to 15
255 ────────────►	0 to 31

The action of P2 is described P 29.

Nota : soft start action is not available in single cycle mode.

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Number of periods of soft start for each cycle proportioning mode according to the value of voltage (P2 action) on switch 10 of diagnostic box EUROTHERM 260.
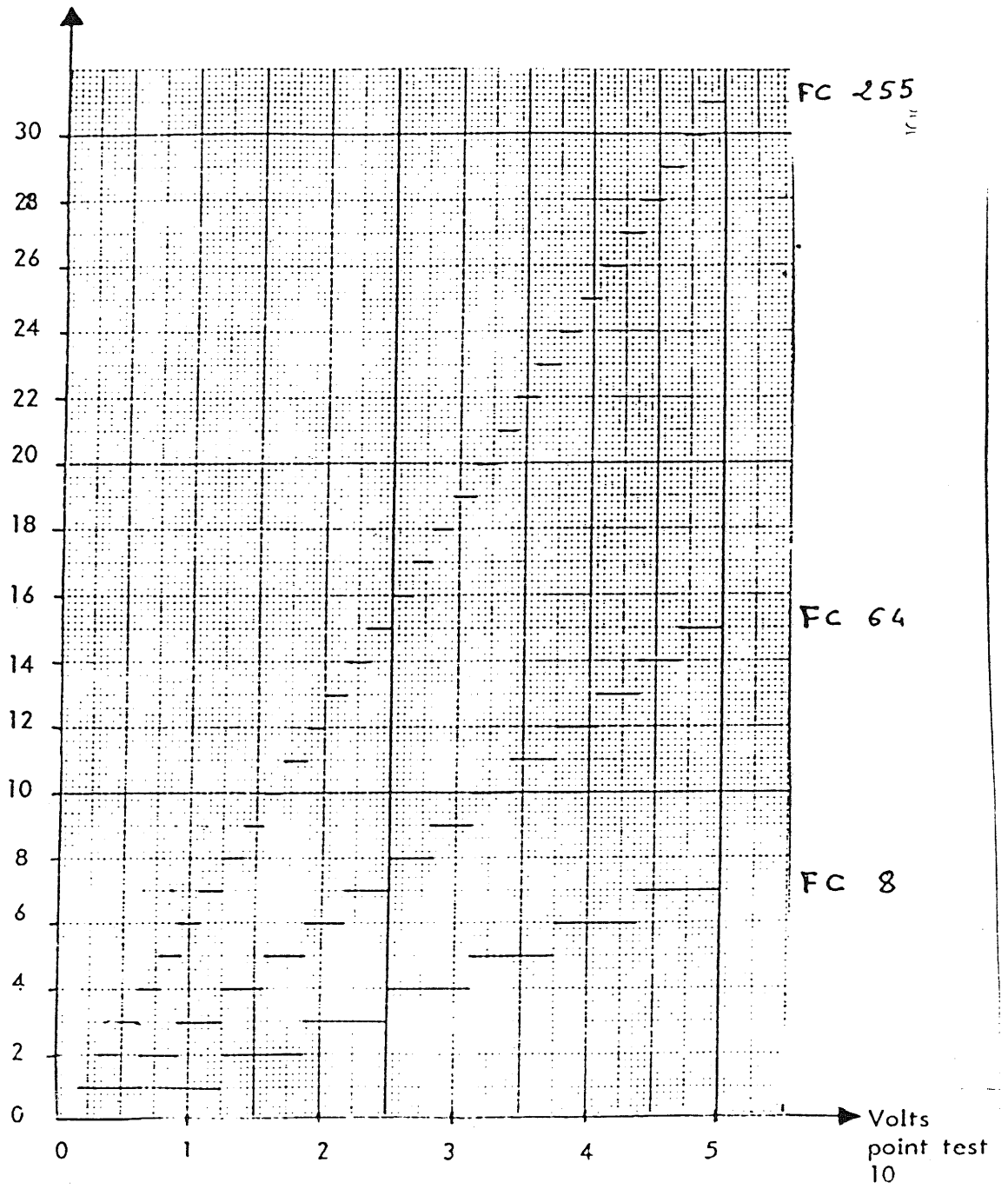
Fig. 2

III.3. Alarm output and enable input

III.3.1. Enable action

When the enable lead (Terminal 6) is not connected, triggering is
inhibited and operation of the thyristor stack is stopped. For
correct operation , this lead must be connected to the + 10V
(Terminal 5) or any other external voltage of a value within + 10V
to 50V dc referenced to the COM. terminal (Terminal 4).


```
       6            S
    Enable      + 10 V
```
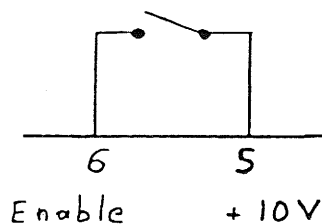
III.3.2. Alarm action

An alarm output is available on the user terminal (Terminal 9).
There is also an alarm acknowledge input on this user terminal
(Terminal 8).

Alarm state conditions :

- If one (or more) phase of the three phase system disappears.
- If there is a synchronization default.
- If there is a nominal current value overshoot in logic or cycle
  proportioning operating modes.

In this case, thyristor triggering is clamped and the driver
module is in stand by until an alarm acknowledge is done :

- High state (+10V) on terminal 8 of the user terminal.

If there is a permanent link between alarm acknowledge (Terminal 8)
and +10V (Terminal 5), the thyristor stack goes back to operation as
soon as the default disappears.

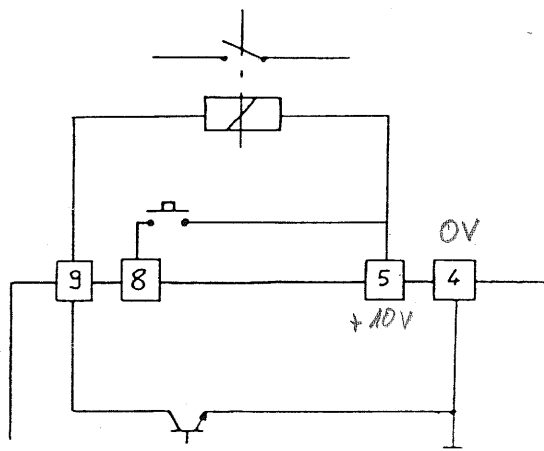Alarm output (Terminal 9) : opened collector transistor
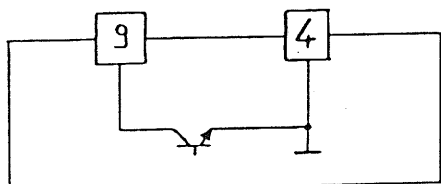
- Max voltage between collector and emettor is 30V (when in alarm, transistor is O FF.

- Max current : 30 mA
  Current available : 20 mA

Stack correctly supplied (load voltage and driver module supply) and not in alarm state : transistor is ON

Stack not correctly supplied or in alarm state : transistor is OFF
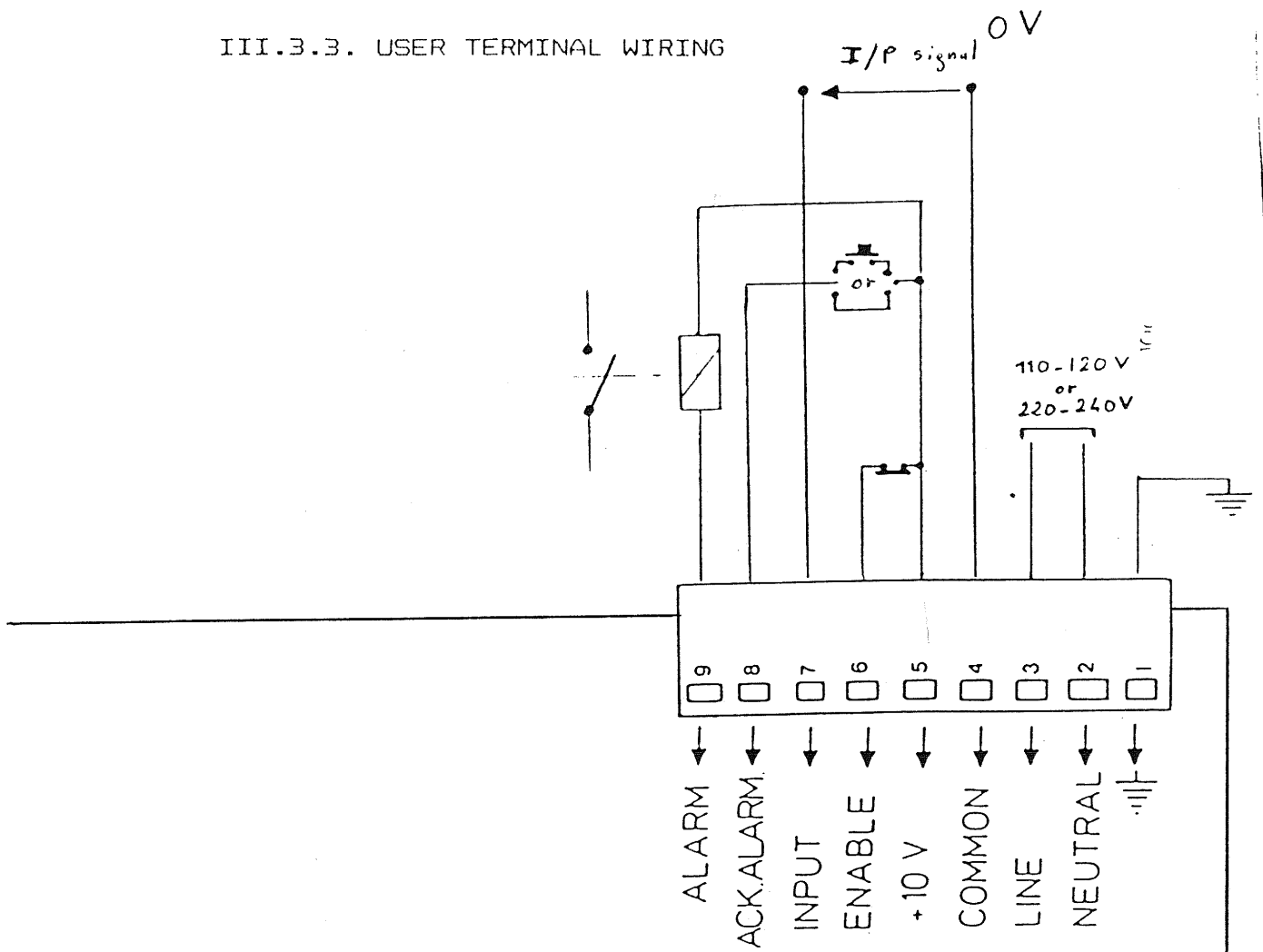
Ex : Alarm use with alarm acknowledge by manual switch.

Nota :

1/ The alarm output is an opened collector output : max voltage 30 V
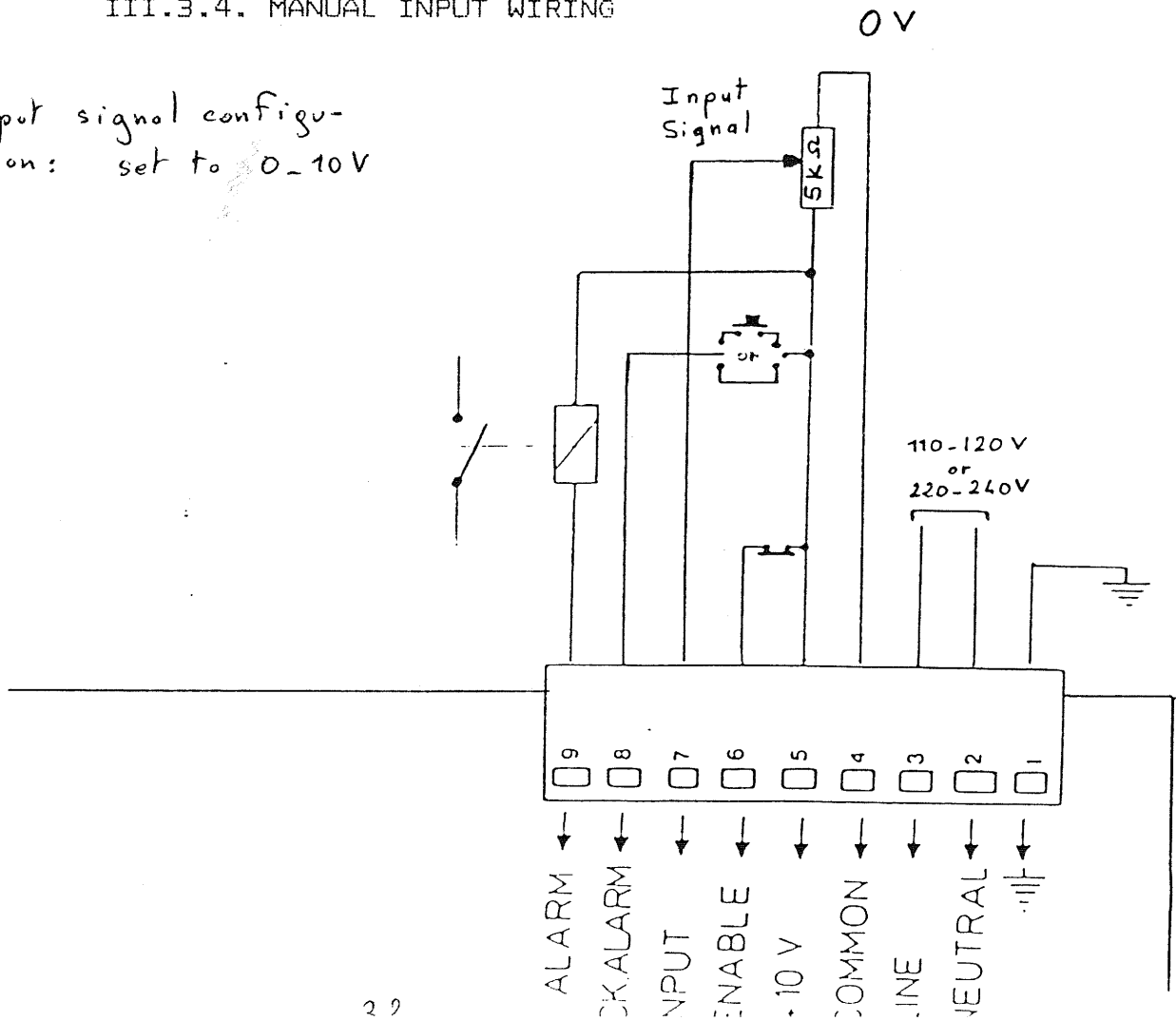   max current : 30 mA

2/ If the driver module is supplied while main supply is not provided to the power module, it goes automatically in alarm state.

III.3.3. USER TERMINAL WIRING

I/P signal   0 V

110-120 V
or
220-240V

9	8	7	6	5	4	3	2	1
ALARM	ACK.ALARM.	INPUT	ENABLE	+ 10 V	COMMON	LINE	NEUTRAL	

III.3.4. MANUAL INPUT WIRING

0 V

Input signal configu-
ration: set to 0 - 10 V

Input
Signal

5 kΩ

110-120 V
or
220-240V

9	8	7	6	5	4	3	2	1
ALARM	CK.ALARM	NPUT	ENABLE	+ 10 V	COMMON	LINE	NEUTRAL	

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III.4. Current limit option configuration

For special loads like superkanthal, reactors...., a current limit
option is available. The current limit is active only in phase
angle mode.

III.4.1. I2 limit (S1 = 1   S2 = 1)

The input signal follows a V2 linearization : a V2 voltage limit is
still active with P3 and the I2 limit is set with P4.

III.4.2. I2 control (S1 = 0   S2 = 0)

In this case, the control signal for the microprocessor is set to 5V
(max) and the threshold of limit is adjusted by the input signal. P4
set the maximum current value for full setpoint and P3 still enables
V2 voltage output limit.

III.4.3. Cautions before turn on

- For safety purpose, potentiometers P3 (V2 limit) and P4 (I2 limit)
are set to minimum.
Warning : for superkanthal loads or similar loads, P4 must be
moved with care in order to prevent overshoot of the load current
rating.

- P1 (ramp) and P2 (soft start cycle mode) are also set to minimum.

Nota : The current limit is active only in phase angle mode.
       In logic and cycle proportioning modes, when S1 = 1 and S2 = 1
       and P4 is set fully   C C W , if there is a nominal current
       value overshoot, thyristor triggering is clamped and alarm
       output is active. The unit goes back to operation after an
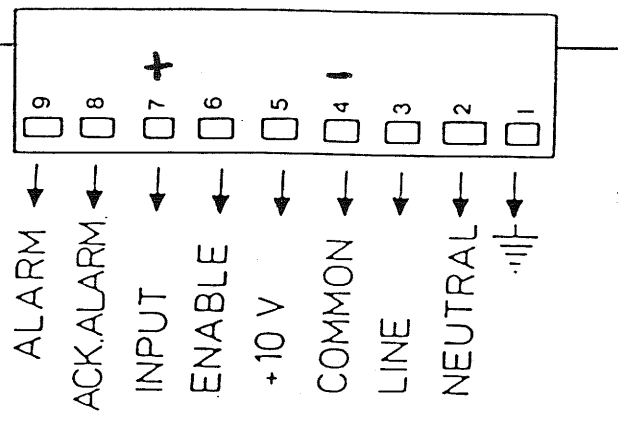   acknowledge action.

AC 172 010

S1
☐ 1/ON
☐ 0/OFF
S2
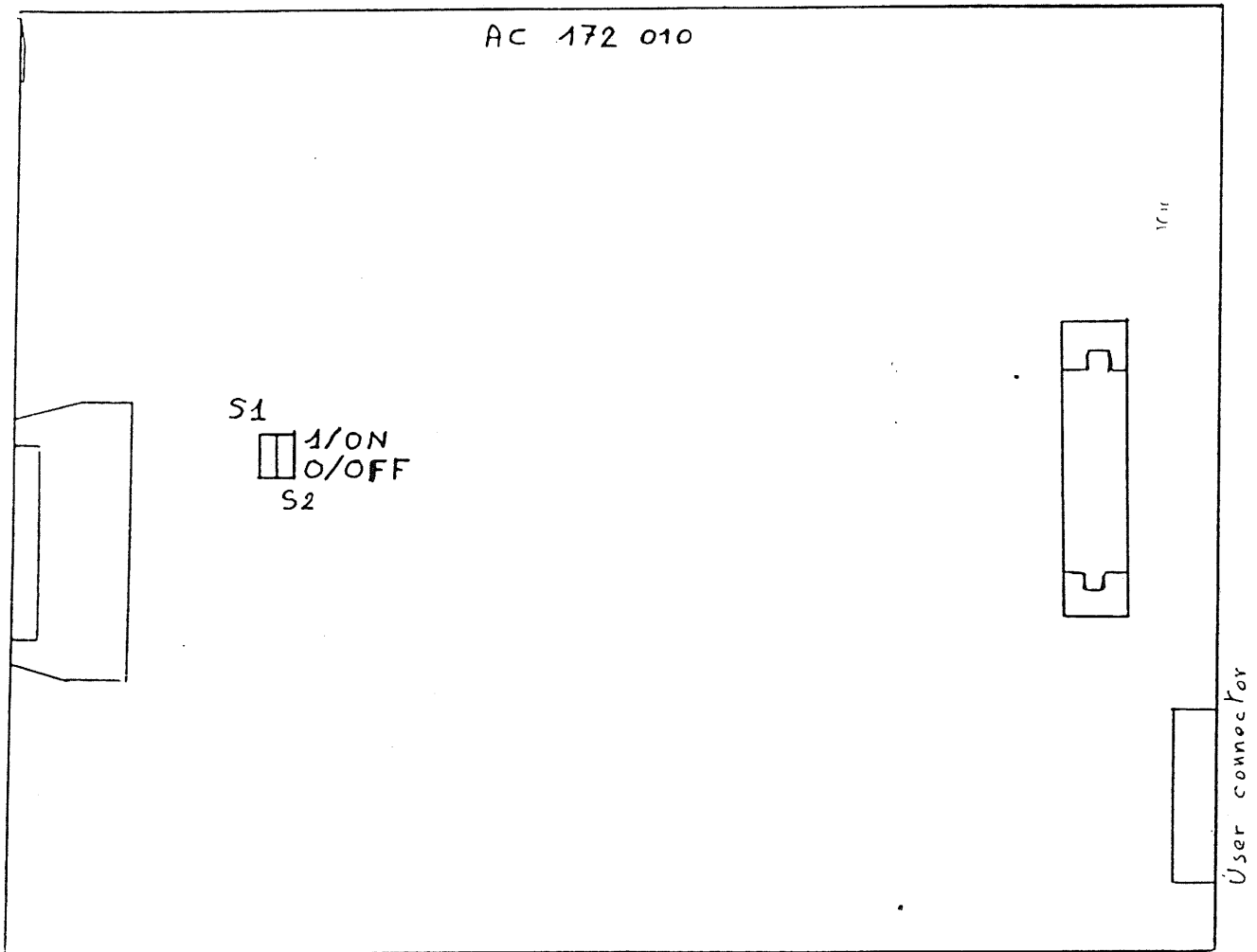
User connector

	S1	S2
V² control with I² limit	1	1
I² control	0	0

LINKS LOCATION FOR CURRENT LIMIT CONFIGURATION

IV - WIRING CONNECTION

IV.1. Low signal connection

The light current signals and driver supply connections are made to a 9 way connector block situated on the right lower corner of the driver board, accessible with access door opened.

1 : Earth
2 : Neutral
3 : Line

4 : Common
5 : + 10V
6 : Enable

7 : Input signal
8 : Alarm acknowledge
9 : Alarm

IV.2. Power connection

The line connectors (at the top of each fuse) and the earth connector are located at the top of the stack and labelled as follow :

        Line

        ⏚

The leads from the load must be connected to the connectors located at the bottom of the stack and labelled
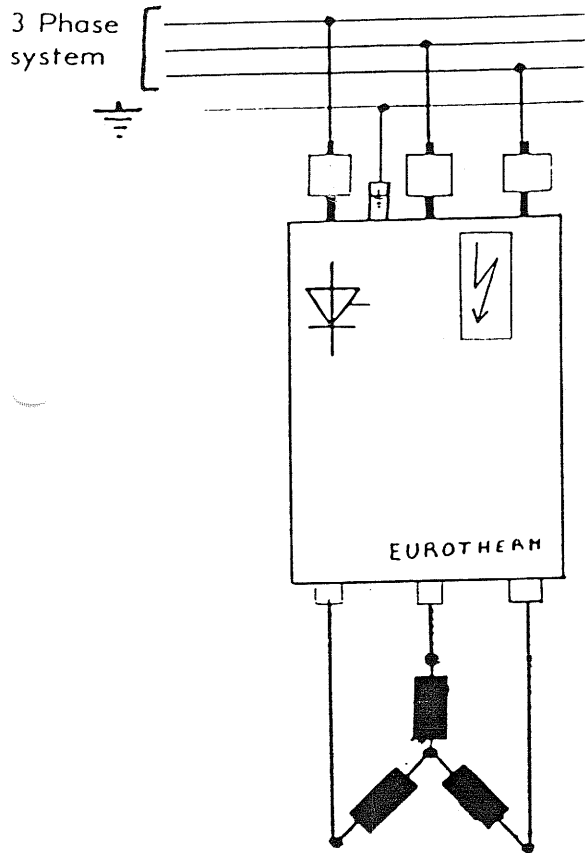
        Load

Nota : in order to tighten correctly the leads, tightening torque must be in respect of :

For M8 size   : max 10 N.m
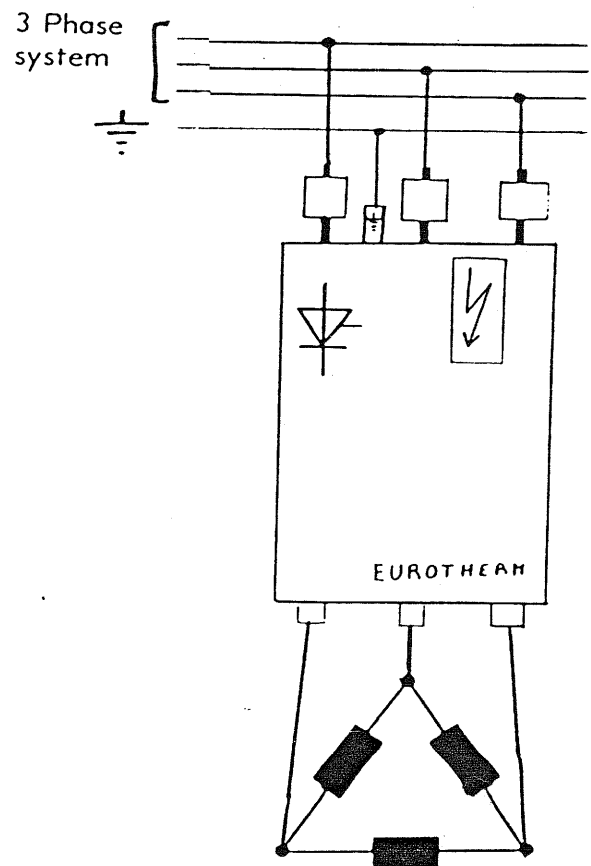For M12 size and M10 size : max 15 N.m
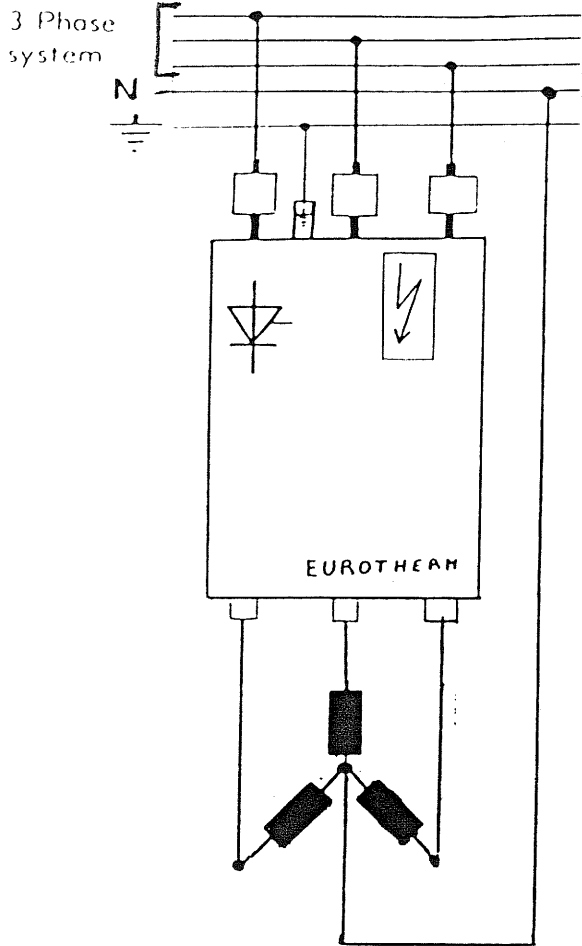
IV.3. Wiring schemes

Three phases control

For transformer load, correct winding phasing must be respected.

Star
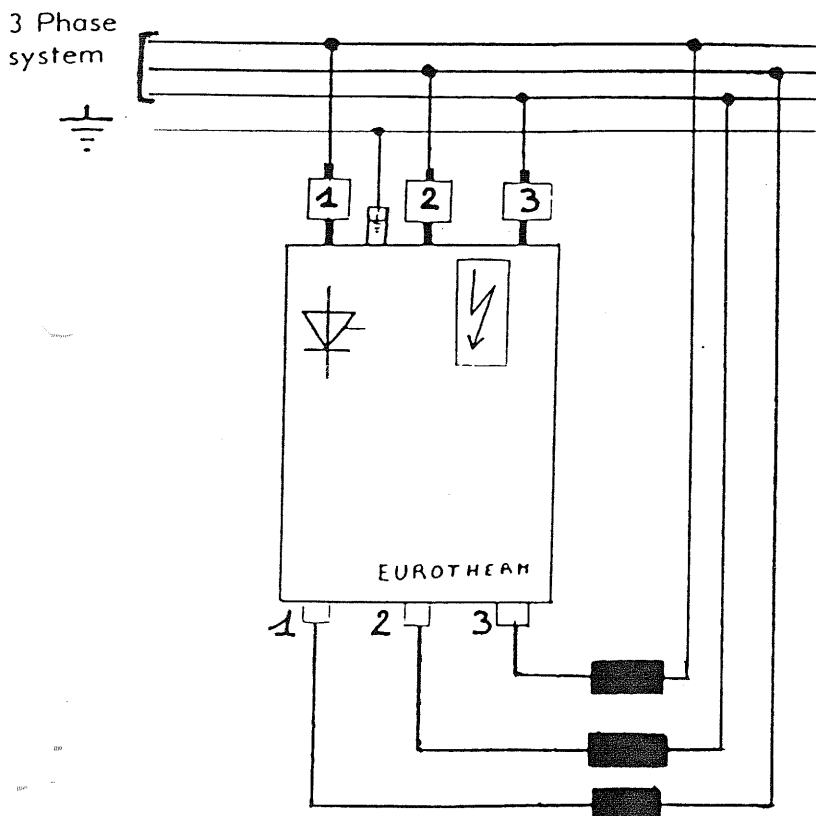Wiring

Delta
Wiring

3 Phase system

N

EUROTHERM

Neutral

Star plus neutral wiring

In phase angle firing mode and for small conduction angles (0° to 60°), current in neutral line can be up to twice higher than current in line.

This is the case for low cold resistance loads where current surge on start makes the modules operate with small conduction angles.

3 Phase system

EUROTHERM

1   2   3

Open delta wiring

This wiring scheme must compulsary be respected.

The load from the stack 1 is connected to the line of the stack 2.

The load from the stack 2 is connected to the line of the stack 3.

The load from the stack 3 is connected to the line of the stack 1.

V - TURN ON PROCEDURE

V.1. Verification

The instrument must be configured to its application before turn on.

Check that the instrument load voltage rating corresponds to the local load supply.

Check that the driver module supply rating (110 or 220V) corresponds to the local supply (the driver module main supply rating is factory set by means of soldered links (see links LK3, LK4 and LK5 chap II.2)).

V.2. Preliminary settings

- Set the output voltage limit potentiometer P3 and the current limit potentiometer P4 (if installed as option) to zero, fully CW.

- Set the ramp potentiometer P1 to zero, fully CW

- If not used, connect the enable input (terminal 6) to the + 10V (terminal 5)

- If not used, connect the alarm acknowledge (terminal 8) to the +10V (terminal 5)

V.3 Turn on in phase angle mode

- Turn on the driver supply and the load supply.

- Turn P3 slowly CCW to increase the output voltage to 100 % and watch the output current. It must not exceed the rating of the unit.

- If the unit is equipped with current limit, the current limit potentiometer P4 must also be turned slowly CCW until the desired current is provided.

V.4 Turn on in fast cycle mode with inductive load

- Link 4 must be set to 1 and P2 fully CCW before turn on.

- After turn on, slowly turn P2 CW until the current transient, seen on an oscilloscope, disappears.