## ASCON TECNOLOGIC

ISO 9001
Certified

## Double action controller with analogue output $1 / 4$ DIN - $96 \times 96$

## Q3 line

User Manual•O3/11•Code: ISTR_M_Q 3_E_O3


Double action controller with analogue output
$1 / 4$ DIN - $96 \times 96$
Q3 line
C


Please, read carefully these instructions before proceeding with the installation of the controller. Class II instrument, for indoor use only.

Notes
This controller has been designed with compliance to:
ON ELECTRIC
SAFETY AND
ELECTROMAGNETIC
COMPATIBILITY
Regulations on electrical apparatus (appliance, systems and installations) according to the European Community directive 73/23/EEC amended by the European Comunity directive 93/68/EEC and the Regulations on the essential protection requirements in electrical apparatus EN61010-1 : 93 + A2 : 95

Regulations on Electromagnetic Compatibility according to the European Community directive $n^{\circ}$ 89/336/EEC, amended by the European Community directive $n^{\circ} 92 / 31 / E E C$, 93/68/EEC, 98/13/EEC
and the following regulations:

- Regulations on RF emissions:

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EN61000-6-3: 2001 residential environments
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EN61000-6-4: 2001

- Regulation on RF immunity:

EN61000-6-2: 2001
industrial equipment and system
It is important to understand that it's responsibility of the installer to ensure the compliance of the regulations on safety requirements and EMC.
Repairs: this device has no user serviceable parts and requires special equipment and specialised engineers. Therefore, a repair can be hardly carried on directly by the user. For this purpose, the manufacturer provides technical assistance and the repair service for its Customers. Please, contact your nearest Agent for further information.
All the information and warnings about safety and electromagnetic compatibility are marked with the $\triangle C \epsilon$ sign, at the side of the note.


TABLE OF CONTENTS

| 1 | Installation - Page |
| :---: | :---: |
| 2 | Electrical connections ...... Page |
| 3 | Product coding ..\| Page |
| 4 | Operations ${ }_{\text {a }}$ - Page |
| 5 | DISPLAYS ${ }^{\text {a }}$ - Page |
| 6 | Commands . Page |
| 7 | Setpoint programmer._ Page |
| 8 | Technical specifications ...... Page |

## Installation must only be carried out by

 qualified personnel.Before proceeding with the installation of this controller, follow the instructions illustrated in this manual and, particularly the installation precautions marked with the $\triangle \subset \epsilon$ symbol, related to the European Community directive on electrical protection and electromagnetic compatibility.

## $\triangle C \in$

To prevent hands or metal touching parts that may be electrically live, the controllers must be installed in an enclosure and/or in a cubicle.

### 1.1 GENERAL DESCRIPTION



### 1.2 DIMENSIONAL DETAILS



### 1.3 PANEL CUT-OUT



## Operating conditions

| 2000 | Altitude up to $2,000 \mathrm{~m}$ |
| :---: | :--- |
| \% f | Temperature $0 \ldots 50^{\circ} \mathrm{C}$ |
| \%Rh | Relative humidity $5 \ldots 95 \%$ non-condensing |


| Special conditions |  | Suggestions |
| :---: | :---: | :---: |
| $\stackrel{2000}{ }$ | Altitude $>2,000 \mathrm{~m}$ | Use 24V~ supply version |
| ${ }^{\circ} \mathrm{O}$ | Temperature $>50^{\circ} \mathrm{C}$ | Use forced air ventilation |
| \%Rh | Humidity > 95 \% | Warm up |
|  | Conducting atmosphere | Use filter |

## Forbidden Conditions

|  | Corrosive atmosphere |
| :---: | :---: |
| WNE | Explosive atmosphere |

### 1.5 PANEL MOUNTING [1]

### 1.5.1 INSERT

THE INSTRUMENT

1 Prepare panel cut-out;
2 Check-front panel gasket position;
3 Insert the instrument through the cut-out.


### 1.5.2 INSTALLATION SECURING

1 Fit the mounting clamps;
2 Push the mounting clamps towards the panel surface to secure the instrument.


### 1.5.3 CLAMPS REMOVING

1 Insert the screwdriver in the clips of the clamps;
2 Rotate the screwdriver.


### 1.5.4 INSTRUMENT UNPLUGGING <br> $\triangle C \epsilon$

1 Push, and
2 Pull to remove the instrument,


Electrostatic discharges can damage the instrument


Before removing the instrument the operator must discharge himself to ground.

ELECTRICAL CONNECTIONS

|  | ${ }^{13}{ }^{\mathrm{N} / \mathrm{C}}$ 14 $\mathrm{N} / \mathrm{C}$ |  |
| :---: | :---: | :---: |
| c 4 c 3 | ［15N／C | 27－ |
| － | 16N／C | $2{ }^{20} 1 \times 7$ |
| 気＋5－1－ | 17N／C | 200 ${ }^{\text {c }}$ |
| \％$+6-2$ | $18 \mathrm{Na} / \mathrm{c}$ | 30 No |
| $\pm{ }_{-1}+7-{ }^{2}$ | ［19＋ | ［307 |
|  | 20－］${ }^{\text {OP5 }}$ | 圂 C |
|  | 2－1NC |  |
| ＋ 10 A | 匀NC | 34－7 |
| crab ${ }^{\text {b }}$ | 圂－7 | ［35＋ |
|  | ［4］＋$]^{\text {RE }}$ | 36＋2 |
|  |  |  |
| $\triangle \triangle$ |  | $\square$ |

## UL note

［1］Use $60 / 70^{\circ} \mathrm{C}$ copper（Cu）conductor only．

2．1 TERMINATION UNIT［1］



Pin connector
$\square 1.4 \mathrm{~mm} 0.055$ in max．


Fork－shape AMP 165004
$\varnothing 5.5 \mathrm{~mm}-0.21$ in


Stripped wire
L $5.5 \mathrm{~mm}-0.21 \mathrm{in}$

## PRECAUTIONS

$\triangle C E$
Despite the fact that the instrument has been designed to work in an harsh and noisy environmental (level IV of the industrial standard IEC 801-4), it is recommended to follow the following suggestions.

## $\Delta$

All the wiring must comply with the local regulations.
The supply wiring should be routed away from the power cables. Avoid to use electromagnetic contactors, power Relays and high power motors nearby.
Avoid power units nearby, especially if controlled in phase angle

Keep the low level sensor input wires away from the power lines and the output cables.
If this is not achievable, use shielded cables on the sensor input, with the shield connected to earth.

### 2.2 PRECAUTIONS AND ADVISED CONDUCTOR COURSE

$\triangle C \epsilon$


Conduit for low level sensor cables


## Notes:

1] Make sure that the power supply voltage is the same indicated on the instrument.
2] Switch on the power supply only after that all the electrical connections have been completed.
3] In accordance with the safety regulations, the power supply switch shall bring the identification of the relevant instrument. The power supply switch shall be easily accessible from the operator.
4] The instrument is is PTC protected. In case of failure it is suggested to return the instrument to the manufacturer for repair.
5] To protect the instrument internal circuits use:

- 2 A~ T fuse for Relay outputs (220 VAC)
- 4 A~ T fuse for Relay outputs (110 VAC)
- 1 A~ T fuse for Triac outputs

6] Relay contacts are already protected with varistors.
Only in case of $24 \mathrm{~V} \sim$ inductive loads, use model A51-065-30D7 varistors (on request)

### 2.3.1 POWER SUPPLY $\triangle C \epsilon$

Switching power supply with multiple isolation and internal PTC

- Standard version: nominal voltage: $100-240 \mathrm{~V} \sim(-15 \%+10 \%)$ Frequency $50 / 60 \mathrm{~Hz}$
- Low Voltage version:

Nominal voltage:
24V~ (- 25\% + 12\%)
Frequency $50 / 60 \mathrm{~Hz}$
or 24 V - (-15\% + 25\%)
Power consumption 4W max.


For better protection against noise, it is recommended not to connect the earth clamp provided for civilian installations.

### 2.3.2 PV CONTROL INPUT

## A L-J-K-S-R-T-B-N-E-W thermocouple type

- Connect the wires with the polarity as shown
- Use always compensation cable of the correct type for the thermocouple used
- The shield, if present, must be connected to a proper earth.


## B For Pt100 resistance

## thermometer

- If a 3 wires system is used, use always cables of the same diameter ( $1 \mathrm{~mm}^{2} \mathrm{~min}$ ) (line $20 \Omega /$ lead maximum resistance)
- When using a 2 wires system, use always cables of the same diameter ( $1,5 \mathrm{~mm}^{2} \mathrm{~min}$ ) and put a jumper between terminals 11 and 12

C For $\Delta \mathbf{T}$ (2x RTD Pt100) Special
4. When the distance between the controller and the sensor is 15 mt . using a cable of $1.5 \mathrm{~mm}^{2}$ diameter, produces an error on the measure of $1^{\circ} \mathrm{C}\left(1^{\circ} \mathrm{F}\right)$.

R1 + R2 must be $<320 \Omega$


For 3 wires only.
Maximum line resistance $20 \Omega /$ line


Use wires of the same length and $1.5 \mathrm{~mm}^{2}$ size.
Maximum line resistance 20 2 /line

## 2 - Electrical connections

### 2.3.2 PV CONTROL INPUT

$\Delta c \epsilon$

D For $\mathrm{mA}, \mathrm{mV}$

$\mathrm{Rj}>10 \mathrm{M} \Omega$

D1 With 2 wires transducer


D2 With 3 wires transducer

[1] Auxiliary power supply for external transmitter 24V- $\pm 20 \%$ /30mA max. without short circuit protection

### 2.3.3 AUXILIARY INPUT (OPTION)

## A - From Remote Setpoint

Current 0/4...20mA
Input resistance $=30 \Omega$
Voltage
1...5V, 0...5V, 0...10V

Input resistence $=300 \mathrm{~K} \Omega$


## B- For current transformer CT - Not isolated

For the measure of the load current (see page 47)

- Primary coil 10A...100A
- Secondary coil 50 mA default 100mA S3 internal jumper selectable



### 2.3.4 DIGITAL INPUT $\triangle C \epsilon$

- The input is active when the logic state is ON, corresponding to the contact closed
- The input is inactive when the logic state is OFF, corresponding to the contact open



## 2 - Electrical connections

2.3.5 OP1 - OP2 - OP3 - OP4 - OP5 OUTPUTS (OPTION)
$\triangle C E$

The functionality associated to each of the OP1, OP2, OP4 and OP5 output is defined during the configuration of the instrument index $\mathbf{N}$ (see page 21).
The suggested combinations are:

|  | Control outputs |  |  | Alarms |  |  | Retransmission |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Heat | Cool | AL1 | AL2 | AL3 | PV / SP |
| A | Single action | OP1 |  |  | OP2 | OP3 | 0P5 |
| B |  | OP4 |  | OP1 | OP2 | OP3 | OP5 |
| C |  | OP5 |  | OP1 | OP2 | OP3 |  |
| D | Double action | OP1 | 0P2 |  |  | OP3 | 0P5 |
| E |  | OP1 | OP4 |  | OP2 | OP3 | OP5 |
| F |  | OP4 | OP2 | OP1 |  | OP3 | OP5 |
| G |  | OP1 | OP5 |  | OP2 | OP3 |  |
| H |  | OP5 | 0P2 | OP1 |  | OP3 |  |
| 1 |  | OP5 | OP4 | OP1 | OP2 | OP3 |  |
| L | Valve drive | OP1 A | OP2 V |  |  | OP3 | OP5 |

where:

| OP1 - OP2 | Relay or Triac output |
| :--- | :--- |
| OP3 | Relay output (for AL3 only) |
| OP4 | SSR drive control or Relay output |
| OP5 | Control or retransmission analogue output |

### 2.3.5-A SINGLE ACTION RELAY (TRIAC) CONTROL OUTPUT <br> $\overline{\mathrm{Z}}$ 人 OP1

$\triangle C \epsilon$
2.3.5-B SINGLE ACTION SSR DRIVE CONTROL OUTPUT
$\triangle C \epsilon$


### 2.3.5-C SINGLE ACTION

 ANALOGUE OUTPUT$\triangle \subset$
2.3.5-D DOUBLE ACTION RELAY (TRIAC)/RELAY (TRIAC) CONTROL OUTPUT
$\triangle C \in$

2.3.5-E DOUBLE ACTION

RELAY (TRIAC)/SSR DRIVE CONTROL OUTPUT
$\triangle C \epsilon$


### 2.3.5-F DOUBLE ACTION

 SSR DRIVE /RELAY (TRIAC) CONTROL OUTPUT$\triangle C \in$



Notes:
[1] Varistor for inductive load 24V~ only.
[2] When basic product code $B=9$, OP4 (terminals 34,35 ) is a Relay output.

### 2.3.5-L VALVE DRIVE OUTPUT

 RELAY (TRIAC) / RELAY (TRIAC)Valve drive PID without potentiometer 3 pole output with N.O. contacts (open, close, stop).


Notes:
OP1 - OP2 Relay output

- SPST Relay N.O., 2A/250 V~ for resistive load, fuse $2 \mathrm{~A} \sim \mathrm{~T}$ at $250 \mathrm{~V}, 4 \mathrm{~A} \sim \mathrm{~T}$ at 110 V .
OP1 - OP2 Triac output
- N.O. contact for resistive load of up to 1A/250 V ~ max., fuse 1A ~ T.
OP4 not isolated SSR drive output
- 0...5V-, $\pm 20 \%, 30 \mathrm{~mA}$ max.

OP4 Relay output

- SPST Relay N.O., 2A/250 V~ for resistive load, fuse $2 \mathrm{~A} \sim \mathrm{~T}$ at $250 \mathrm{~V}, 4 \mathrm{~A} \sim \mathrm{~T}$ at 110 V .
OP5 isolated analogue output
- 0/4...20mA, $750 \Omega$ / 15V max.


### 2.3.6 ALARM OUTPUTS

## $\triangle C$

© The relay/triac output OP1, OP2 and OP3, can be used as alarm outputs only if they are not used as control outputs.

[1] Varistor for inductive load 24V~ only

### 2.3.7 OP5 ANALOGUE CONTROL OUTPUT (OPTION) <br> $\triangle C$



For control or PV/SP retransmission:

- Galvanic isolation 500V~/1 min
- 0/4... 20 mA , ( $750 \Omega$ or 15 V - max.)

Please, read:
gammadue ${ }^{\circledR}$ and deltadue ${ }^{\circledR}$ controller series serial communication and configuration

### 2.3.8 SERIAL COMMUNICATIONS (OPTION) <br> $\triangle C \in$



- Galvanic isolation 500V~/1 min
- Compliance to the EIA RS485 standard for Modbus/Jbus.
- Setting dip switches.



## 3 - Product coding

## 3 PRODUCT CODING

The complete code is shown on the instrument label. The informations about product coding are accessible from the front panel by mean of a particular procedure described at section 5.2 page 49.


### 3.1 MODEL CODE

The product code indicates the specific hardware configuration of the instrument, that can be modified by specialized engineers only.


### 3.2 CONFIGURATION CODING

## A 4+4 index code follows the model of the controller. The code has to be set to configure the controller (see chapter 3.1 page 19).


E.g. Enter the code 0320 to choose:

- T/C type J input with range $0 . . .600^{\circ} \mathrm{C}$.
- Single PID control algorithm, reverse action.
- Relay output.

E.g. Enter the code 2301 to choose:
- AL1 absolute, active high;
- AL2 absolute, active low;
- AL3 Used by Timer;
- Local + 2 Stored Setpoints with tracking function.

| Input type and range |  |  | I 1 L |  |
| :---: | :---: | :---: | :---: | :---: |
| TR Pt100 IEC751 | -99.9...300.0 | 99.9..572.0 ${ }^{\circ} \mathrm{F}$ | 0 | 0 |
| TR Pt100 IEC751 | $-200 . .600^{\circ} \mathrm{C}$ | $-328 . .1112^{\circ} \mathrm{F}$ | 0 |  |
| TC L Fe-Const DIN43710 | $0 . . .600^{\circ} \mathrm{C}$ | $32 . . .1112^{\circ} \mathrm{F}$ | 0 |  |
| TC J Fe-Cu45\% Ni IEC584 | $0 . .600{ }^{\circ} \mathrm{C}$ | $32 . .1112^{\circ} \mathrm{F}$ | 0 |  |
| TC T Cu-CuNi | $-200 \ldots 400^{\circ} \mathrm{C}$ | $-328 . . .752^{\circ} \mathrm{F}$ | 0 |  |
| TC K Chromel-Alumel IEC584 | $0 . .1200{ }^{\circ} \mathrm{C}$ | 32... $2192{ }^{\circ} \mathrm{F}$ | 0 |  |
| TC S Pt10\%Rh-Pt IEC584 | $0 . .1600^{\circ} \mathrm{C}$ | 32... $2912^{\circ} \mathrm{F}$ | 0 |  |
| TC R Pt13\%Rh-Pt IEC584 | $0 . .1600{ }^{\circ} \mathrm{C}$ | 32... $2912{ }^{\circ} \mathrm{F}$ | 0 |  |
| TC B Pt30\%Rh | $0 . . .1800{ }^{\circ} \mathrm{C}$ | $32 . . .3272{ }^{\circ} \mathrm{F}$ | 0 |  |
| TC N Nicrosil-Nisil IEC584 | $0 . . .1200{ }^{\circ} \mathrm{C}$ | 32... $2192{ }^{\circ} \mathrm{F}$ | 0 |  |
| TC E Ni10\%Cr-CuNi IEC584 | $0 . . .600^{\circ} \mathrm{C}$ | $32 . . .1112^{\circ} \mathrm{F}$ | 1 | 0 |
| TC NI-NiMo18\% | $0 . .1100{ }^{\circ} \mathrm{C}$ | 32... $2012^{\circ} \mathrm{F}$ | 1 |  |
| TC W3\%Re-W25\%Re | $0 . . .2000^{\circ} \mathrm{C}$ | 32.. $3632{ }^{\circ} \mathrm{F}$ | 1 | 2 |
| TC W5\%Re-W26\%Re | $0 . .2000{ }^{\circ} \mathrm{C}$ | 32... $3632{ }^{\circ} \mathrm{F}$ | 1 | 3 |
| Dc input 0...50mV linear | Engineering and units |  | 1 |  |
| Dc input 10...50mV linear | Engineering and units |  | 1 |  |
| Custom input and range [1] |  |  | 1 |  |

[1] For instance, other thermocouples types, $\Delta \mathrm{T}$ (with 2 PT 100), custom linearisation etc.

| Control mode |  | M |
| :---: | :---: | :---: |
| ON-OFF reverse action |  | 0 |
| ON-OFF direct action |  | 1 |
| PID single reverse action |  | 2 |
| PID single direct action |  | 3 |
| PID double action | Linear cool output | 4 |
|  | ON-OFF cool output | 5 |
|  | Water cool output [2] | 6 |
|  | Oil cool output [2] | 7 |
|  |  |  |
| Output configuration |  | N |
| Single action | Double action |  |
| Relay (OP1) | Heat OP1, Cool OP2 | 0 |
| SSR drive (OP4) | Heat OP1, Cool OP4 | 1 |
| Analogue (OP5) | Heat OP4, Cool OP2 | 2 |
| Valve drive (OP1 and OP2) | Heat OP1, Cool OP5 | 3 |
|  | Heat OP5, Cool OP2 | 4 |
|  | Heat OP4, Cool OP5 | 5 |
|  | Heat OP5, Cool OP4 | 6 |

[2] In consideration of the themal characteristics of the different cooling liquids, 2 different correcting methods of the control output are available. One for water and the other for oil

OP water $=100 \bullet(\mathrm{OP} 2 / 100)^{2}$
OP oil $=100 \cdot(\text { OP2/100 })^{1.5}$
[3] Only possible whether "Output configuration" $\mathbf{N}=0$ or 1 and $H 1$ I.F.E. parameter is different to [IFF (see page 31).

| Alarm 1 type and function |  | $\mathbf{0}$ |
| :--- | :--- | :--- |
| Disabled | $\mathbf{0}$ |  |
| Sensor break/Loop break alarm (LBA) | $\mathbf{1}$ |  |
| Absolute | active high | $\mathbf{2}$ |
|  | active low | $\mathbf{3}$ |
| Deviation | active high | $\mathbf{4}$ |
|  | active low | $\mathbf{5}$ |
| Band | active out | $\mathbf{6}$ |
|  | active in | $\mathbf{7}$ |
| Heater break | active during ON output state | $\mathbf{8}$ |
| by CT [3] | active during OFF output state | $\mathbf{9}$ |


| Alarm 2 type and function |  | $\mathbf{P}$ |
| :--- | :--- | :--- |
| Disabled | $\mathbf{0}$ |  |
| Sensor break/Loop break alarm (LBA) | $\mathbf{1}$ |  |
| Absolute | active high | $\mathbf{2}$ |
|  | active low | $\mathbf{3}$ |
| Deviation | active high | $\mathbf{4}$ |
|  | active low | $\mathbf{5}$ |
| Band | active out | $\mathbf{6}$ |
|  | active in | $\mathbf{7}$ |
|  | active during ON output state | $\mathbf{8}$ |
|  | active during OFF output state | $\mathbf{9}$ |

3 - Product coding

| Alarm 3 type and function | $\mathbf{Q}$ |
| :--- | :--- |
| Disabled or used by Timer or related to the program | $\mathbf{0}$ |
| Sensor break/Loop break alarm (LBA) | $\mathbf{1}$ |
| Absolute | active high |
|  | active low |
| Deviation | active high |
|  | active low |
| Band | active out |
|  | active in |


| Setpoint type | R |
| :--- | :--- |
| Local only | $\mathbf{0}$ |
| Local and 2 tracking stored Setpoints | $\mathbf{1}$ |
| Local and 2 Stand-by stored Setpoints | $\mathbf{2}$ |
| Local and Remote (only if option is installed) | $\mathbf{3}$ |
| Local with trim (only with remote Setpoint) | $\mathbf{4}$ |
| Remote with trim (only if option is installed) | $\mathbf{5}$ |
| Time programmable (if option installed) | $\mathbf{6}$ |

## 4 OPERATIONS

### 4.1.1 KEYS FUNCTIONS AND DISPLAY IN OPERATOR MODE



## 4 - Operations

### 4.1.2 KEYS FUNCTIONS AND DISPLAY IN PROGRAMMING MODE

## $\uparrow$

The parameter setting procedure has a timeout. If no keys are pressed for, at least, 30 seconds, the controller switches back, automatically, to the operator mode.

After having selected the parameter or the code, press and $\mathbb{W}$ to display or modify the value (see page 25 )
The value is entered when the next parameter is selected, by pressing the key.

Until the
 or
 are pressed or if you wait for 30 seconds the parameter value is not inserted

Pressing the $\square$ key, the next group of parameters is presented on the display.


### 4.2 PARAMETER SETTING

### 4.2.1 NUMERIC ENTRY

(i.e. the modification of the Setpoint value from 275.0 to 240.0 )

Press $\rightarrow$ $\qquad$ momentarily to change the value of 1 unit every push
Continued pressing of $\boldsymbol{\sim}$ or $\checkmark$ changes the value, at rate that doubles every second. Releasing the button the rate of change decreases.
In any case the change of the value stops when it has reached the max./min limit set for the parameter.

In case of Setpoint modification: press $\widehat{\sim}$ or once to display the local Setpoint instead of working Setpoint.
To evidence this change the display flashes once. Then the Setpoint can be modified


### 4.2.2 MNEMONIC CODES SETTING

## (e.g. configuration see page 30 )

Press the or to display the next or previous mnemonic for the selected parameter.
Continued pressing of $\widehat{\sim}$ or will display further mnemonics at a rate of one mnemonic every 0.5 s . The mnemonic displayed at the time the next parameter is selected, is the one stored in the parameter.


Engineering Units Degree Centigrade


### 4.3 PARAMETERISATION - MAIN MENU



### 4.3.1 PARAMETERISATION - SETPOINT MENU




### 4.3.3 PARAMETERISATION - AUXILIARY PARAMETERS MENU

|  | Auxiliary parameters Menu |
| :---: | :---: |
| $\square\rangle$ |  |
| [1. $\square_{0}$ |  |
|  | AL1 hysteresis <br> 0.1... $10.0 \%$ of span |
| $\square \hat{\theta} \square$ |  |
| Huncor |  |
| シ | Alarm latching and blocking functions <br>  <br>  |
| $\square \theta \square$ |  |
|  |  |



### 4.3.4 PARAMETERISATION - TIMER AND START-UP MENU If options installed



### 4.3.5 CONFIGURATION MENU

Enter the password before accessing to the configuration menu.

If a not configured controller is supplied, when powered up for the first time, the display shows:


Until the configuration code is set correctly, the controller remains in stand-by with input and output deactivated.

A 4+4 index code follows the model of the controller. It has to be set to configure the controller.
(see chapter 3.1 page 19)

 choose:

- T/C type J input with range $0 . . .600^{\circ} \mathrm{C}$;
- Single PID control algorithm, reverse action;
- Relay output.

Index 0 PQ
2nd part of configuration
code

E.g. Enter the code choose:

- AL1 absolute, active high;
- AL2 absolute, active low;
- AL3 Used by Timer;
- Local + 2 Stored Setpoints with Tracking function.



Table 1 －Digital input functions

| IL I |  | H2－ | IL $\exists$ |
| :---: | :---: | :---: | :---: |
| Value | Description | Value | Description |
| ロローロー | Not used | Fir． | 1st stored Setpoint |
| ビロ゙リ｜ | Keyboard lock | F．F．E | 2st stored Setpoint |
| H．FPI | Measure Hold | Gヒート | Run Timer |
| A1．7\％ | Auto／Man | r．－H． | Run／stop of a program |
| $\mathrm{L}-\mathrm{r}$ | Local／Remote |  |  |

Table 2 －Engineering units

| いロー וト |  |  |  |
| :---: | :---: | :---: | :---: |
| Value | Description | Value | Description |
| －1－1 | degree centigrade | A | Ampere |
| $\square \mathrm{F}$ | degree Fahrenheit |  | Bar |
| ロローロー | none |  | PSI |
| －1．1 | mV | － | Rh |
| $\square$ | Volt | FH\％ | pH |
| 1.17 | mA |  |  |

Table 3 －Remote Setpoint input type

| 15.1 In |  |  |  |
| :---: | :---: | :---: | :---: |
| Value | Description | Value | Description |
| ［］－5 | 0．．．5 Volt | ［1）－－ | 0．．． 20 mA |
| 1－与 | 1．．．5 Volt | －－－－ | 4．．． 20 mA |
| ［］－1［］ | 0．．． 10 Volt |  |  |

## 4．4 PARAMETERS

For a simpler use of the con－ troller，its parameters have been organised in groups（menu）， according to their functionality area．

## 4．4．1 SETPOINT MENU

The OP1，OP2 or OP3 outputs，can be used for alarms if they are not used as control outputs
It is possible to configure up to 4 alarms：AL1，AL2，AL3，AL4（see pages 21 and 22），selecting，for each of them：
A the type and the operating condi－ tion of the alarm；
B the functionality of the alarm acknowledgement（latching） Lに上荘（see page 39）；
C The blocking function is activated on start up（see p．39）；
D Loop break or sensor break （see page 40）．

## A ALARM TYPE AND OPERATION CONDITIONS

Absolute alarm（full scale）


Deviation alarm


Band alarm


## 

AL1 alarm threshold AL2 alarm threshold AL3 alarm threshold HET．F月35． Alarm occurrences of OP1，OP2 and OP3 outputs，respectively linked to AL1，AL2 and AL3．

The range of the alarm thresh－ old correspond to the whole span and it is not limited by the SP Setpoint span．

When the event occures，the display will shows the red leds 1 ， 2 or 3 respec－ tively on．

|  | Setpoint ramp up |
| :---: | :---: |
|  | Setpoint ramp down |

This parameter specifies the maximum rate of change of the Setpoint in digit/min.

When the parameter is 1 FF , this function is disabled and the new Setpoint is reached immediately after being entered.
Otherwise, the Setpoint value is reached according to the configured rate of change.
The new Setpoint value is called "Target Setpoint". It can be displayed by means the parameter L.E.I.I.1.
(see procedure at page 49).

When Remote Setpoint is configured, we suggest to disable FLL. H and ELL. B] parameters BIFF。



Low / high limit of the Setpoint value.


Values of the two Setpoints, that are activated by mean of digital inputs, communication parameters, and keypad. The Setpoint active is indicated by the $\mathbf{S 1}$ or $\mathbf{S} 2$ green led.

If index $R=1$ (tracking),
the previous Local Setpoint value will be lost, when the stored Setpoint is selected.

If index $\mathbf{R}=\mathbf{2}$ (Stand-by),
the Local Setpoint value will not
be lost, when the Stand-by Setpoint is selected. It will operate again when back to Local.

See stored Setpoint selection procedure at page 52.

## 4．4．1 SETPOINT MENU

## －じール <br> Remote <br> Setpoint Ratio

Ratio is the coeff．which defines the remote Setpoint span with respect to the input span．

## 

Bias defines the starting point of analogue Remote Setpoint in eng．units corresponding to the low limit（current or voltage）of the remote signal．

Remote Setpoint Bias and Ratio


PV＝process variable
LR＝PV low limit
HR＝PV high limit
SR＝Remote Setpoint
$a(a)=$ SR starting point
$b(b)=$ SR ending point

If SR starting point is lower then
the ending point，both
expressed in engineering units：
ローゴコンstarting point＝a
－$-ル=\frac{b-a}{H R-L R}$
Example：

－もに

$$
\frac{100-20}{600-(-200)}=\frac{80}{800}=0.1
$$

If SR starting point is higher then the ending point，both expressed in engineering units

ロール＝starting point＝a＇
rt $-a=\frac{b^{\prime}-a^{\prime}}{H R-L R}$
Example：

ーもに＝

$$
\frac{20-100}{600-(-200)}=\frac{-80}{800}=-0.1
$$

Working Setpoint（SP）as com－Examples：
bination of Local Setpoint（SL）Local Setpoint（SL）with an and remote signal

Setpoint type L－ו：
（configuration index $\mathbf{R}=4$ ）
$\mathrm{SP}=\mathrm{SL}+(1-\mathrm{E}$ •REM）
＋
Setpoint type r－Ell｜．1．
（configuration index $\mathbf{R}=5$ ）
$S P=R E M+(-L \square \bullet S L)$
＋
SIGN $=\begin{aligned} & \text { Remote signal } \\ & \text { percentage }\end{aligned}$
SPAN $=$ HR－LR
REM $=\frac{\text { SIGN＊SPAN }}{100}$
external Trim with multiplying coeff．of 1／10：
Setpoint type＝ L aー． L
rt に＝0．1
ロージョー

Remote Setpoint（SR）with an internal Trim with multiplying coeff．of 1／5：
Setpoint type＝r－77．E
$r-\quad ぃ=0.2$
ロージョー

Remote Setpoint range equal to the Input range：

rt

G＝0

### 4.4.2 CONTROL MENU

## EunE <br> Run Tuning

### 4.4.2.1 AUTOMATIC TUNE

The Fuzzy-Tuning determines automatically the best PID term with respect to the process behaviour.

The controller provides 2 types of "one shot" tuning algorithm, that are selected automatically according to the process condition when the operation is started.

## STEP response



This type is selected when, at the start of the autotune operation, the PV is far from the Setpoint of more than $5 \%$ of the span. This method has the big advantage of fast calculation, with a reasonable accuracy in the term calculation.

Natural frequency


This type is selected when the PV is close to the SP Setpoint.
This method has the advantage of a better accuracy in the term calculation with a reasonable speed calculation.

The Fuzzy Tuning determines automatically the best method to use to calculate the PID term, according the process conditions.

## FUZZY-TUNING <br> START/STOP PROCEDURE

Start/stop of the Fuzzy Tuning The Tuning operation can be started or stopped any time.

The green led AT is ON when the Fuzzy Tuning is in progress. At the end of this operation, the calculated PID terms parameter are stored and used by the control algorithm and the controller goes back to the operator mode. The green led AT becomes off.


## FII Proportional band

This parameter specifies the proportional band coefficient that multiplies the error (SP - PV).

## I-. I.

Integral time
It is the integral time value, that specifies the time required by the integral term to generate an output equivalent to the proportional term. When term is not included in the control algorithm.

##  <br> Derivative time

It is the time required by the proportional term $P$ to repeat the output provided by the derivative term D. When [IF F the derivative term is not included in the control algorithm.
$\square$ Overshoot control
This parameter specifies the span of action of the overshoot control. Setting lower values ( $1.00 \rightarrow 0.01$ ) the overshoot generated by a Setpoint change is reduced. The overshoot control doesn't affect the effectiveness of the PID algorithm. Setting 1, the overshoot control is disabled.

## 

This specifies the control output value when $P V=S P$, in a PD only algorithm (lack of the integral term).

##  <br> Error Dead Band

Inside this band for (PV - SP), the control output does not change to protect the actuator (output Stand-by).

-     - Control output
 cycle time Cool cycle time It's the cycle time of the time proportioning control output. The PID control output is provided by the pulse width modulation of the waveform.


## [IF. H <br> Control output high limit <br> Cool output high limit

It specifies the maximum value the control output can be set. It is applied in manual mode, too.

## EITAI Output Safety Value

Output Value in case of input anomaly


Control or alarm output hysteresis span, set in \% of the full scale.

## 

It provides the time required to the motor positioner to go from the $0 \%$ position to $100 \%$.

## [711.5!] <br> Minimum step

It specifies the minimum allowed time of activation of the output to a motor positioner that produces a sensible effect. It is related to the deadband of the positioner.

### 4.4.2 CONTROL MENU

### 4.4.2.2 HEAT / COOL CONTROL

By a sole PID control algorithm, the controller handles two different outputs, one of these performs the Heat action, the other one the Cool action.
It is possible to overlap the outputs.
The dead band parameter is the zone where it is possible to separate or overlap the Heat and Cool actions.

The Cool action can be adjusted using the


To limit the Heat and Cool outputs the para-


When there is an overlap, the displayed output [IIIT shows the algebric sum of the Heat and Cool outputs.

## A Heat/Cool actions separated

 Insert positive

B Heat/Cool actions overlapped
Insert negative [llin! value (-10...0\%)


## C Cool action adjusting

Example with different relative cool gains


D On-Off Cool action


## 4．4．3 AUXILIARY PARAMETERS MENU



AL1 alarm hysteresis AL2 alarm hysteresis AL3 alarm hysteresis Hysteresis of the threshold of both the alarms，that activate OP1 and OP2 control output．It is specified as a \％of the full scale．


AL1，AL2，AL3
latching
and
blocking
functions
For each alarm it is possible to select the following functions：

したにな latching；
にしール blocking
L

## Lにに田 ALARM

## ACKNOWLEDGE FUNCTION

The alarm，once occurred，is presented on the display until to the time of acknowledge．The acknowledge operation consists in pressing any key．
After this operation，the alarm leaves the alarm state only when the alarm condition is no longer present．

## BL－aI START－UP DISABLING



Ramp up


### 4.4.2 CONTROL MENU

## ALARMS WITH LBA (LOOP BREAK ALARM) AND SENSOR BREAK OPERATION

Select the code 1 on $\mathbf{0}, \mathbf{P}$ or $\mathbf{Q}$ configuration indexes (see pages 21 or 22). The following parameter is then available:

## E. A.

Setting a value between 1 and 9999 s the alarm works as LBA+Sensor break with delay [1]. This condition is shown by means a red led as well as the blinking PV display.


Setting OFF the alarm works as Sensor break with immediate action.
This condition is shown by means the red led of the selected alarm as well as:


Note [1] In case of sensor break, condition, the alarm action is immediate.

### 51.17

Soft-start control output value
Value of the control output during the Soft-start activation time.

## ELETI

Soft-start activation time Time duration (starting from the power on) of the Soft-start function.


Power-on

## I- I- I Input filter

 time constantTime constant, in seconds, of the RC input filter applied to the PV input.
When this parameter is set to [1FF the filter is bypassed.

Filter response


## 

This value is added to the measured $P V$ input value. Its effect is to shift the whole PV scale of up to $\pm 60$ digits.

When the cause of the alarm disappears, the alarm status stops.

## address

the address range is from 1 to 247 and must be unique for each controller on the communication bus to the supervisor.
When set to lill F the controller is not communicating.

Retransmission
low range Retransmission high range

### 4.4.4 TIMER AND START-UP MENU (OPTION)

To improve the instrument performances and to reduce the wiring and installation costs, two special functions are available:

### 4.4.4.1 Start-up

4.4.4.2 Timer

In order to have the above functions the product code digit E must be 2 (see page 19).

For example: Q3 3100-2000
To select these functions use the parameter: (see page 43).

## thlad <br> Timer/Start-up operator mode

Selecting Timer or Startup, the Soft-start function is disabled, therefore the parameters $E 1 .[1]$ and ITE.LT] will not be shown (see page 29)

### 4.4.4.1 START-UP FUNCTION (OPTION)

By means of this function it is possible to manipulate the control output when the controller is switched on.


To configure Startup function the parameter
"Timer/Start-up operating mode" must be set to $\quad 1$ (see page 43).

Three parameters are associated to the Start-up function.

##  <br> Start-up hold time

 $0 . .500 \mathrm{~min}$5.F.5.LI

Start-up
Setpoint (EIF: L...EF: H)


## Control output

high limit
5.0\%...100.0\%

The Start-up function includes three phases:
$1^{\text {st }}$ " is limited to the [1] ITIE
$2^{\text {nd }}$ "Holl-l" - The process variable is maintained to the Start-up Setpoint for the time fixed by


3rd "IFF" - When the $[$ E. time is elapsed the process variable is maintained to the working Setpoint.

Whether the process variable, for any reason (e.g. load change), decreases at a value lower than ( $[$ the Start-up function starts again


### 4.4.4.1 START-UP FUNCTION (OPTION)

When the Start-up is in Hold phase, if the local Setpoint becomes lower than the Startup Setpoint or if the operating mode changes to manual, the Start-up function passes to the "[IFF" phase.

There are two possibilities:
A Start-up Setpoint $[5,1+!11]$ lower than the local Setpoint.
The "Hold" phase starts when the process variable PV achieves the 50.51 (with a tolerance of 1 digit).
B Start-up Setpoint $[5,1$ IT greater than or equal to the local Setpoint.
When the process variable PV achieves the local Setpoint (with a tolerance of 1 digit), the Start-up function passes directly to the "IIFF" phase.

If, at the controller power-on, the process variable PV is greater than the lowest between the [51 and the working Setpoint, the next phase ("Hal -l" or "IIFF") will be executed instead of the "しا phase.


Start-up
Setpoint
During the "L phases the RUN led is on.



B $[5.1,[1] \geq$ local Setpoint SP


### 4.4.4.2 TIMER FUNCTION (OPTION)

## \$The Timer can't be enabled with Heat / Cool control.

To enable this function do the following:
1 In order to use this AL3 function, index $\mathbf{Q}$ must be set to in configuration (see page 22).
2 To select one of the 6 possible functioning modes of the Timer, set the value of the 2 following parameters in parameterisation (see p. 29).

##  operating mode

By this parameter can be defined (see table 1):

- the counting start time;
- the control output status at the end of the counting.


## table 1

Timer/Start-up counting mode Value

| Disabled |  | [IFF |
| :---: | :---: | :---: |
| Start-up function |  | 1 |
| Counting start time | End mode |  |
| When inside the | Control mode | $\square$ |
| band | Output to 0 | $\exists$ |
| When launched | Control mode | 4 |
|  | Output to 0 | 5 |
| When launched. Control disabled | Control mode | E |
| When launched stand-by Setpoint | Control mode | 7 |

Now the other parameter values can be entered:

## 

By this parameter can be defined (see table 2):

- the time units;
- the starting mode;
- the OP3 status when the timer is running.
When the timer is not running, the OP3 takes the opposite status.
table 2

| Time <br> units | Starting <br> mode | $[1]$ |  |
| :--- | :--- | :---: | :---: |
|  |  |  |  |
|  |  |  |  | Value

[1] If used by Timer;
[2] Using this selection, manual starting mode is possible too.

\section*{| -1 | IVIN $^{-1}$ | $\begin{array}{l}\text { Timer } \\ \text { setting }\end{array}$ |
| :--- | :--- | :--- | :--- |}

(1... $9999 \mathrm{~s} / \mathrm{min}$ )

## 

(only for $\mathfrak{t}$ (7) -


### 4.4.4.2 TIMER FUNCTION (OPTION)

## TIMER COUNTING MODES

## A - Counting start time inside the band, end in control mode.

The time counting starts only when the error is inside a $\pm 1$ digit band. The control action is not affected by the Timer function.


## B - Counting start time inside the band,

 end with control output forced to zero.The time counting starts only when the error is inside $a \pm 1$ digit band. At the end, the control output is forced to zero. [1]

[1] When the Timer is not running the control output is forced to zero, also before the Timer launch,

## C - Counting start time = timer launch

 time, end in control mode.The time counting starts when the timer is launched. The control action is not affected by the Timer function.


## TIMER COUNTING MODES

D - Counting start time = timer launch time, end with control output forced to zero.

The time counting starts when the timer is launched. At the end, the control output is forced to zero [1].

[1] When the Timer is not running the control output is forced to zero, also before the Timer launch.

## E - No control action during the counting time.

The time counting starts when the timer is launched and the control output is forced to zero. At the end, the control action starts.


## F - Control action with stand-by Setpoint during the counting time

The time counting starts when the timer is launched and the control action use the Stand-by Setpoint. At the end, the control action use the working Setpoint.


### 4.4.4.2 TIMER FUNCTION (OPTION)

## POWER FAILURE

If there is a power failure during the Timer execution, the value of the elapsed time is lost.

Depending on Timer action L.EAE selection, when the controller restarts you can have two different situations:

- with automatic mode
( $\mathrm{E} . \mathrm{BCE}=\square, \exists, \bar{E}, 7$ ), the Timer function starts again and the counting time is reinitialised;
- with manual mode
 trol output is forced to 9
 wise the control action restarts using the working Setpoint.


## TIMER STARTING

See the Timer starting procedure at page 50 (chapter 6.2.2).

DISPLAY


When the Timer is running, the led RUN is on.


When the Timer ends, the Setpoint display shows alternatively the message End and the Setpoint value until a key is pressed.

## TIMER REMAINING TIME

When the timer is running it is always possible to see the remaining time and to modify it.


### 4.4.5 CONFIGURATION MENU

## RETRANSMISSION

When OP5 output is present and not configured as control output, it retransmits linearised PV or SP.
On configuration (see page 31) it is possible to set


Analogue
range



Retransmitted
signal

The following parameters define the low and high range of the OP5 retransmission output corresponding to $0 . . .4 \mathrm{~mA}$ or 20 mA (see page 29):


Retransmission
low range
Retransmission
high range

Example:

- T/C S, range $0 . . .1600^{\circ} \mathrm{C}$;
- Output range, 4... 20 mA ;
- Retransmitted signal PV on $800 . .1200^{\circ} \mathrm{C}$ range.


With rL.L I greater than $r t . l$, it is possible to obtain a reverse scale.

## CURRENT TRANSFORMER INPUT

With CT option, it is possible to display the load current and set an alarm threshold.

The setting can be done by means the 8 or 9 configuration index of the codes $\mathrm{O}, \mathrm{P}$ or Q (see pages 21 and 22).
It is possible to set one of the alarms (see pages 21 and 22) to have an alarm when, during the ON time of the time proportional output, the load current is less then the specified threshold (index 8), or during the OFF time there is a value $>3 \%$ of full scale load current.

The alarm condition must be longer than 120 ms to set the alarm.
By the parameter:

## FOE.E.E CT primary <br> high range <br> RIFF/1...200A

the load current display can be adapted to the transformer characteristics (OFF means disabled).

During the OFF time the parameter [ETI latches the last on time current value.

## 4 - Operations

### 4.4.5 CONFIGURATION MENU

## CURRENT TRANSFORMER INPUT

SERIAL COMMUNICATIONS

## Example:

CT input on OP1, alarm on AL2 during on time (configuration digit $\mathbf{P}=8$, see page 21)


- 7 Baud rate
 41810


## DISPLAYS

### 5.1 OF THE PROCESS VARIABLES



### 5.2 OF THE CONFIGURATION CODES



6 COMMANDS COMMANDS TO THE CONTROLLER AND OPERATING PHASES

The commands can be entered in 3 ways:


- Keypad lock
- Outputs lock


### 6.1 KEYPAD COMMANDS

### 6.1.1 SETPOINT

 MODIFICATIONThe Setpoint is directly modified with the $\triangle$ keys.
Once entered, the new value is checked and becomes operating after 2 seconds.. The end of this phase is flagged by flashing momentarily the display with SP.


### 6.1.2 AUTO/MANUAL MODE



### 6.1 KEYPAD COMMANDS

### 6.1.4 PROGRAM STARTING

(see chapter 7, page 55)

### 6.1.5 LOC/ REM SELECTION

configuration index $\mathbf{R}=4$ or


The selected Setpoint becomes operating pressing the
When in Remote, the green led REM is on

### 6.1.6 STORED SETPOINTS SELECTION

(configuration index $\mathbf{R}=\mid$ or $E^{-1}$ )


### 6.1.7 KEYPAD LOCK

To lock/unlock the keypad press the keys $\square$ and simultaneously for 2 seconds.
To confirm the keypad lock/unlock the display flashes once.

The keypad lock/unlock can be achieved by serial communications too.
$\widehat{\$}$ The keypad lock is maintained in case of power failure.

## operator mode



Press simultaneously
for 2 seconds

### 6.1.8 OUTPUTS LOCK

The outputs are switched to the OFF status by pressing the keys $\checkmark$ and ${ }^{\infty}$ together.
When the outputs are locked, the message HIF is displayed instead of the Setpoint value.
To unlock the outputs press again the keys simultaneously (the Soft-start will be enabled).

The outputs lock/unlock can be achieved by serial communications too
\The outputs lock/unlock is maintained in case of power failure.
operator mode


### 6.2 DIGITAL INPUT COMMANDS

A function is assigned, through the configuration procedure to each IL1, IL2 and IL3 digital input. (see the parameters setting at tab. 1 at page 31).
The configured function is activated when the digital input (free voltage contact or open collector output) is in the On state (closed). It is deactivated by setting the input to the Off state (open).
The activation of the function through the digital input has the highest priority than through the keypad or through the serial communication.

| Function |  | Narameter | Performed operation |  |
| :--- | :--- | :--- | :--- | :--- |
| None | Notes |  |  |  |

## 7 PROGRAMMED SETPOINT

## INTRODUCTION

The controller supplied with the Setpoint programmer option (mod. Q3-3... 1 ) offers the functionality to define, store, display and execute a program consisting in the Setpoint profile in time.

## MAIN CHARACTERISTICS

- 1 program, 8 segments/program
- start, stop, hold etc, commands from the keypad
- time base in seconds, minutes or hours
- continuous or up to $1 . . .9999$ time cycling of the program
- 1 OP3 digital output with the state profile defined by the program
- setting of the maximum allowed deviation from the Setpoint


### 7.1 PROGRAM STRUCTURE

The program consists of a sequence of segments.

For each segment, it is specified:

- the Setpoint to reach 5, IT.
- the duration of the segment t. I.
- the state of the OP3 output

The program consists of:

- 1 initial segment named
- 1 end segment named $F$
- 1 ... 6 normal segments



## Initial segment -

Its main purpose is to define the value the process variable has to maintain before starting the program.

## End segment - $F$

Its main purpose is to define the value the process variable has to maintain at the end of the program and until further changes of Setpoint.

## Normal segments - --

These segments build up the profile program. There are 3 types of segments:

## Ramp



Dwell


Step

5.F. = Target Setpoint
t. =Duration
---- =Previous segment
-_Current segmente
__ =Next segment

7 - Programmed Setpoint

## EXAMPLE OF SETPOINT PROFILE




56

### 7.2 SETPOINT PROGRAMMER OPERATION

### 7.2.1 MAXIMUM ALLOWED DEVIATION (band)

If the PV controlled input value exceeds the band, centred around the SP, the segment time is extended of the same time the PV input stays out of the band. The band width is defined in a parameter of the program segment.
The actual segment period is calculated as $t t^{-}+\mathrm{Ti}$
A. Ramp

B. Dwell


### 7.2 SETPOINT PROGRAMMER OPERATION

### 7.2.2 RE-START OF A PROGRAM AFTER A POWER FAILURE

The parameter Fa, . specifies the behaviour of the programmer at power up (see page 58). Selected between the following 3 choices:

res
Reset

-     - \#7)

Ramp
 the execution of the program starts from the point reached at the power failure time.

All the parameters, like Setpoint and the remaining time are restored at the values they had at power off.


If $1-$
at power on the program ends and goes back to local mode.
 the execution of the program starts from the point reached at the power failure time.
In this case, the programs continue with PV reaching SV with a ramp, whose slope corresponds to the one of the segment running at the power off.

Power off during a dwell


Power off during a ramp


### 7.3 PARAMETERISATION - PROGRAM MENU (OPTION)



### 7.4 START/STOP OF A PROGRAM

The various commands, supported by the controller, are different for each of the following operating phases:
A] when in Local Setpoint mode B]during the execution of a program
C] when the program is in hold
Commands supported by the controllers


The different phase are displayed in a chained way, just for easing the understanding of the functionality.
Two different mode for starting and stopping a program are provided:
direct mode with the * key through the parameter menu

7 - Programmed Setpoint


The RUN green led is flashed at high rate when the controlled variable is out of the allowed deviation band
The current time of a segment is hold up to the time the variable re-enter in the band.

| Features <br> (at $25^{\circ} \mathrm{C}$ environmental temp.) | Description |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Total configurability (see chapter 3.2 page 20 chapter 4.3.5 page 30 | From keypad or serial communication the user selects: <br> - the type of input <br> - the type of control algorithm <br> - the type of output |  | - the type and functionality of the alarms - the type of Setpoint <br> - control parameter values |  |
| PV Input <br> (see pages 11,12 and page 20) | Common A/D converter with resolution of 50,000 points <br> Update measurement time: 0.2 seconds <br> characteristics <br> Sampling time: 0.5 seconds <br> Input bias: $-60 . \ldots+60$ digit <br> Input filter with enable/disable: $1 \ldots 30$ seconds  |  |  |  |
|  | Accuracy | $0.25 \% \pm 1$ digits for temper $0.1 \% \pm 1$ digits (for mV and | sensors | Between 100...240V~ the error is minimal |
|  | Resistance thermometer (for $\Delta \mathrm{T}: \mathrm{R} 1+\mathrm{R} 2$ must be $<320 \Omega$ ) | $\operatorname{Pt} 100 \Omega$ at $0^{\circ} \mathrm{C}$ (IEC 751) ${ }^{\circ} \mathrm{C} /{ }^{\circ} \mathrm{F}$ selectable | 2 or 3 wires connection Burnout (with any combination) | Max. wire Res: $20 \Omega$ max. (3 wires) Sensitivity: $0.35^{\circ} \mathrm{C} / 10^{\circ}$ T.env. $<0.35^{\circ} \mathrm{C} / 10 \Omega$ Wire Resistance |
|  | Thermocouple | L,J,T,K,S, R, B, N, E, W3, W5 (IEC 584) $\mathrm{Rj}>10 \mathrm{M} \Omega$ ${ }^{\circ} \mathrm{C} /{ }^{\circ} \mathrm{F}$ selectable | Internal cold junction compensation con NTC Error $1^{\circ} \mathrm{C} / 20^{\circ} \mathrm{C} \pm 0.5^{\circ} \mathrm{C}$ Burnout | Line: $150 \Omega$ max. Input drift: $<2 \mu \mathrm{~V} /{ }^{\circ} \mathrm{C}$ T. env. $<5 \mu \mathrm{~V} / 10 \Omega$ Wire Resistance |
|  | DC input (current) | 4... $20 \mathrm{~mA}, 0-20 \mathrm{~mA}$ <br> with external shunt $2.5 \Omega$ <br> Rj $>10 \mathrm{M} \Omega$ | Burnout. Engineering units Conf. decimal point position Init. Scale -999...9,999 | Input drift: $<0.1 \% / 20^{\circ} \mathrm{C} \text { T.env. }$ |
|  | DC input (voltage) | $\begin{aligned} & 10 \ldots 50 \mathrm{mV}, 0-50 \mathrm{mV} \\ & \mathrm{Rj}>10 \mathrm{M} \Omega \end{aligned}$ | Full Scale -999. . .9,999 (min. range of 100 digits) | $<5 \mu \mathrm{~V} / 10 \Omega$ Wire Resistance |

## Features <br> (at $25^{\circ} \mathrm{C}$ environmental temp.)

## Description

| Auxiliary inputs | Remote Setpoint (option) Not isolated accuracy $0.1 \%$ |  | Current <br> 0/4...20mA <br> $\mathrm{Rj}=30 \Omega$ | Bias in engineering units and $\pm$ range Ratio from -9.99...+99.99 Local + Remote Setpoint |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | $\begin{aligned} & \text { Voltage } \\ & 1-5 / 0-5 / 0-10 \mathrm{~V} \\ & \mathrm{Rj}=300 \mathrm{~K} \Omega \end{aligned}$ |  |  |  |  |  |
|  | CT current transformer (see pages13 and 47) |  | 50 or 100 mA input hardware selectable | Current visualisation 10 ... 200A With 1 A resolution and Heater Break Alarm |  |  |  |  |
| Digital inputs 3 logic | The closure of the external contact produces any of the following actions: |  | Auto/Man mode change, Local/Remote Setpoint mode change, Stored Setpoints activation, keypad lock, measure hold |  |  |  |  |  |
|  |  |  | Timer activation, program run/hold (if options installed) |  |  |  |  |  |
| Operating mode and Outputs | 1 single or double action PID loop or On/Off with 1, 2 or 3 alarms | Single action | Control output |  | AL1 alarm | AL2 alarm | AL1 alarm | Retransmiss. |
|  |  |  | OP1-Relay/Triac |  |  | OP2-Relay/Triac | OP3-Relay | OP5-Analogue |
|  |  |  | OP4-SSR drive-Relay |  | OP1-Relay/Triac | OP2-Relay/Triac | OP3-Relay | OP5-Analogue |
|  |  |  | OP5-Analogue |  | OP1-Relay/Triac | OP2-Relay/Triac | OP3-Relay |  |
|  |  | Double action Heat / Cool | OP1-Relay/Triac | OP2-Relay/Triac |  |  | OP3-Relay | OP5-Analogue |
|  |  |  | OP1-Relay/Triac | OP4-SSR drive-Relay |  | OP2-Relay/Triac | OP3-Relay | OP5-Analogue |
|  |  |  | OP4-SSR drive-Relay | OP2-Relay/Triac | OP1-Relay/Triac |  | OP3-Relay | OP5-Analogue |
|  |  |  | OP1-Relay/Triac | OP5-Analogue |  | OP2-Relay/Triac | OP3-Relay |  |
|  |  |  | OP5-Analogue | OP2-Relay/Triac | OP1-Relay/Triac |  | OP3-Relay |  |
|  |  |  | OP5-Analogue | OP4-SSR drive-Relay | OP1-Relay/Triac | OP2-Relay/Triac | OP3-Relay |  |
|  |  | Valve drive | OP1-Relay/Triac | OP2-Relay/Triac |  |  | OP3-Relay | OP5-Analogue |


| Features (at $25^{\circ} \mathrm{C}$ environmental temp.) | Description |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Control mode | Algorithm | PID with overshoot control or On-off - PID with valve drive algorithm, for controlling motorised positioners |  |  |
|  | Proportional band (P) | 0.5...999.9\% |  | Single action PID algorithm |
|  | Integral time (l) | 0.1... 100.0 min | DFF $=0$ |  |
|  | Derivative time (D) | $0.01 \ldots 10.00 \mathrm{~min}$ |  |  |
|  | Error dead band | 0.1...10.0 digit |  |  |
|  | Overshoot control | 0.01...1.00 |  |  |
|  | Manual reset | 0.0...100.0\% |  |  |
|  | Cycle time (Time proportional only) | 1... 200 s |  |  |
|  | Control output high limit | 10.0...100.0\% |  |  |
|  | Soft-start output value | 0.1...100.0\% | DFF $=0$ |  |
|  | Output safety value | 0.0...100.0\% (-100 | Heat / Cool) |  |
|  | Control output hysteresis | 0.1...10.0\% |  | On-Off algorithm |
|  | Dead band | -10.0...10.0\% |  | Double action PID algorithm (Heat / Cool) with overlap |
|  | Relative cool gain | 0.1... 10.0 |  |  |
|  | Cycle time (Time proportional only) | 1... 200 s |  |  |
|  | Control output high limit | 10.0...100.0\% |  |  |
|  | Cool output hysteresis | 0.1...10.0\% |  |  |
|  | Motor travel time | 15... 600 s |  | Valve drive PID algorithm without feedback potentiometer |
|  | Motor minimum step | to 0.1...5.0\% |  |  |

## 8 - Technical specification

| Features <br> (at $25^{\circ} \mathrm{C}$ environmental temp.) | Description |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| OP1-OP2 outputs | SPST Relay N.O., 2A/250V~ for resistive load Triac, 1A/250V~ for resistive load |  |  |  |  |
| OP3 output | SPDT relay N.O., 2A/250V ~ for resistive load |  |  |  |  |
| OP4 output | Logic not isolated: 0/5V-, $\pm 10 \%$ 30mA max. - SPST Relay N.0., 2A/250V ~ for resistive load |  |  |  |  |
| OP5 analogue output (option) | Control or PV/SP retransmission | Galvanic isolation: Resolution 12bit (0 Accuracy: 0.1 \% | /1 min | In current: 0/4...20m | 0 $2 / 15 \mathrm{~V}$ max. |
| AL1 - AL2 - AL3alarms | Hysteresis 0.1...10.0\% c.s. |  |  |  |  |
|  | Action | Active high | Action type | Deviation threshold | $\pm$ range |
|  |  |  |  | Band threshold | $0 . .$. range |
|  |  | Active low |  | Absolute threshold | whole range |
|  |  | Special functions | Sensor break, heater break alarm |  |  |
|  |  |  | Acknowledge (latching), activation inhibit (blocking) |  |  |
|  |  |  | Connected to Timer or program (if options installed) |  |  |
| Setpoint | Local |  | Up and down ramps $0.1 \ldots 999.9$ digit $/ \mathrm{min} \quad(0 F F=0)$ Low limit: from low range to high limit High limit: from low limit to high range |  |  |
|  | Local plus two stored (tracking or STAND-BY) |  |  |  |  |
|  | Local and Remote | If option installed |  |  |  |
|  | Local with trim |  |  |  |  |
|  | Remote with trim |  |  |  |  |
|  | Programmable |  |  |  |  |


| Features <br> (at $25^{\circ} \mathrm{C}$ environmental temp.) | Description |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Programmable Setpoint (optional) | 1 program, 8 segments ( 1 initial and 1 end) - From 1 to 9999 cycles or continuous cycling ([IFF) Start, stop, hold, etc. activated from the keypad, digital input and serial communications |  |  |  |
| Special functions (option) | Timer (see page 43) | Automatic start at the power on, manual start by keypad, Digital inputs or serial comm.s |  |  |
|  |  | Setting time: $\quad 1 . . .9,999 \mathrm{~s} / \mathrm{min}$ |  |  |
|  |  | Stand-by Setpoint: | point low limit to |  |
|  | Start-up <br> (see page 41) | Start-up Setpoint: from Setpoint low limit to Setpoint high limit |  |  |
|  |  | Hold time: $\quad 0 . .50 \mathrm{~min}$ |  |  |
|  |  | Control output high limit: 5.0...100.0\% |  |  |
| Fuzzy-Tuning one shoot | The controller selects automatically the best method Step response |  |  |  |
|  | according to the process conditions ${ }^{\text {a }}$ Natural frequency |  |  |  |
| Auto/Man station | Standard with bumpless function, by keypad, digital input or serial communications |  |  |  |
| Serial comm. (option) | RS485 isolated, Modbus/Jbus protocol, 1,200, 2,400, 4,800, 9,600 bit/s 3 wires |  |  |  |
| Auxiliary Supply | +24V- $\pm 20 \%$ 30mA max. - for external transmitter supply |  |  |  |
| Operational Safety | Measure input | Detection of out of range, short circuit or sensor break with automatic activation of the safety strategies and alerts on display |  |  |
|  | Control output | Safety value: -100\% ...100\% |  |  |
|  | Parameters | Parameter and configuration data are stored in a non volatile memory for an unlimited time |  |  |
|  | Access protection | Password to access the configuration and parameters data, keypad lock, outputs lock |  |  |
| General characteristics | Power supply (PTC protected) | $\begin{aligned} & 100-240 \mathrm{~V} \sim(-15 \%+10 \%) 50 / 60 \mathrm{~Hz} \text { or } \\ & 24 \mathrm{~V} \sim(-25 \%+12 \%), 50 / 60 \mathrm{~Hz} \text { and } 24 \mathrm{~V}-(-15 \%+25 \%) \end{aligned}$ |  | Power consumption 4W max. |
|  | Safety | Compliance to EN61010-1 (IEC 1010-1), installation class 2 (2500V) pollution class 2, instrument class II |  |  |
|  | Electromagnetic compatibility | Compliance to the CE standards (see page 2) |  |  |
|  | UL and CUL Omologation | File 176452 |  |  |
|  | Protection <br> EN60529 (IEC 529) | IP65 front panel |  |  |
|  | Dimensions | ¼ DIN - $96 \times 96$, depth 110 mm , weight 470 g approx. |  |  |

## WARRANTY

We warrant that the products will be free from defects in material and workmanship for 18 months from the date of delivery.
The warranty above shall not apply for any failure caused by the use of the product not in line with the instructions reported on this manual.

- ICONS TABLE

| Main universal input |  |
| :---: | :---: |
| 1 | Thermocouple |
| Pitioo | RTD (Pt100) |
|  | Delta Temp (2x RTD) |
| $\begin{aligned} & \text { mA } \frac{V}{9} \end{aligned}$ | mA and mV |
| Custom <br> $\sqrt[2]{ }$ | Custom |
| Hz | Frequency |
|  | Auxiliary input |
| $\xi$ | Current transformer |
|  | mA Remote setpoint |
|  | Volt Remote setpoint |
| $\begin{aligned} & \text { Рот. } \\ & \hline \Gamma=7 \\ & \hline \end{aligned}$ | Feedback potentiometer |
|  |  |


|  | Digital input connected functions |
| :---: | :---: |
| 2m | Auto/Manual |
| $\begin{aligned} & \text { RUN } \\ & \hline \end{aligned}$ | Run, Hold, Reset and program selection |
| $\begin{gathered} \text { HOLD } \\ \text { PV } \end{gathered}$ | PV hold |
| $\begin{gathered} \text { Sp } \\ \text { KON } \end{gathered}$ | Setpoint slopes inhibition |
|  | Output |
|  | SPST Relay |
| $\frac{\text { 雰 }}{}$ | Triac |
|  | SPDT Relay |
| $\begin{aligned} & \mathrm{mA} \\ & \Theta \end{aligned}$ | mA |
| $\begin{aligned} & \mathrm{mA} \mathrm{~V} \\ & \Theta \Phi \\ & \hline \end{aligned}$ | mA mV |
| ФJ | Logic |
|  |  |

