

**Engler Viscometer  
BM465**

Impact Test Equipment Ltd  
[www.impact-test.co.uk](http://www.impact-test.co.uk) & [www.impact-test.com](http://www.impact-test.com)

User Guide  
**User Guide**  
**User Guide**

**Impact Test Equipment Ltd.  
Building 21 Stevenston Ind. Est.  
Stevenston  
Ayrshire  
KA20 3LR**

T: 01294 602626

F: 01294 461168

E: [sales@impact-test.co.uk](mailto:sales@impact-test.co.uk)

Test Equipment Web Site

[www.impact-test.co.uk](http://www.impact-test.co.uk)

Test Sieves & Accessories Web Site

[www.impact-test.com](http://www.impact-test.com)

# CONTENTS

<b>Chapter 1</b>		<b>GENERAL INFORMATION</b>
	<b>1.1</b>	<b>GENERAL FEATURES</b>
	<b>1.2</b>	<b>IDENTIFICATION</b>
	<b>1.3</b>	<b>APPLICATIONS</b>
<b>Chapter 2</b>		<b>SAFETY INFORMATION</b>
	<b>2.1</b>	<b>GENERAL SAFETY STANDARDS</b>
	<b>2.2</b>	<b>SAFETY SYSTEMS</b>
	<b>2.3</b>	<b>DANGEROUS PARTS AND RESIDUAL RISKS</b>
	<b>2.4</b>	<b>NOISE</b>
<b>Chapter 3</b>		<b>INSTALLATION</b>
	<b>3.1</b>	<b>LIFTING</b>
	<b>3.2</b>	<b>UNPACKING</b>
	<b>3.3</b>	<b>INSTALLATION</b>
	<b>3.4</b>	<b>ELECTRIC CONNECTION</b>
<b>Chapter 4</b>		<b>MACHINE FEATURES</b>
	<b>4.1</b>	<b>FEATURES AND MASS OF THE APPLIANCE</b>
<b>Chapter 5</b>		<b>OPERATOR'S INTERFACE</b>
	<b>5.1</b>	<b>COMMANDS AND SIGNALES</b>
<b>Chapter 6</b>		<b>USE</b>
	<b>6.1</b>	<b>WARNINGS</b>
	<b>6.2</b>	<b>FUNCTIONING MODE</b>
	<b>6.3</b>	<b>SWITCHING ON THE APPARATUS</b>
	<b>6.4</b>	<b>PROGRAM AND REGULATION THE APPARATUS</b>
	<b>6.5</b>	<b>SWITCHING OFF THE APPARATUS</b>
	<b>6.6</b>	<b>FIRST TRIAL STARTING</b>
	<b>6.7</b>	<b>PRACTICAL EXAMPLE</b>
<b>Chapter 7</b>		<b>MAINTENANCE</b>
	<b>7.1</b>	<b>ROUTINE MAINTENANCE</b>
	<b>7.2</b>	<b>SPECIAL MAINTENANCE</b>
	<b>7.3</b>	<b>PERIODICAL OPERATIONS</b>
<b>Chapter 8</b>		<b>DIAGNOSTIC</b>
<b>Chapter 9</b>		<b>SCRAPPING</b>
	<b>9.1</b>	<b>SETTING ASIDE</b>
	<b>9.2</b>	<b>SCRAPPING</b>
<b>ENCLOSURES</b>		
	<b>A</b>	<b>GENERAL VIEW OF THE APPLIANCE</b>

ELECTRONIC CONTROLLER INSTRUCTIONS

<b>Chapter 1</b>	<b>GENERAL INFORMATION</b>
------------------	----------------------------

<b>1.1</b>	<b>GENERAL FEATURES</b>
------------	-------------------------

- **This manual is addressed** to the carrier, the installer, the user, the maintenance operator, the scrapping operator.
- Please read it carefully because it informs you about the operating of the machine in safety conditions.
- This manual has to be considered a part of the product and concerns only the machine it is delivered with.
- Keep the manual in order during the whole life of the appliance to consult it for any needs.
- In case of sale, the manual and its enclosures should be given together with the machine.
- The manufacturer assumes no liability for any damages caused by a misuse of the machine.
- The manufacturer has the right to modify this technical literature as well as the machines this refers to without any previous notice.
- Messages meaning:

<b>ATTENTION</b>	It shows the procedures that can damage seriously the machine if they are not followed carefully.
------------------	---

<b>DANGER</b>	It shows the procedures that can be dangerous to the operator if they are not followed carefully.
---------------	---

<b>1.2</b>	<b>IDENTIFICATION</b>
------------	-----------------------

**MANUFACTURER IDENTIFICATION:** See the cover page

**MACHINE IDENTIFICATION:** See the plate on the machine where the complete identification data and the electrical features are to be found.

<b>1.3</b>	<b>APPLICATIONS</b>
------------	---------------------

The Engler viscometer is used to compare specific bitumen viscosity to water viscosity  
This appliance is made for the aim, which it has been conceived for. Any other uses are not allowed.

<b>ATTENTION</b>	The instructions given in this operating manual are only made for the right use of the appliance. To carry out the test in the right way, the user must refer to the specific standards in force for the test itself.
------------------	--

<b>Chapter 2</b>	<b>SAFETY INFORMATION</b>
------------------	---------------------------

<b>2.1</b>	<b>GENERAL SAFETY STANDARDS</b>
------------	---------------------------------

- **The use, lifting, installation, maintenance and scrapping of the machine are allowed only to qualified staff.** Qualified staffs are composed by people who are authorised by the safety responsible to do any activities due to their experience and acknowledgement of the operating of the machine and of the standards, rules and actions.  
The user must be carefully taught about the operating of the machine to avoid any misuse of it and about the safety devices, which the machine could be eventually equipped with. The safety devices will have to be kept always assembled and to be daily checked.  
The manufacturers offer training and assume no liability for any damages due to a misuse of the machine by an unskilled staff.
- The manufacturer recommends following carefully the instructions and procedures of the operating manual and the safety standards concerning the safety devices and the general rules of the work environment.
- Verify the accordance of the machine to the standards in force in the State where the machine has to be installed.

- The operating manual must be carefully read by the safety responsible, by the operators and maintenance engineers. It must always be kept near the machine in order to be able to read it any times it will be necessary.
- Any tampering or modifications of the machine (electric, mechanical etc.) that are not allowed by a written agreement of the manufacturer must be considered as not permitted and the manufacturer will not accept to be charged for any damages.
- The removal or the tampering of the safety devices will be an infringement to the EEC Safety Standards. The manufacturer assumes no liability for any damages.
- The machine has to be installed in places safe from fire and explosions.
- We do recommend using only original spare parts and accessories; on the contrary the manufacturer assumes no liability.
- Be careful that any dangerous situations won't happen during the working; stop immediately the machine in the event that it will not work properly and ask the manufacturer or the Authorised Service Staff of the dealer at once.

The manufacturer assumes no liability for any damages caused to people, things and animals in case the general safety standards or if the instructions of this manual are not followed.

## 2.2 SAFETY SYSTEMS

MEANING: Safety devices are all the safety measures using specific technical equipment (guards, cages etc.) to protect the operator from any danger that couldn't be avoided when the appliance was planned.

<b>DANGER</b>	The removal of the safety devices or any tampering of the machine could cause risks to the operator or to any other people. The manufacturer assumes no liability for any damages to people, things or animals due to the tampering of the safety devices.
---------------	---

- **PASSIVE SAFETY DEVICES**

All those devices avoiding or reducing the risks for the operators are passive safety devices. These devices don't require any active and aware intervention to be operated.

- **ACTIVE SAFETY DEVICE**

All those devices avoiding or reducing the risks for the operators are active safety devices. These devices require an active and aware intervention to be operated.

## 2.3 DANGEROUS PARTS AND RESIDUAL RISK

The dangerous place is the space inside and around the machine where the operator could be wounded or damaged.

During some procedures the operator could face some risks of danger.

The risks can be eliminated following carefully the procedures written in this manual and using suitable safety devices.

<b>ATTENTION</b>	In case the Manufacturer does not do the machine installation, employ only skilled operators particularly trained for the lifting of heavy machinery.
------------------	---

### GENERAL INFO.

- **Before starting the standard use of the equipment, ensure that all the components are in good working conditions check there are no defective or damaged parts. If necessary repair or replace any damaged part.**
- Pay attention to the risk of electric shocks both for direct or indirect contact, due to unforeseen failure to the electric system.
- Do not subject the equipment to violent shocks.
- Do not expose the equipment to fire, extreme temperature or weld splatters.
- Avoid corrosive substances to come in touch with the equipment.

- Never wash the appliance using water sprays.

## DURING THE USE

- In order to grant the max. safety levels for the operator, it is recommended not to touch any moving components during the test execution and always use the proper safety means.
- During the test execution always pay attention to the possibility of hands, fingers or body squeezing, cutting or trapping caused by the moving parts of the container.
- The products tested could be a risk for the operator health. As a caution do not breath steams and do not let the products be in touch with the eyes and the skin.
- Do not wear large clothes, ties, watches, rings or others, which could entangle into the moving parts of the appliance.

## LIFTING

- During the lifting take care that the machine is conveniently held and secured and that it cannot slide.
- Do not stand in a direct line with the application of force. Do not allow people entrance under loads that are no conveniently supported by mechanical means.

RISK OR DANGER	FORESEEN SAFETY MEASURE
FINGER OR HANDS SQUEEZE	REINFORCED GLOVES
ABRASIONS – CUTTINGS	REINFORCED GLOVES
STEAM EJECTIONS	OVERALLS AND GLOVES

The manufacturer assumes no liability for any damages to people and things due to a lack of observance of the instructions and the use of the safety devices. (See laws against the accidents in force)

## 2.4 NOISE

The indicated levels of noise are not necessarily safety levels for the operator.

The exposure levels of the operator are obviously related to the emission levels of the appliance, but other factors influence the exposure levels as the time of exposure, the environment, and other appliances installed near to the appliance etc.

The exposure levels permit to value the damages that could be caused by the noise.

Acoustical pressure level equivalent $L_{aeq}$ at 1 mt. distance	62 dB(A)
Acoustical power emitted by the appliance <b>LWA</b>	67 dB(A)
Standard above data are referred	EN ISO 3746

<b>DANGER</b>	The continuous use of the machine together with other noisy appliances could cause a high level of exposure to the noise. If the daily exposure of the operator is equal or higher than 85 dB(A), Safety Devices as headphone are suggested to be worn. If the daily exposure is equal or higher than 90 dB(A), the use of the Safety Device is compulsory. For further information consult the standards of the country where the machine has been installed.
---------------	---

## Chapter 3 INSTALLATION

<b>DANGER</b>	Consult <b>DANGEROUS PARTS AND RESIDUAL RISKS</b> before proceeding
---------------	---

## 3.1 LIFTING

The operating instructions must be respected during the moving of the appliance and particularly in the following phases:

- The lifting and the storing
- The first installation

- The further installations

The machine is usually packed in a wooden case or in a carton that allow the easy moving of the same. The machine must be moved by a forklift truck suitable for the weight indicated on the plate on the machine.

The moving of cases with lifting devices must be made with all cautions required and following the indications given on the packing. Never use chains to lift the cases.

<b>ATTENTION</b>	Pay attention to avoid impacts and turnovers
------------------	--

<b>ATTENTION</b>	Protect the machine from the atmospheric agents. Water and humidity could oxidise it, damaging it seriously.
------------------	--

### 3.2 UNPACKING

After removing the package, check that any parts of the machine are not damaged. In case of doubt, **DO NOT USE THE MACHINE** and ask the manufacturer.

<b>DANGER</b>	The materials used for the package (plastic, polystyrene, screws, nails, wood etc.) have to be kept far from children. They must be thrown away in a proper collection centre.
---------------	--

<b>ATTENTION</b>	Pay attention to avoid impacts and turnovers.
------------------	---

<b>ATTENTION</b>	Before throwing away the package, pay attention that any accessory, manuals, documents, spare parts are not inside.
------------------	---

### 3.3 INSTALLATION

- The machine has to be placed in an environment suitable for the aim it has been conceived for (laboratory protected by any atmospheric agents). Skilled operator must do the installation.

<b>ALLOWED TEMPERATURE</b>	from + 5°C to + 40°C
<b>ALLOWED HUMIDITY</b>	from 30% to 95%
<b>O.S.L. MAXIMUM HEIGHT</b>	1000 m

#### GENERAL RECOMMENDATIONS

- The machine must be installed so that it is free from each side in order to be able to carry out easily the maintenance operations
- No authorised people and no dangerous objects must be near the machine.
- The machine must be placed on a desk in order to be able to work at a proper height for the user.
- The machine must be placed in a place properly aired in order not to accumulate any noxious gas.

### 3.4 ELECTRIC CONNECTIONS

<b>DANGER</b>	Skilled operators must arrange the electric connections.
---------------	--

<b>DANGER</b>	Before connecting, see the attached electric diagram and the plate on the machine for the information about the voltage, the frequency, etc.
---------------	--

<b>DANGER</b>	Connect the ground by the terminal PE (yellow-green) before making any other connections.
---------------	---

<b>DANGER</b>	<p>Apply a knife switch at the top of the connecting cable of the machine to the power system.</p> <p>The knife switch must be combined with a safety device against the overload with a differential switch (safety switch).</p> <p>The technical features of the safety device must be in accordance with the standards in force in the country where the machine has been installed and following the machine features.</p>
---------------	--

**ELECTRIC TOLERANCES:**

- Real voltage  $\pm 10\%$  of the nominal one
- Frequency:  $\pm 1\%$  of the nominal one in a continuous way  
 $\pm 2\%$  of the nominal one for a short period
- The harmonic distortion of the sum from the second to the fifth harmonics not more than 10% of the total voltage as a real value between the conductors. A further distortion of 2% is accepted for the sum from the sixth to the thirtieth harmonics of the real total value between the conductors.
- With reference to the tension unbalance of the three-phase voltage, the inverted sequence component and the zero sequence component must not be more than 2% of the direct sequence component of the voltage
- The voltage pulses must not last more than 1,5 ms with an up/down time between 500 ms e 500  $\mu$ s and a peak value not higher than 200% of the real value of the nominal tension.
- The electric feeding must not be interrupted or zeroed for more than 3 ms. Between two interruptions it must not take more than 1 s.
- The interruptions must not overcome 20% of the tension peak for more than one cycle. Between two interruptions it must not take more than 1 s.

<b>Chapter 4</b>	<b>MACHINE FEATURES</b>
------------------	-------------------------

<b>4.1</b>	<b>DIMENSIONS AND MASS</b>
------------	----------------------------

LENGTH	*	WIDTH	*	HEIGHT	*	MASS	See plate
--------	---	-------	---	--------	---	------	-----------

- May vary depending on the models.

<b>Chapter 5</b>	<b>OPERATOR'S INTERFACE</b>
------------------	-----------------------------

<b>5.1</b>	<b>CONTROLS AND MESSAGES</b>
------------	------------------------------

**DESCRIPTION PARTS OF ENCLOSURE A**

<b>A1</b>	<b>OIL-INN</b>
-----------	----------------

To introduce oil to test

<b>A2</b>	<b>MAIN AND MOTOR ON/OFF SWITCH</b>
-----------	-------------------------------------

ON-OFF main switch (green button)

ON-OFF motor switch (red button)

<b>A3</b>	<b>DIGITAL THERMOREGULATOR</b>
-----------	--------------------------------

<b>A4</b>	<b>INTERNAL SERPENTINE'S CONTACTS</b>
-----------	---------------------------------------

<b>A5</b>	<b>OUTFLOWING LIQUID</b>
-----------	--------------------------

It's used to empty the Engler viscometer



<b>Chapter 6</b>	<b>USE</b>
------------------	------------

<b>DANGER</b>	Consult <b>DANGEROUS PARTS AND RESIDUAL RISKS</b> before proceeding.
---------------	--

<b>6.1</b>	<b>WARNINGS</b>
------------	-----------------

Before starting the normal use of the equipment it is recommended to verify that it is in good working conditions with no defective or damaged parts.  
If necessary proceed with the required maintenance operations

<b>6.2</b>	<b>FUNCTIONING MODE</b>
------------	-------------------------

The viscometer's functioning is : AUTOMATIC

<b>6.3</b>	<b>SWITCHING ON THE APPARATUS</b>
------------	-----------------------------------

Put the main switch (green button) on position ON

<b>6.4</b>	<b>PROGRAMMING AND REGULATION OF THE APPARATUS</b>
------------	--

See the digital thermoregulator' s manual attached

<b>6.5</b>	<b>SWITCHING OFF</b>
------------	----------------------

Put the main switch (green button) on position OFF.

<b>6.6</b>	<b>FIRST TRIAL SWITCHING ON</b>
------------	---------------------------------


Before beginning the standard use of this machine, check its perfect working conditions by performing at least a complete trial cycle according to the instructions given up to this point.  
In case of problems during this test cycle, see Chapter " DIAGNOSIS ".  
If neither the instructions given in this manual are not able to solve the problem, please contact our After Sale Service.

<b>6.7</b>	<b>PRACTICAL EXAMPLE</b>
------------	--------------------------

<b>DANGER</b>	Proceed as per following example of operating only after having entirely read and understood all the indications given in this manual.
---------------	--

We here describe a "standard procedures" allowing even to an operator without a wide experience to complete a correct centrifuging operation.

1. Carefully clean and dry the in internal part of the oil cup.
2. Filter the oil to test and pour it in the cup up to the reference line, after having closed the flowing pipe by the teflon bar
3. Close the cup by sliding the lid on the bar. Position a thermometer on the bath and the other thermometer through the lid.
4. Fill up the bath with 3/3.5 litres of distilled water for viscosity up to 50°C and with oil for higher temperature
5. Connect the apparatus to a 220V power supply
6. Switch on the main switch on the right, a light will switch on.
7. Program the temperature required as is shown in the enclosure (thermoregulator instructions)

	<b>WARNING</b>	<p>In order to carry out the test in the most proper way, make sure before proceeding the temperature to be the prescribed one according to the Standard relevant to this test execution.</p> <p>In case would be necessary to amend the initial bath temperature, just add water (having lower or higher temperature as necessary) in a moderate way, then mix the water to make as homogeneous and uniform as possible the effective temperature measured by the thermoregulator.</p>
---	----------------	---

8. Switch on the motor switch
9. Once in a while, mix the oil in the cup by moving the lid by the apposite knob
10. When the oil's temperature will remain constant for 5 minutes, raise the bar allowing the chronometer to start, in order to determine the flowing out time for 200 ml oil.

NOTE: when a test is performed with a temperature close to the ambient temperature, please connect the cooling serpentine to the water net by the rubber holding on the lid .

<b>Chapter 7</b>	<b>MAINTENANCE</b>
------------------	--------------------

<b>DANGER</b>	Consult " <b>DANGEROUS PARTS AND RESIDUAL RISKS</b> " before proceeding.
---------------	--

<b>DANGER</b>	All the maintenance operations must be carried out with the machine turned off and unplugged from the knife switch.
---------------	---

<b>DANGER</b>	Skilled operators instructed about the purposes the machine is made for must carry any kind of maintenance operations concerning the components of the machine and of the electric components, even those that may seem very simple.
---------------	--

<b>DANGER</b>	Only original spare parts are allowed. The Manufacturer assumes no liability in the event that non – original parts are used.
---------------	---

<b>7.1</b>	<b>ROUTINE MAINTENANCE</b>
------------	----------------------------

In order to maintain good working of the machine for a long time, clean periodically all the parts and oil the parts that are not painted.

Do not use solvents, which may damage the painting and the parts made of synthetic materials.

After each test check that all the parts of the appliance are not damaged. In case something is damaged get in touch with the After Sales Service.

Ensure that all procedures described in the Chapter "**PERIODICAL INSPECTIONS**" and "**PERIODICAL OPERATIONS**" are correctly and punctually executed. This care will help preventing failures and dysfunctions.

<b>7.2</b>	<b>SPECIAL MAINTENANCE</b>
------------	----------------------------

In case of special maintenance operations (repairs, replacement of parts and any other operation not described in this manual) ask directly to the manufacturer.

<b>7.3</b>	<b>PERIODICAL OPERATIONS</b>
------------	------------------------------

Ensure that all procedures described in this Chapter are correctly and punctually executed. This care will help preventing failures and dysfunctions.

<b>OPERATION</b>	CLEANING OF THE VISCOMETER
<b>PROCAUTION</b>	Before starting, ensure the apparatus is plugged off. Do not clean the apparatus immediately after use, in order to avoid any danger of scalding or abrasion
<b>FREQUENCY</b>	AFTER EACH TEST

<b>Chapter 8</b>	<b>DIAGNOSTIC</b>
------------------	-------------------

<b>8.1</b>	<b>DIAGNOSIS</b>
------------	------------------

Some easy to solve and simple problem, which can happen during the working of the appliance, are introduced in this chapter.

<b>ATTENTION</b>	All maintenance, checking, control and repairing operations of each part of the machine or of the electric system, must be carried out by skilled operators instructed about the functions and working procedures of the appliance.
------------------	---

<b>PROBLEM</b>	<b>POSSIBLE CAUSE</b>	<b>CURE</b>
The apparatus doesn't switch on	No supply	Check that the plug is properly plugged to the main and the switches are on position ON
	Fuses damaged	Change fuses with new ones with the same capacity
The motor doesn't start	No supply	Correct position to main switch
	Fuses damaged	Change fuses with new ones with the same capacity

<b>Chapter 9</b>	<b>SCRAPPING</b>
------------------	------------------

<b>9.1</b>	<b>SETTING ASIDE</b>
------------	----------------------

In case of setting aside for a long time it is necessary to disconnect the electric feeding.

Execute all the maintenance operations.

Lubricate with some oil the parts not painted of the appliance. It's recommended to cover the machine against the dust.

<b>9.2</b>	<b>SCRAPPING</b>
------------	------------------

When the machine is not used anymore, it is recommended:

- Disconnect the feeding cable.
- Cover/destroy all the parts which may be dangerous as cutting, projecting or sharpened ones.
- Disassemble the machine and scrap it as per the actual laws.

### **Recycling notice for the disposal of electrical and electronic devices**



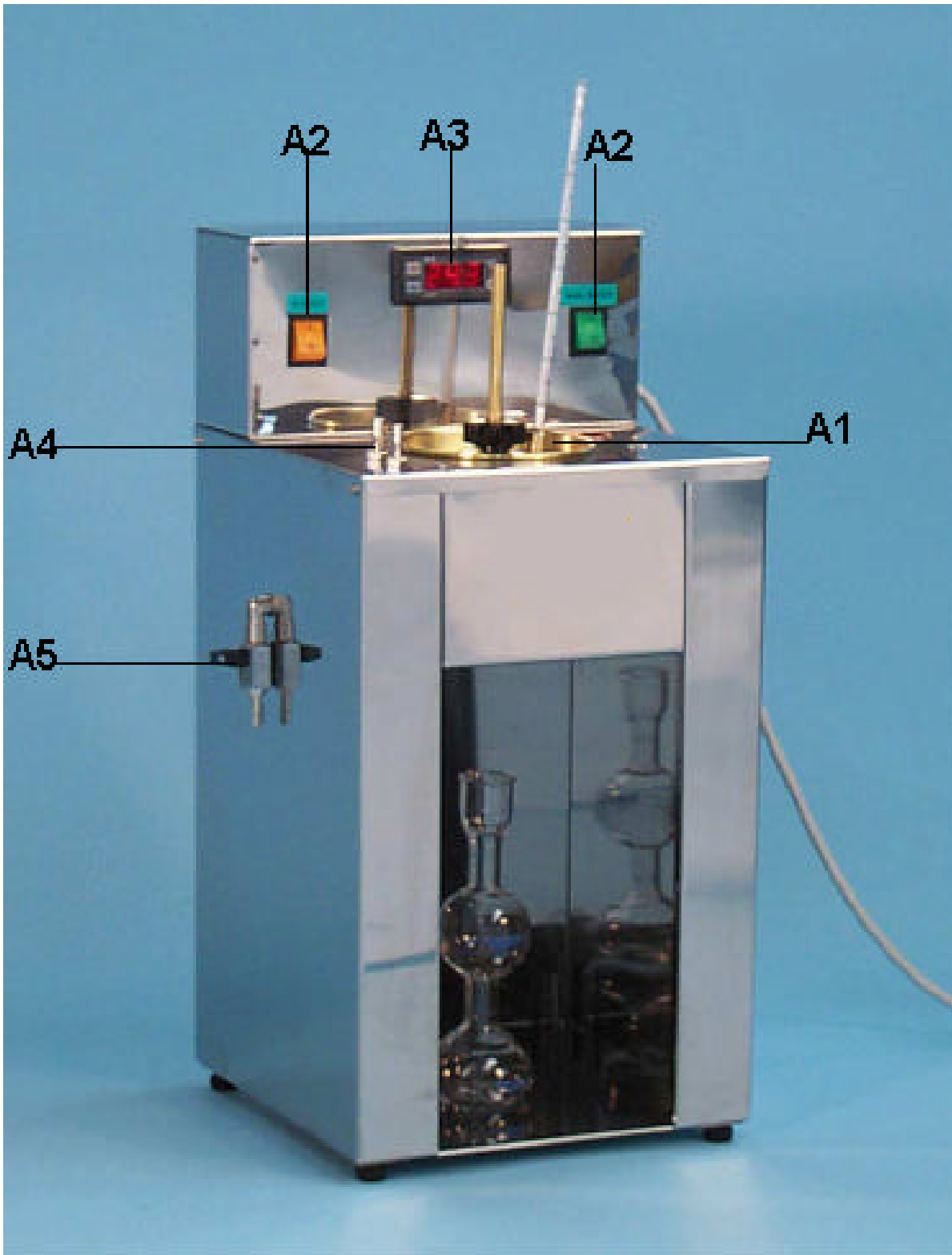
This symbol, placed on the device or on the package and/or on the documentation, suggest that the device shouldn't be dispose together with other home garbage at the end of its life cycle. To avoid further environment, or health-care damages, caused by the unsuitable disposal of garbage, we kindly recommend the user to separate this device from other different types of garbages and to recycle it in a responsible way to avoid the arguable reuse of material

resources. Indeed users must take care at the disposal of the equipment that have to be discarded, taking them away to the next recycling site for the appropriate recycling treatment for electrical and electronic devices. Gathering and Recycling deplete devices allow the preservation of natural resources and grant for them the adequate treatment respecting health and environment.

For further information about your local recycling site please contact your local city hall or city waste treatment department. The developer, as producer of electrical and electronic devices, will provide to finance the recycling and treatment services for deplete devices that will come back through these recycling site accordingly the local statement.

A

GENERAL VIEW OF THE APPLIANCE



# MICROPROCESSOR-BASED DIGITAL ELECTRONIC CONTROLLER



## OPERATING INSTRUCTIONS

### FOREWORD:

This manual contains the information necessary for the product to be installed correctly and also instructions for its maintenance and use; we therefore recommend that the utmost attention is paid to the following instructions.

Though this manual has been issued with the greatest care, we will not take any responsibility deriving from its use.

The same applies to each person or Company involved in the issuing of this manual.

INDEX	INSTRUMENT DESCRIPTION
1.1	GENERAL DESCRIPTION
1.2	FRONT PANEL DESCRIPTION
<b>2</b>	<b>PROGRAMMING</b>
2.1	FAST PROGRAMMING OF SET POINT
2.2	SELECTION OF CONTROL STATE AND PARAMETER PROGRAMMING
2.3	PARAMETER PROGRAMMING LEVELS
2.4	CONTROL STATES
2.5	ACTIVE SET POINT SELECTION
<b>3</b>	<b>INFORMATION ON INSTALLATION AND USE</b>
3.1	PERMITTED USE
3.2	MECHANICAL MOUNTING
3.3	ELECTRICAL CONNECTIONS
3.4	ELECTRICAL WIRING DIAGRAM
<b>4</b>	<b>FUNCTIONS</b>
4.1	MEASURING AND VISUALIZATION
4.2	OUTPUTS CONFIGURATION
4.3	ON/OFF CONTROL
4.4	NEUTRAL ZONE ON/OFF CONTROL
4.5	SINGLE ACTION PID CONTROL
4.6	DOUBLE ACTION PID CONTROL
4.7	AUTO-TUNING AND SELF-TUNING FUNCTIONS
4.8	REACHING OF SET POINT AT CONTROLLED SPEED AND AUTOMATIC COMMUTATION BETWEEN TWO SET POINTS
4.9	SOFT-START FUNCTION
4.10	ALARMS OUTPUTS FUNCTIONS
4.11	LOOP BREAK ALARM FUNCTION
4.12	FUNCTION OF KEY "U"
4.13	PARAMETERS CONFIGURATION BY KEY01
<b>5</b>	<b>PROGRAMMABLE PARAMETERS TABLE</b>
<b>6</b>	<b>PROBLEMS , MAINTENANCE AND GUARANTEE</b>
6.1	ERROR SIGNALLING
6.2	CLEANING
6.3	GUARANTEE AND REPAIRS
<b>7</b>	<b>TECHNICAL DATA</b>
7.1	ELECTRICAL DATA
7.2	MECHANICAL DATA
7.3	MECHANICAL DIMENSIONS, PANEL CUT-OUT AND MOUNTING
7.4	FUNCTIONAL DATA
7.5	MEASUREMENT RANGE TABLE
7.6	INSTRUMENT ORDERING CODE

### 1.1 - GENERAL DESCRIPTION

TLK 38 is a "single loop" digital microprocessor-based controller, with ON/OFF, Neutral Zone ON/OFF, PID single action, PID dual action (direct and reverse) control and with **AUTO-TUNING FAST** function, **SELF-TUNING** function and automatic calculation of the **FUZZY OVERSHOOT CONTROL** parameter for PID control. The PID control has a particular algorithm with **TWO DEGREES OF FREEDOM** that optimises the instrument's features independently in the event of process disturbance and Set Point variations. The process value is visualized on 4 red displays, while the output status is indicated by 2 LED displays. The instrument is equipped with a 3 LED programmable shift indexes. The instrument provides for the storage of 4 Set Points and can have up to 2 outputs: relay type or can drive solid state relays type (SSR).

Depending on the model required the input accept:

**C**: Thermocouples temperature probes (J,K,S and IRS Infrared sensors), mV signals (0..50/60 mV, 12..60 mV), Thermoresistances PT100.

**E** : Thermocouples temperature probes (J,K,S and IRS Infrared sensors), mV signals (0..50/60 mV, 12..60 mV), Thermistors PTC and NTC.

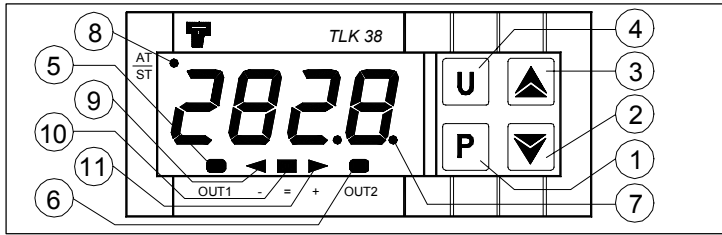
**I** : normalized analogue signals 0/4..20 mA

**V** : normalized analogue signals 0..1 V, 0/1..5 V, 0/2..10 V

Other important available functions are: Loop-Break Alarm function, reaching of the Set Point at controlled speed, ramp and dwell

function, Soft-Start function, protection compressor function for neutral zone control, parameters protection on different levels.

## 1.2 - FRONT PANEL DESCRIPTION



**1 - Key P** : This is used to access the programming parameters and to confirm selection.

**2 - Key DOWN** : This is used to decrease the values to be set and to select the parameters. If the key is held down, the user returns to the previous programming level until he exits the programming mode.

**3 - Key UP** : This is used to increase the values to be set and to select the parameters. If the key is held down, the user returns to the previous programming level until he exits the programming mode. Outside the programming mode it permits visualisation of the output control power.

**4 - Key U** : This is a key with a function programmable by par. "USrb". It can be set to : Activate Auto-tuning and Self-tuning functions, swap the instrument to manual control, silence the alarm, change the active Set Point, deactivate control (see par. 4.12) and modify the visibility of the parameters in "ConF" menu (see par. 2.3).

**5 - Led OUT1** : indicates the state of output OUT1

**6 - Led OUT2** : indicates the state of output OUT2

**7 - Led SET** :It indicates access to the programming mode and parameter programming level.

**8 - Led AT/ST** : indicates that the Self-tuning function is activated (light on) or that Auto-tuning (flashing ) is in progress.

**9 - Led - Shift index**: indicates that the process value is lower than the one programmed on par. "AdE".

**10 - Led = Shift index**: indicates that the process value is within the range [SP+AdE ... SP-AdE]

**11 - Led + Shift index**: indicates that the process value is higher than the one set on par. "AdE".

## 2 - PROGRAMMING

### 2.1 - FAST PROGRAMMING OF THE SET POINT

This procedure permits rapid programming of the active Set Point and possibly the alarm thresholds (see par 2.3)

Push key "P", then release it and the display will visualise "SP n" (where n is the number of the Set Point active at that moment) alternatively to the programmed value.

To modify the value, press "UP" key to increase it or the "DOWN" key to decrease it.

These keys change the value one digit at a time but if they are pressed for more than one second, the value increases or decreases rapidly and, after two seconds in the same condition, the changing speed increases in order to allow the desired value to be reached rapidly.

Once the desired value has been reached, by pushing key P it is possible to exit by the fast programming mode or it is possible to visualise the alarm thresholds (see par. 2.3).

To exit the fast Set programming it is necessary to push key P, after the visualisation of the last Set Point, or alternatively, if no key is pressed for approx. 15 seconds, the display will return to normal functioning automatically.

### 2.2 - SELECTION OF THE CONTROL STATE AND PARAMETER PROGRAMMING

By pushing key "P" and holding it down for approx. 2 sec. it is possible to enter into the main selection menu.

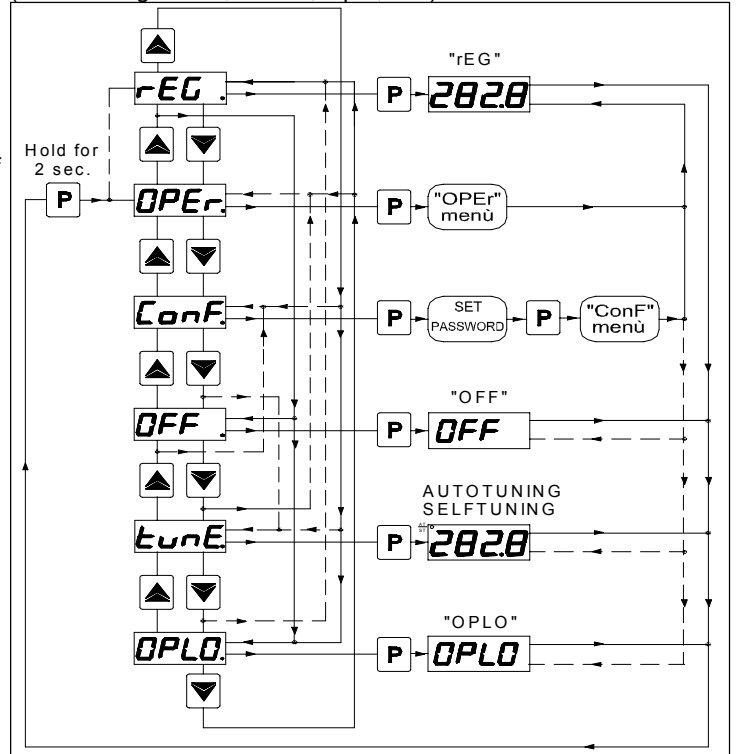
Using the "UP" or "DOWN" keys, it is then possible to roll over the selections:

"OPER"	to enter into the operating parameters menu
--------	---

"ConF"	to enter into the configuration parameters menu
"OFF"	to swap the regulator into the OFF state
"rEG"	to swap the regulator into the automatic control state
"tunE"	to activate the Auto-tuning or Self-tuning function
"OPLO"	to swap the regulator to the manual control state and therefore to program the % control value using the "UP" and "DOWN" keys

Once the desired item has been selected, push key "P" to confirm. Selecting "OPER" and "ConF" gives the possibility of accessing other menus containing additional parameters and more precisely :  
**"OPER"** - Operating parameters Menu: this normally contains the Set Point parameters but it can contain all the desired parameters (see par. 2.3).

**"ConF"** - Configuration parameters Menu: this contains all the operating parameters and the functioning configuration parameters (alarm configuration, control, input, etc.)



To enter the menu "ConF" select the option "ConF", press the key "P" and the display will show "0".

At this request, enter, using keys "UP" and "DOWN", the number reported on the last page of this manual and push key "P".

If an incorrect password is entered, the instrument exit from programming mode.

If the password is correct, the display will visualise the code identifying the first group of parameters ("SP ") and with keys "UP" and "DOWN" it will be possible to select the desired group of parameters.

Once the desired group of parameters has been selected, the code identifying the first parameter of the selected group will be visualised by pushing the "P" key.

Again using the "UP" and "DOWN" keys, it is possible to select the desired parameter and, if the key "P" is pressed, the display will alternatively show the parameter's code and its programming value, which can be modified by using the "UP" or "DOWN" keys.

Once the desired value has been programmed, push key "P" once more: the new value will be memorised and the display will show only the code of the selected parameter.

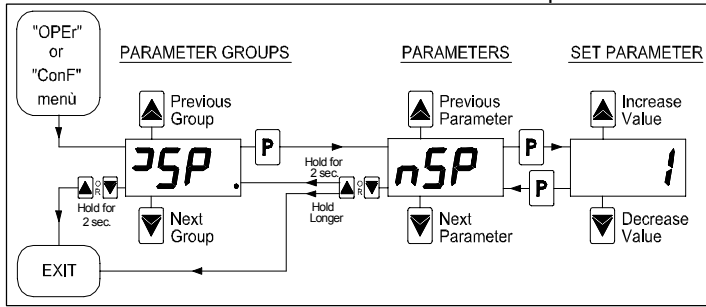
By using the "UP" or "DOWN" keys, it is then possible to select a new parameter (if present) and modify it as described above.

To select another group of parameters, keep the "UP" or "DOWN" key pressed for approx. 2 sec., afterwards the display will return to visualise the code of the group of parameters.

Release the key and by using the "UP" and "DOWN" keys, it will be possible to select a new group.

To exit the programming mode, no key should be pressed for approx. 20 seconds, or keep the "UP" or "DOWN" pressed until exit from the programming mode is obtained.

The programming and exit modes for the "OPER" menu are the same as those described for menu "ConF" with the difference that to access the menu "OPER" the Password is not required.



**ATTENTION:** The instrument is programmed in factory with all the parameters, to exception of the Set Point "SP1" (and 2,3,4), programmable in the menu "ConF" to the purpose to prevent wrong accidental programming from non experienced consumers.

### 2.3 - PARAMETERS PROGRAMMING LEVELS

The menu "OPER" normally contains the parameters used to program the Set Point; however it is possible to make all desired parameters appear or disappear on this level, by following this procedure:

Enter the menu "ConF" and select the parameter to be made programmable or not programmable in the menu "OPER".

Once the parameter has been selected, if the LED SET is switched off, this means that the parameter is programmable only in the menu "ConF", if instead the LED is on, this means that the parameter is also programmable in the menu "OPER".

To modify the visibility of the parameter, push key "U": the LED SET will change its state indicating the parameter accessibility level (on = menu "OPER" and "ConF"; off = menu "ConF" only).

The active Set Point and the alarm thresholds will only be visible on the Set Point fast programming level (described in par. 2.1) if the relative parameters are programmed to be visible (i.e. if they are present in the menu "OPER").

The possible modification of these Sets, with the procedure described in par. 2.1, is instead subordinate to what is programmed in par. "Edit" (contained in the group "IPan").

This parameter can be programmed as:

=SE: The active Set Point can be modified while the alarm thresholds cannot be modified.

=AE: The active Set Point cannot be modified while the alarm thresholds can be modified

=SAE: Both the active Set Point and the alarm thresholds can be modified

=SAnE: Both the active Set Point and the alarm thresholds cannot be modified

### 2.4 - CONTROL STATES

The controller can act in 3 different ways: automatic control (rEG), control off (OFF) and manual control (OPLO).

The instrument is able to pass from one state to the other:

- by selecting the desired state from the main selection menu using the keyboard.

- By using the key "U" on the keyboard; suitably programming par. "USrb" ("USrb" = tunE; "USrb" = OPLO; "USrb" = OFF) it is possible to pass from "rEG" state to the state programmed on the parameter and vice versa.

- Automatically (the instrument swaps into "rEG" state at the end of the auto-tuning execution)

When switched on, the instrument automatically reassumes the state it was in when it was last switched off.

**AUTOMATIC CONTROL (rEG)** – Automatic control is the normal functioning state of the controller.

During automatic control it is possible to visualize the control power on the display by pushing key "UP".

The range of the power values goes from H100 (100% of the output power with reverse action) to C100 (100% of the output power with direct action).

**CONTROL OFF (OFF)** – The instrument can be swapped into the "OFF" state, i.e. the control and the relative outputs are deactivated.

The alarm outputs are instead working normally.

**BUMPLESS MANUAL CONTROL (OPLO)** – By means of this option it is possible to manually program the power percentage given as output by the controller by deactivating automatic control.

When the instrument is swapped to manual control, the power percentage is the same as the last one supplied and can be modified using the "UP" and "DOWN" keys.

As in the case of automatic control, the programmable values range from H100 (+100%) to C100 (-100%).

To return to automatic control, select "rEG" in the selection menu.

### 2.5 - ACTIVE SET POINT SELECTION

This instrument permits pre-programming of up to 4 different Set points ("SP1", "SP2", "SP3", "SP4") and then selection of which one must be active. The maximum number of Set points is determined by the par. "nSP" located in the group of parameters "ISP".

The active Set point can be selected:

- by parameter "SPAt" in the group of parameters "ISP".

- by key "U" if par. "USrb" = CHSP

- Automatically between SP1 and SP2 if a time "dur.t" (see par. 4.8) has been programmed.

Set Points "SP1", "SP2", "SP3", "SP4" will be visible depending on the maximum number of Set Points selected on par. "nSP" and they can be programmed with a value that is between the value programmed on par. "SPLL" and the one programmed on par. "SPHL".

**Note:** in all the following examples the Set point is indicated as "SP", however the instrument will act according to the Set point selected as active.

## 3 - INFORMATION ON INSTALLATION AND USE



### 3.1 - PERMITTED USE

The instrument has been projected and manufactured as a measuring and control device to be used according to EN61010-1 for the altitudes operation until 2000 ms. The use of the instrument for applications not expressly permitted by the

above mentioned rule must adopt all the necessary protective measures. The instrument CANNOT be used in dangerous environments (flammable or explosive) without adequate protection. The installer must ensure that EMC rules are respected, also after the instrument installation, if necessary using proper filters. Whenever a failure or a malfunction of the device may cause dangerous situations for persons, thing or animals, please remember that the plant has to be equipped with additional devices which will guarantee safety.

### 3.2 - MECHANICAL MOUNTING

The instrument, in case 33 x 75 mm, is designed for flush-in panel mounting. Make a hole 29 x 71 mm and insert the instrument, fixing it with the provided special bracket. We recommend that the gasket is mounted in order to obtain the front protection degree as declared. Avoid placing the instrument in environments with very high humidity levels or dirt that may create condensation or introduction of conductive substances into the instrument. Ensure adequate ventilation to the instrument and avoid installation in containers that house devices which may overheat or which may cause the instrument to function at a higher temperature than the one permitted and declared. Connect the instrument as far away as possible from sources of electromagnetic disturbances such as motors, power relays, relays, solenoid valves, etc.

### 3.3 - ELECTRICAL CONNECTION

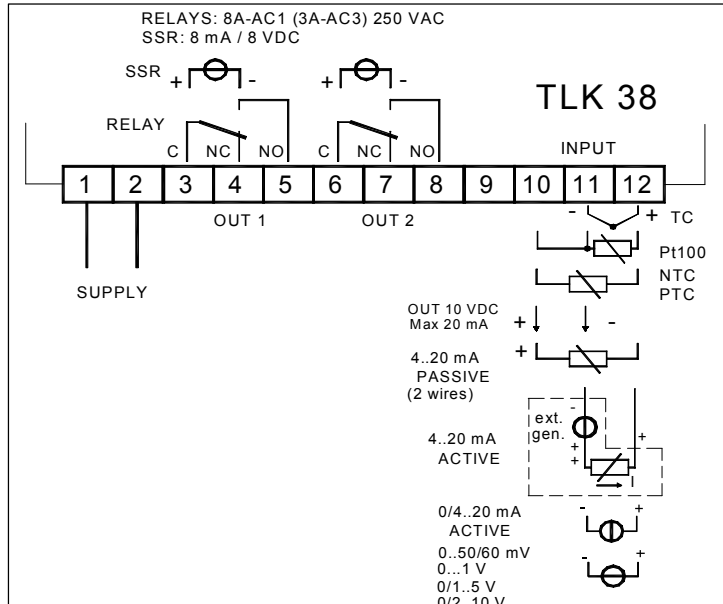
Carry out the electrical wiring by connecting only one wire to each terminal, according to the following diagram, checking that the power supply is the same as that indicated on the instrument and that the load current absorption is no higher than the maximum electricity current permitted. As the instrument is built-in equipment

with permanent connection inside housing, it is not equipped with either switches or internal devices to protect against overload of current: the installation will include an overload protection and a two-phase circuit-breaker, placed as near as possible to the instrument, and located in a position that can easily be reached by the user and marked as instrument disconnecting device which interrupts the power supply to the equipment. It is also recommended that the supply of all the electrical circuits connected to the instrument must be protected properly, using devices (ex. fuses) proportionate to the circulating currents. It is strongly recommended that cables with proper insulation, according to the working voltages and temperatures, be used. Furthermore, the input cable of the probe has to be kept separate from line voltage wiring. If the input cable of the probe is screened, it has to be connected to the ground with only one side. Whether the instrument is 12 V version it's recommended to use an external transformer TCTR, or with equivalent features, and to use only one transformer for each instrument because there is no insulation between supply and input. We recommend that a check should be made that the parameters are those desired and that the application functions correctly before connecting the outputs to the actuators so as to avoid malfunctioning that may cause irregularities in the plant that could cause damage to people, things or animals.

**We do not assume**

**any responsibility for any damage to people, things or animals deriving from violation, wrong or improper use or in any case not in compliance with the instrument's features.**

**3.4 - ELECTRICAL WIRING DIAGRAM**



**4 - FUNCTIONS**

**4.1 - MEASURING AND VISUALIZATION**

All the parameters referring measurements are contained in the group "InP".

Depending on the model required the input accept:

**C**: Thermocouples temperature probes (J,K,S and IRS Infrared sensors), mV signals (0..50/60 mV, 12..60 mV), Thermoresistances PT100.

**E**: Thermocouples temperature probes (J,K,S and IRS Infrared sensors), mV signals (0..50/60 mV, 12..60 mV), Thermistors PTC and NTC.

**I**: normalized analogue signals 0/4..20 mA

**V**: normalized analogue signals 0..1 V, 0/1..5 V, 0/2..10 V

Depending on the model, using par. "SEnS", it's possible to select the type of input probe, which can be:

- for thermocouples J (J), K (CrAL), S (S) or for infrared sensors serie IRTC1 with linearization J (Ir.J) or K (Ir.CA)
- for thermoresistances Pt100 IEC (Pt1) or thermistors PTC KTY81-121 (Ptc) or NTC 103AT-2 (ntc)

- for normalised signals in current 0..20 mA (0.20) or 4..20 mA (4.20)

- for normalised signals in tension 0..1 V (0.1), 0..5 V (0.5), 1..5 V (1.5), 0..10 V (0.10) or 2..10 V (2.10).

- for normalised signals in tension 0..50 mV (0.50), 0..60 mV (0.60), 12..60 mV (12.60).

We recommend to switch on and off the instrument when these parameters are modified, in order to obtain a correct measuring.

For the instruments with input for temperature probes (tc, rtd) it's possible to select, through par. "Unit", the unit of measurement (°C, °F) and, through par. "dP" (Pt100, PTC and NTC only) the desired resolution (0=1°; 1=0,1°).

Instead, with regards to the instruments with normalised analogue input signals, it is first necessary to program the desired resolution on par. "dP" (0=1; 1=0,1; 2=0,01; 3=0,001) and then, on par. "SSC", the value that the instrument must visualise at the beginning of the scale (0/4 mA, 0/12 mV, 0/1 V o 0/2 V) and, on par. "FSC", the value that the instrument must visualise at the end of the scale (20 mA, 50 mV, 60 mV, 5 V or 10 V).

The instrument allows for measuring calibration, which may be used to recalibrate the instrument according to application needs, by using par. "OFSt" and "rot".

Programming par. "rot"=1,000, in par. "OFSt" it is possible to set a positive or negative offset that is simply added to the value read by the probe before visualisation, which remains constant for all the measurements.

If instead, it is desired that the offset set should not be constant for all the measurements, it is possible to operate the calibration on any two points.

In this case, in order to decide which values to program on par. "OFSt" and "rot", the following formulae must be applied:

$$\text{"rot"} = (D2 - D1) / (M2 - M1) \quad \text{"OFSt"} = D2 - (\text{"rot"} \times M2)$$

where:

M1 = measured value 1

D1 = visualisation value when the instrument measures M1

M2 = measured value 2

D2 = visualisation value when the instrument measures M2

It then follows that the instrument will visualise:

$$DV = MV \times \text{"rot"} + \text{"OFSt"}$$

where: DV = visualised value MV= measured value

**Example 1:** It is desired that the instrument visualises the value effectively measured at 20° but that, at 200°, it visualises a value lower than 10° (190°).

Therefore: M1=20; D1=20; M2=200; D2=190

$$\text{"rot"} = (190 - 20) / (200 - 20) = 0,944$$

$$\text{"OFSt"} = 190 - (0,944 \times 200) = 1,2$$

**Example 2:** It is desired that the instrument visualises 10° whilst the value actually measured is 0°, but, at 500° it visualises a 50° higher value (550°).

Therefore: M1=0; D1=10; M2=500; D2=550

$$\text{"rot"} = (550 - 10) / (500 - 0) = 1,08$$

$$\text{"OFSt"} = 550 - (1,08 \times 500) = 10$$

By using par. "FIL" it is possible to program time constant of the software filter for the input value measured, in order to reduce noise sensitivity (increasing the time of reading).

In case of measurement error, the instrument supplies the power as programmed on par. "OPE".

This power will be calculated according to cycle time programmed for the PID controller, while for the ON/OFF controllers the cycle time is automatically considered to be equal to 20 sec. (e.g. In the event of probe error with ON/OFF control and "OPE"=50, the control output will be activated for 10 sec., then it will be deactivated for 10 sec. and so on until the measurement error remains.).

By using par. "InE" it is also possible to decide the conditions of the input error, allowing the instrument to give the power programmed on par. "OPE" as output.

The possibilities of par. "InE" are:

= Or: the condition occurs in case of over-range or probe breakage

= Ur: the condition occurs in case of under-range or probe breakage



= OUr : the condition occurs in case of over-range or under-range or probe breakage

Using par. "diSP", located in the group "PAN", it is possible to set normal visualization of the display which can be the process variable (dEF), the control power (Pou), the active Set Point (SP.F) the Set Point operating when there are active ramps (SP.o) or alarm threshold AL1 or AL2 (AL1, AL2).

Again in the group "PAN" the par. "AdE" is present that defines the 3 led shift index functioning.

The lighting up of the green led = indicates that the process value is within the range [SP+AdE ... SP-AdE], the lighting up of the led - indicates that the process value is lower than [SP-AdE] and the lighting up of the led + indicates that the process value is higher than [SP+AdE].

#### 4.2 - OUTPUTS CONFIGURATION

The instrument's outputs can be programmed by entering the group of parameters "iOut, where the relative parameters "O1F" and "O2F" (depending on the number of outputs available on the instrument) are located.

The outputs can be set for the following functions :

- Main control output (1.rEG)
- Secondary control output (2.rEG)
- Alarm output normally open (ALno)
- Alarm output normally closed (ALnc)
- Alarm output normally closed with led reverse indication (ALni)
- Output deactivated (OFF)

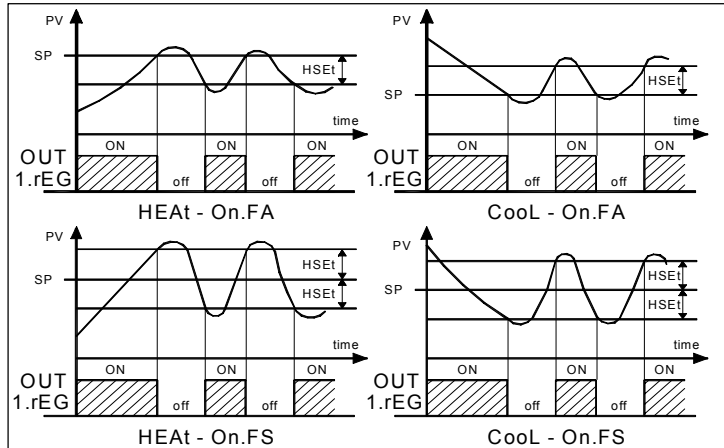
The coupling outputs number outputs – number alarms can be made in the group referring to the alarm to the alarm ("AL1", "AL2").

#### 4.3 - ON/OFF CONTROL (1.rEG)

All the parameters referring to the ON/OFF control are contained in the group "iREG".

This type of control can be obtained by programming par. "Cont" = On.FS or = On.FA and works on the output programmed as 1.rEG, depending on the measure, on the active Set Point "SP", on the functioning mode "Func" and on the hysteresis "HSEt".

The instrument carries out an ON/OFF control with symmetrical hysteresis if "Cont" = On.FS or with asymmetrical hysteresis if "Cont" = On.FA.



The control works in the following way : in the case of reverse action, or heating ("Func"=HEAt), it deactivates the output, when the process value reaches [SP + HSEt] in case of symmetrical hysteresis, or [SP] in case of asymmetrical hysteresis and is then activated again when the process value goes below value [SP - HSEt].

Vice versa, in case of direct action or cooling ("Func"=CoolL), it deactivates the output, when the process value reaches [SP - HSEt] in case of symmetrical hysteresis, or [SP] in case of asymmetrical hysteresis and is activated again when the process value goes above value [SP + HSEt].

#### 4.4 - NEUTRAL ZONE ON/OFF CONTROL (1.rEG - 2.rEG)

All the parameters referring to Neutral Zone ON/OFF control are contained in the group "iREG".

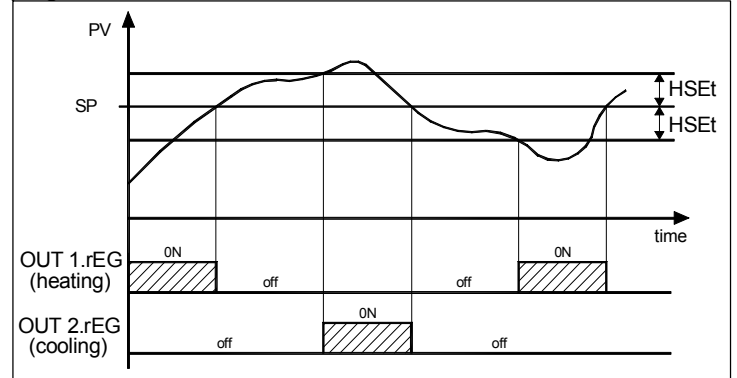
This type of control can be obtained when 2 outputs are programmed respectively as 1.rEG and 2.rEG and the par. "Cont" = nr .

The Neutral Zone control is used to control plants in which there is an element which causes a positive increase (ex. Heater, humidifier, etc.) and an element which causes a negative increase (ex. Cooler, de-humidifier, etc).

The control functions works on the programmed outputs depending on the measurement, on the active Set Point "SP" and on the hysteresis "HSEt".

The control works in the following way : it deactivates the outputs when the process value reaches the Set Point and it activates the output 1.rEG when the process value goes below value [SP - HSEt], or it activates the output 2.rEG when the process value goes above [SP + HSEt].

Consequently, the element causing a positive increase has to be connected to the output programmed as 1.rEG while the element causing a negative increase has to be connected to the output programmed as 2.rEG.



If 2.rEG output is used to control compressor is possible to use the "Compressor Protection" function that has the meaning to avoid compressor "short cycles".

This function allows a control by time on the output 2.rEG activation, independently by the temperature control request.

The protection is a "delayed after deactivation" type.

This protection permits to avoid the output activation for a time programmable on par. "CPdt" (expressed in sec.); the output activation will occurs only after the elapsing of time "CPdt".

The time programmed on parameter "CPdt" is counted starting from the last output deactivation.

Obviously, whether during the time delay caused by the compressor protection function, the regulator request should stop, the output activation foreseen after time "CPdt" would be erased.

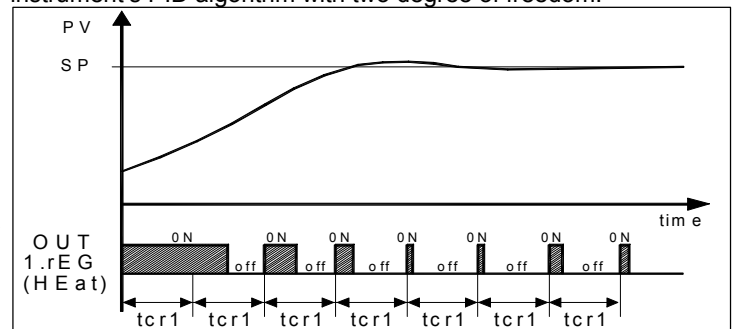
The function is not active programming "CPdt" =OFF.

The led relative to 2.rEG output blinks during the phases of output activation delay, caused by "Compressor Protection" function.

#### 4.5 - SINGLE ACTION PID CONTROL (1.rEG)

All the parameters referring to PID control are contained in the group "iREG".

The Single Action PID control can be obtained by programming par. "Cont" = Pid and works on the output 1.rEG depending on the active Set Point "SP", on the functioning mode "Func" and on the instrument's PID algorithm with two degree of freedom.



In order to obtain good stability of the process variable, in the event of fast processes, the cycle time "tcr1" has to have a low value with a very frequent intervention of the control output.

In this case use of a solid state relay (SSR) is recommended for driving the actuator.

The Single Action PID control algorithm foresees the setting of the following parameters :

"Pb" – Proportional Band

"tcr1" – Cycle time of the output 1.rEG

"Int" – Integral Time

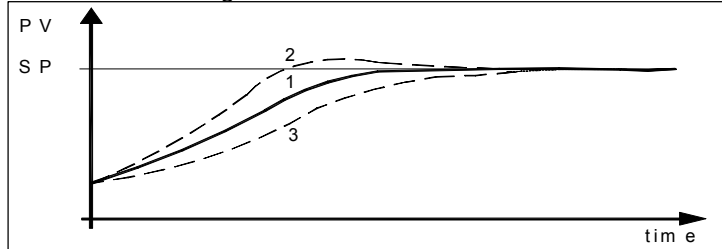
"rS" – Manual Reset (if "Int =0 only)

"dEr" – Derivative Time

"FuOC" – Fuzzy Overshoot Control

This last parameter allows the variable overshoots at the start up of the process or at the changing of the Set Point to be avoided.

Please remember that a low value on this parameter reduces the overshoot while a high value increase it.



1: Value "FuOC" OK

2: Value "FuOC" too high

3: Value "FuOC" too low

#### 4.6 - DOUBLE ACTION PID CONTROL (1.rEG - 2.rEG)

All the parameters referring to PID control are contained in the group "rEG".

The Double Action PID control is used to control plants where there is an element which causes a positive increase (ex. Heating) and an element which causes a negative increase (ex. Cooling).

This type of control can be obtained when 2 outputs are programmed respectively as 1.rEG and 2.rEG and the par. "Cont" = Pid.

The element causing a positive increase has to be connected to the output programmed as 1.rEG while the element causing a negative increase has to be connected to the output programmed as 2.rEG.

The Double Action PID control works on the outputs 1.rEG and 2.rEG depending on the active Set Point "SP" and on the instrument's PID algorithm with two degrees of freedom.

In order to obtain good stability of the process variable, in case of fast processes, the cycle times "tcr1" and "tcr2" have to have a low value with a very frequent intervention of the control outputs.

In this case use of solid state relays (SSR) to drive the actuators is recommended.

The Double Action PID control algorithm needs the programming of the following parameters :

"Pb" - Proportional Band

"tcr1" - Cycle time of the output 1.rEG

"tcr 2" - Cycle time of the output 2.rEG

"Int" - Integral Time

"rS" - Manual Reset (if "Int =0 only)

"dEr" - Derivative Time

"FuOC" - Fuzzy Overshoot Control

"Prat" - Power Ratio or relation between power of the element controlled by output 2.rEG and power of the element controlled by output 1.rEG.

If par. "Prat" = 0, the output 2.rEG is disabled and the control behaves exactly as a single action PID controller, through output 1.rEG.

#### 4.7 - AUTOTUNING AND SELFTUNING FUNCTIONS

All the parameters referring to the AUTO-TUNING and SELF-TUNING functions are contained in the group "rEG".

The AUTO-TUNING and SELF-TUNING functions permit the automatic tuning of the PID controller.

The **AUTO-TUNING** function permits the calculation of the PID parameters by means of a FAST type tuning cycle and, at the end of this operation, the parameters are stored into the instrument's memory and remain constant during control.

The **SELF-TUNING** function (rule based "TUNE-IN") instead allows control monitoring and the continuous calculation of the parameters during control.

Both functions automatically calculate the following parameters :

"Pb" - Proportional Band

"tcr1" - Cycle time of the output 1rEG

"Int" - Integral Time

"dEr" - Derivative Time

"FuOC" - Fuzzy Overshoot Control

and, for the Double Action PID control, also :

"tcr 2" - Cycle time of the output 2rEG

"Prat" - Power Ratio P 2.rEG/ P 1.rEG

To activate the AUTO-TUNING function proceed as follows :

1) Program and activate the desired Set Point.

2) Program par. "Cont" =Pid.

3) Program par. "Func" according to the process to be controlled through output 1rEG.

4) Program an output as 2.rEG if the instrument controls a plant with double action

5) Program par. "Auto" as:

- "1" – if auto-tuning is desired automatically, each time the instrument is switched on, on the condition that the process value is lower (with "Func" =HEAT) than  $[SP - |SP/2|]$  or higher (with "Func" =Cool) than  $[SP + |SP/2|]$ .

- "2" – if auto-tuning is desired automatically, the next time the instrument is switched on, on the condition that the process value is lower (with "Func" =HEAT) than  $[SP - |SP/2|]$  or higher (with "Func" =Cool) than  $[SP + |SP/2|]$ , and once the tuning is finished, the par. "Auto" is automatically swapped to the OFF state

- "3" - if manual auto-tuning is desired, by selecting par. "tunE" in the main menu or by correctly programming key "U" as "USrb" = tunE. The Autotuning will start at the condition that the process value is lower (with "Func" =HEAT) than  $[SP - |SP/5|]$  or higher (with "Func" =Cool) than  $[SP + |SP/5|]$ .

- "4" - if it's desired to activate the autotuning automatically to every change of Set Point, or at the end of programmed Soft-Start cycle. The Autotuning will start at the condition that the process value is lower (with "Func" =HEAT) than  $[SP - |SP/5|]$  or higher (with "Func" =Cool) than  $[SP + |SP/5|]$ .

6) Exit from the parameter programming.

7) Connect the instrument to the controlled plant.

8) Activate the Auto-tuning by switch off and turn on the instrument if "Auto"=1 or 2 , or by selecting par. "tunE" in the main menu (or by correctly programming key "U" ).

At this point the Auto-tuning function is activated and is indicated by the flashing led AT/ST.

The regulator carries out several operations on the connected plant in order to calculate the most suitable PID parameters.

If, at the Auto-tuning start, the condition for the lower or higher process value is not found the display will show "ErAt" and the instrument will be swapped to normal control conditions according to the previously programmed parameters.

To make the error "ErAt" disappear, press key P.

The Auto-tuning cycle duration has been limited to 12 hours maximum.

If Auto-tuning is not completed within 12 hours, the instrument will show "noAt" on the display.

In case of probe error, the instrument automatically stops the cycle in progress.

The values calculated by Auto-tuning are automatically stored in the instrument's memory at the end of the correct PID parameters tuning.

**Note** : The instrument is already programmed in our factory to carry out auto-tuning at first instrument switch on ("Auto" = 2).

To activate the SELF-TUNING function proceed as follows

1) Program and activate the desired Set Point.

2) Program par. "Cont" =Pid.

3) Program par. "Func" according to the process to be controlled through output 1.rEG.

4) Program an output as 2.rEG if the instrument controls a dual-action plant

- 5) Program par. **"SELF"** = yES
- 6) Exit from the parameter programming.
- 7) Connect the instrument to the controlled plant.
- 8) Activate Self-tuning selecting par. **"tunE"** in the main menu (or by correctly programming key "U").

When the Self-tuning function is active, the led AT/ST is permanently lit up and all the PID parameters ("Pb", "Int", "dEr", etc.) are no longer visualized.

**Note :** *It's always preferable tuning the instrument using the Autotuning and to activate the Selftuning after because the tuning through Selftuning is more slow.*

To stop the Auto-tuning cycle or deactivate the Self-tuning function select one of the control types : "rEG", "OPLO" or "OFF" from the menu "SEL". If the instrument is switched off during Auto-tuning or with the Self-tuning function activated, these functions will remain activated the next time it is switched on.

#### 4.8 - REACHING OF THE SET POINT AT CONTROLLED SPEED AND AUTOMATIC SWITCHING BETWEEN TWO SET POINTS (RAMPS AND DWELL TIME)

All the parameters referring to the ramps functioning are contained in the group **"rEG"**.

It is possible to reach the set point in a predetermined time (in any case longer than the time the plant would naturally need). This could be useful in those processes (heating or chemical treatments, etc.) where the set point has to be reached gradually, in a predetermined time.

Once the instrument has reached the first Set Point (SP1) it is possible to have automatic switching to the second Set Point (SP2) after a set time, thus obtaining a simple automatic process cycle.

These functions are available for all the programmable controls (PID single and double action, ON/OFF and Neutral Zone ON/OFF).

The function is determined by the following parameters :

**"SLor"** - Gradient of first ramp expressed in unit/minute

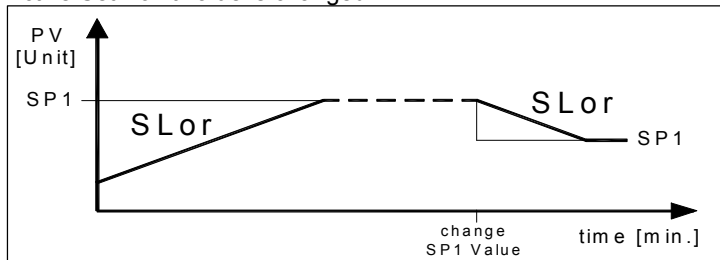
**"SLoF"** - Gradient of second ramp expressed in unit/minute.

**"dur.t"** - Dwell time of Set Point "SP1" before automatic switching to Set Point "SP2" (expressed in hrs. and min.).

The functions are deactivated when the relative parameters are = InF.

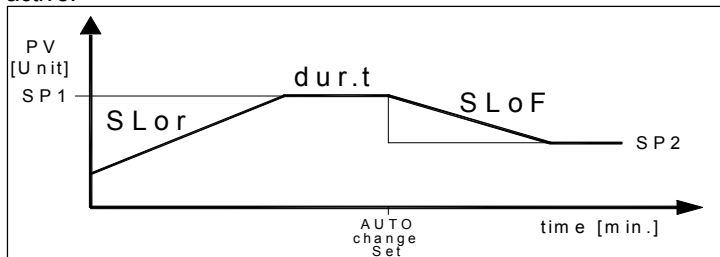
If is desired only one ramp (ex. to reach "SP1") it is enough to program on the par. "SLor" the desired value.

The ramp "SLor" it will always active at power on and when the Active Set Point value is changed.



If it is desired an automatic cycle from the power on instead it is necessary to program the par. "nSP" = 2, to program the two Set Point values "SP1" and "SP2" and naturally to program the par. "SLor", "dur.t" and "SLoF" with the desired values.

In this case at the end of the cycle all the ramps won't be more active.



*Examples with starts from values lower than SP and with decreasing of SP.*

**Note:** *In case of PID control, if Auto-tuning is desired whilst the ramp function is active, this will not be carried out until the tuning*

*cycle has been completed. It is therefore recommended that Auto-tuning be started avoiding activating the ramp function and, once the tuning is finished, deactivate Auto-tuning ("Auto" = OFF), program the desired ramp and, if it automatic tuning is desired, enable the Self-tuning function.*

#### 4.9 - SOFT-START FUNCTION

All the parameters referring to the Soft -Start functioning are contained in the group **"rEG"**.

The Soft-Start function only works through PID control and allows the limitation of control power when the instrument is switched on, for a programmable period of time.

This is useful when the actuator, driven by the instrument, may be damaged excess power supplied when the application is not yet in the normal rating. (ex. for certain heating elements).

The function depends on the following parameters :

**"St.P"** - Soft-Start power

**"SSt"** - Soft-Start time (expressed in hh.mm)

**"HSEt"** - End Soft Start cycle threshold

If both parameters are programmed with values other than OFF, when switched on the instrument gives an output power as programmed on par. "St.P" for the time programmed on par. "SSt" or when is reached the absolute value programmed at par. "HSEt".

Practically, the instrument works in manual condition and switches to automatic control at the elapsing of time "SSt" or when is reached the absolute value programmed at par. "HSEt".

To disable the Soft-Start function simply program par. "SSt" = OFF.

Whenever, a measurement errors occurs during the Soft-Start execution, the function is interrupted and the instrument gives an output power as programmed on par. "OPE".

If the measurement is restored, the Soft-Start is still deactivated.

If it's desired to activate the Autotuning with Soft-Start set par. "Auto"=4.

The Autotuning will start automatically at the end of programmed Soft-Start cycle at the condition that the process value is lower (with "Func" =HEAt) than [SP- |SP/5|] or higher (with "Func" =Cool) than [SP+ |SP/5|].

#### 4.10 - ALARMS OUTPUTS FUNCTIONS (AL1, AL2)

The alarms (AL1, AL2) are depending on the process value and before to set his functioning it's necessary to establish to which output the alarm has to correspond to.

First of all it's necessary to configure, in the parameters group **"jOut"**, the parameters relative to the outputs required as alarm ("O1F", "O2F") programming the parameter relative to the desired output as follows :

= **ALno** if the alarm output has to be ON when the alarm is active, while it's OFF when the alarm is not active

= **ALnc** if the alarm output has to be ON when the alarm is not active, while it's OFF when the alarm is active

= **ALni** if the alarm output has to be ON when the alarm is not active, while it is OFF when the alarm is active but with reverse led indication (led ON= alarm OFF).

**Note:** *In all the examples that follow is made reference to the alarm AL1. Naturally the operation of the other alarms results analogous.*

Have now access at the group **"jAL1"**, and program on par. **"OAL1"**, to which output the alarm signal has to be sent.

The alarm functioning is instead defined by parameters :

**"AL1t"** - ALARM TYPE

**"Ab1"** - ALARM CONFIGURATION

**"AL1"** - ALARM THRESHOLD

**"AL1L"** - LOW ALARM THRESHOLD (for band alarm) OR MINIMUM SET OF AL1 ALARM THRESHOLD (for low or high alarm)

**"AL1H"** - HIGH ALARM THRESHOLD (for band alarm) OR MAXIMUM SET OF AL1 ALARM THRESHOLD (for low or high alarm)

**"HAL1"** - ALARM HYSTERESIS

**"AL1d"** - ALARM ACTIVATION DELAY (in sec.)

**"AL1i"** - ALARM BEHAVIOUR IN THE EVENT OF MEASUREMENT ERROR

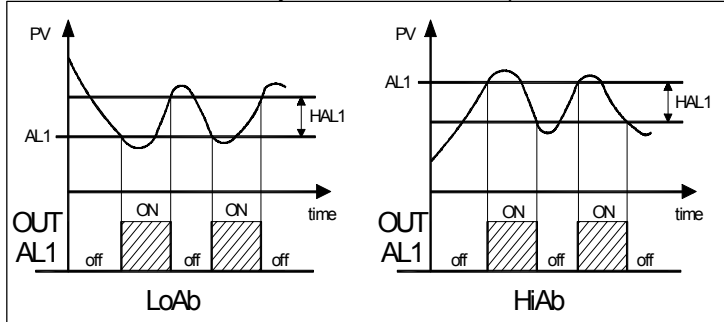
**"AL1t" – ALARM TYPE :** the alarm output can behave in six different ways.

**LoAb = ABSOLUTE LOW ALARM:** The alarm is activated when the process value goes below the alarm threshold set on parameter "AL1" and will be deactivated when it goes above the value [AL1+HAL1].

With this mode is possible to program the minimum and the maximum set of "AL1" by "AL1L" and "AL1H" parameters.

**HiAb = ABSOLUTE HIGH ALARM:** The alarm is activated when the process value goes higher than the alarm threshold set on parameter "AL1" and will be deactivated when it goes below the value [AL1 - HAL1].

With this mode is possible to program the minimum and the maximum set of "AL1" by "AL1L" and "AL1H" parameters.

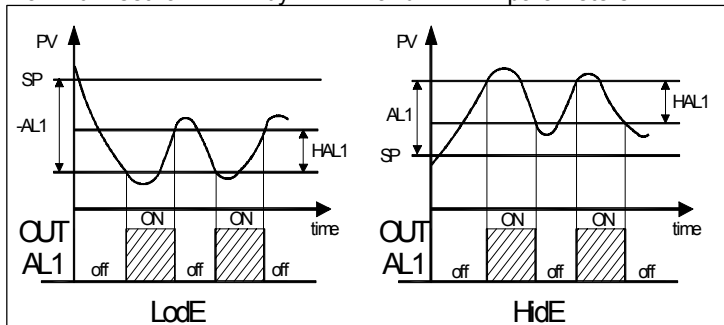


**LodE = DEVIATION LOW ALARM:** The alarm is activated when the process value goes below the value [SP + AL1] and will be deactivated when it goes above the value [SP + AL1 + HAL1].

With this mode is possible to program the minimum and the maximum set of "AL1" by "AL1L" and "AL1H" parameters.

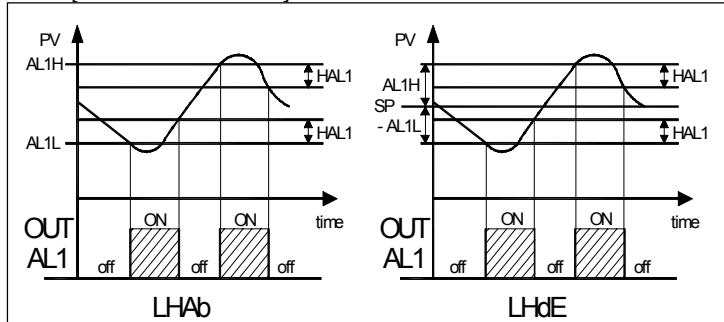
**HidE = DEVIATION HIGH ALARM:** The alarm is activated when the process value goes above the value [SP + AL1] and will be deactivated when it goes below the value [SP + AL1 - HAL1].

With this mode is possible to program the minimum and the maximum set of "AL1" by "AL1L" and "AL1H" parameters.



**LHAb = ABSOLUTE BAND ALARM:** The alarm is activated when the process value goes under the alarm threshold set on parameter "AL1L" or goes higher than the alarm threshold set on parameter "AL1H" and will be deactivated when it goes below the value [AL1H - HAL1] or when it goes above the value [AL1L + HAL1].

**LHdE = DEVIATION BAND ALARM:** The alarm is activated when the process value goes below the value [SP + AL1L] or goes above than the value [SP + AL1H] and will be deactivated when it goes below the value [SP + AL1H - HAL1] or when it goes above the value [SP + AL1L + HAL1].



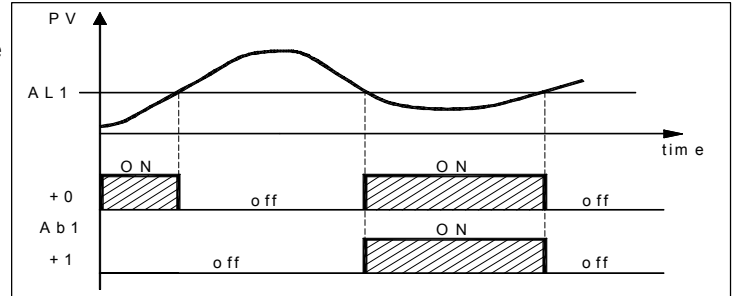
**"Ab1" - ALARM CONFIGURATION:** This parameter can assume a value between 0 and 31.

The number to be set, which will correspond to the function desired, is obtained by adding the values reported in the following descriptions :

**ALARM BEHAVIOUR AT SWITCH ON:** the alarm output may behave in two different ways, depending on the value added to par. "Ab1".

+0 = NORMAL BEHAVIOUR: The alarm is always activated when there are alarm conditions.

+1 = ALARM NOT ACTIVATED AT SWITCH ON: If, when switched on, the instrument is in alarm condition, the alarm is not activated. It will be activated only when the process value is in non-alarm conditions and then back in alarm conditions.



*example with absolute low alarm*

**ALARM DELAY:** the alarm output may behave in two different ways depending on the value added to par. "Ab1".

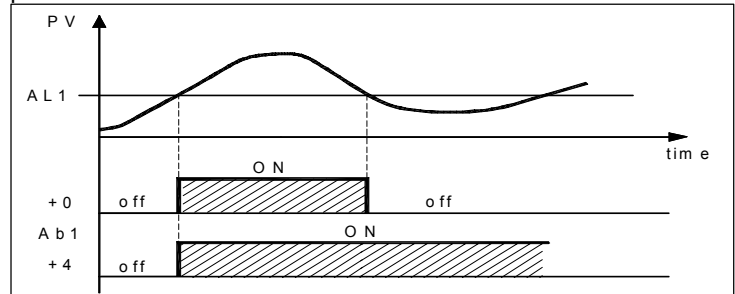
+0 = ALARM NOT DELAYED: The alarm is immediately activated when the alarm condition occurs.

+2 = ALARM DELAYED: When the alarm condition occurs, delay counting begins, as programmed on par. "AL1d" (expressed in sec.) and the alarm will be activated only after the elapsing of that time.

**ALARM LATCH:** : the alarm output may behave in two different ways depending on the value added to par. "Ab1".

+0 = ALARM NOT LATCHED: The alarm remains active in alarm conditions only.

+4 = ALARM LATCHED: The alarm is active in alarm conditions and remains active even when these conditions no longer exist, until the correctly programmed key "U", ("USrb"=Aac) has been pushed.



*example with absolute high alarm*

**ALARM ACKNOWLEDGEMENT:** : the alarm output may behave in two different ways depending on the value added to par. "Ab1".

+0 = ALARM NOT ACKNOWLEDGED: The alarm always remains active in alarm conditions.

+8 = ALARM ACKNOWLEDGED: The alarm is active in alarm conditions and can be deactivated by key "U" if properly programmed ("USrb"=ASi), and also if alarm conditions still exist.

**ALARM BEHAVIOUR AT SET POINT CHANGE (DEVIATION ALARMS ONLY):** the alarm output may behave in two different ways, depending on the value added to par. "Ab1".

+0 = NORMAL BEHAVIOUR: The alarm is always activated when there are alarm conditions.

+16 = ALARM NOT ACTIVATED AT SET POINT CHANGE: If, when Set Point change, the instrument is in alarm condition, the alarm is not activated. It will be activated only when the process value is in non-alarm conditions and then back in alarm conditions.

**"AL1i" - ALARM ACTIVATION IN CASE OF MEASUREMENT**

**ERROR:** This allows one to establish how the alarm have behave in the event of a measurement error (yES=alarm active; no=alarm deactivated).

#### 4.11 - LOOP BREAK ALARM FUNCTION

All the parameters referring to the Loop Break alarm function are contained in the group “**LbA**”.

The Loop Break alarm is available on all the instruments, which intervenes when, for any reason (short-circuit of a thermocouple, thermocouple inversion, load interruption), the loop control is interrupted.

First of all, it is necessary to establish to which output the alarm has to correspond.

To do this it is necessary to set the parameter relative to the output to be used (“O1F” , “O2F”) in the group “**Out**”, programming the parameter as :

= **ALno** if the alarm output has to be ON when the alarm is active while it is OFF when the alarm is not active.

= **ALnc** if the alarm output has to be ON when the alarm is not active while it is OFF when the alarm is active.

= **ALni** if the alarm output has to be ON when the alarm is not active, while it is OFF when the alarm is active but with reverse led indication (led ON= alarm OFF).

Enter group “**LbA**” and program which output the alarm signal has to be addressed to on par. “**OLbA**”.

The Loop Break alarm is activated if the output power remains at the 100% of the value for the time programmed on par. “**LbAt**” (expressed in sec.).

To avoid false alarms, the value of this parameter has to be set considering the time the plant takes to reach the Set point when the measured value is a long distance from it (for example at the plant start-up).

On alarm intervention, the instrument visualizes the message “**LbA**” and behaves as in the case of a measurement error giving a power output as programmed on par. “**OPE**” (programmable in the group “**InP**”).

To restore normal functioning after the alarm, select the control mode “OFF” and then re-program the automatic control (“rEG”) after checking the correct functioning of probe and actuator.

To exclude the Loop Break alarm, set “OLbA” = OFF.

#### 4.12 - FUNCTIONING OF KEY “U”

The function of key “U” can be set through par. “**USrb**” contained in the group “**Pan**”.

The parameter can be programmed as :

= **noF** : no function

= **tunE** : Pushing the key for 1 sec. at least, it is possible to activate/deactivate Auto-tuning or Self-tuning

= **OPLO** : Pushing the key for 1 sec. at least, it is possible to swap from automatic control (rEG) to manual one (OPLO) and vice versa.

= **Aac** : Pushing the key for 1 sec. at least, it is possible to acknowledge the alarm. (see par. 4.10)

= **ASi** : Pushing the key for 1 sec. at least, it is possible to acknowledge an active alarm (see par. 4.10)

= **CHSP** : Pushing the key for 1 sec. at least, it is possible to select one of the 4 pre-programmed Set Points on rotation.

= **OFF** : Pushing the key for 1 sec. at least, it is possible to swap from automatic control (rEG) to OFF control (OFF) and vice versa.

#### 4.13 - PARAMETERS CONFIGURATION BY “KEY01”

The instrument is equipped with a connector that allows the transfer from and toward the instrument of the functioning parameters through the device **KEY01** with **5 poles** connector.

This device it's mainly useable for the serial programming of the instruments which need to have the same parameters configuration or to keep a copy of the programming of an instrument and allow its rapid retransmission.

To use the device KEY01 it's necessary that the device or instrument are being supplied.

To transfer the configuration of an instrument into the device (**UPLOAD**) it is necessary to proceed in the following way:

1) position both dip switch of KEY 01 in the **OFF** mode.

2) connect the device to the instrument TLK plugging the special connector.

3) verify that the instrument or the device are supplied

4) observe the indication led on the device KEY 01: if it results green this means that a configuration is already loaded on the

device while if it results green blinking or red blinking this means that it has not been loaded any valid configuration on the device .

5) press the button placed on the device.

6) observe the indication led : after having pressed the button, the led becomes red and therefore, at the end of the data transfer, it becomes green.

7) now it is possible to disconnect the device.

To transfer the configuration loaded on the device onto an instrument of the same family (**DOWNLOAD**), it is necessary to proceed in the following way:

1) position both dip switch of KEY 01 in the **ON** mode.

2) connect the device to an instrument TLK having the same features of the one from which has been downloaded the desired configuration, plugging the special connector.

3) verify that the instrument or the device are supplied

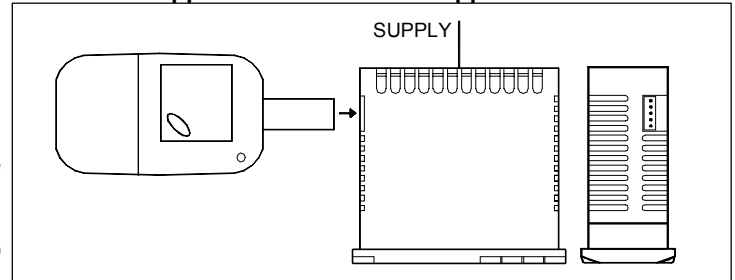
4) observe the indication led on the device KEY 01: it has to result green, because if the led results green blinking or red blinking, this means that on the device it has not been downloaded any valid configuration and therefore it's useless to continue.

5) if the les results green, press the button placed on the device.

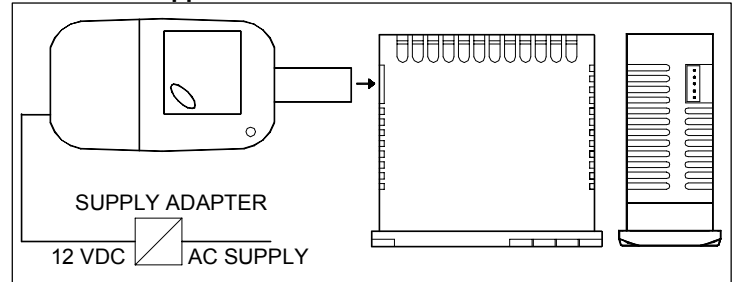
6) observe the indication led : after having pressed the button, the led becomes red and therefore, at the end of the data transfer, it becomes green.

7) now it is possible to disconnect the device.

#### Instrument supplied and device not supplied



#### Instrument supplied from the device



For additional info, please have a look at the KEY01 instruction manual.

## 5 - PROGRAMMABLE PARAMETERS

Here following are described all the parameters available on the instrument. Some of them could be not present or because they are depending on the type of instrument or because they are automatically disabled as unnecessary.

#### Group “1 SP” (parameters relative to the Set Point)

Par.	Description	Range	Def.	Note
1	<b>nSP</b> Number of the programmable Set point	1 ÷ 4	1	
2	<b>SPAt</b> Active Set point	1 ÷ nSP	1	
3	<b>SP1</b> Set Point 1	SPLL ÷ SPHL	0	
4	<b>SP2</b> Set Point 2	SPLL ÷ SPHL	0	
5	<b>SP3</b> Set Point 3	SPLL ÷ SPHL	0	
6	<b>SP4</b> Set Point 4	SPLL ÷ SPHL	0	
7	<b>SPLL</b> Low Set Point	-1999 ÷ SPHL	-1999	
8	<b>SPHL</b> High Set Point	SPLL ÷ 9999	9999	



46	<b>Auto</b>	Autotuning Fast enable OFF = Not active 1 = Start each power on 2= Start at first power on 3= Start manually 4= Start after Soft Start or change Set Point	OFF / 1 / 2 / 3 / 4	2	
47	<b>SELF</b>	Selftuning enable	no / yES	no	
48	<b>Pb</b>	Proportional band	0 ÷ 9999	50	
49	<b>Int</b>	Integral time	OFF ÷ 9999 sec.	200	
50	<b>dEr</b>	Derivative time	OFF÷ 9999 sec.	50	
51	<b>FuOc</b>	Fuzzy overshoot control	0.00 ÷ 2.00	0.5	
52	<b>tcr1</b>	Cycle time of output 1.rEG	0.1 ÷ 130.0 sec.	20.0	
53	<b>Prat</b>	Power ratio 2.rEG / 1.rEG	0.01 ÷ 99.99	1.00	
54	<b>tcr2</b>	Cycle time of 2.rEG	0.1 ÷ 130.0 sec.	10.0	
55	<b>rS</b>	Manual reset	-100.0÷100.0 %	0.0	
56	<b>SLor</b>	Gradient of first ramp : InF= Ramp not active	0.00 ÷ 99.99 / InF unit/min.	InF	
57	<b>dur.t</b>	Duration time between two ramps InF= Time not active	0.00 ÷ 99.59 / InF hrs.-min.	InF	
58	<b>SLoF</b>	Gradient of second ramp: InF= Ramp not active	0.00 ÷ 99.99 / InF unit / min.	InF	
59	<b>St.P</b>	Soft-Start power	-100 ÷ 100 %	0	
60	<b>SSt</b>	Soft-Start time	OFF/0.1÷7.59 / InF hrs.-min.	OFF	

#### Group "1 Pan" (parameters relative to the user interface)

Par.	Description	Range	Def.	Note
61	<b>USrb</b>	Functioning of key "U" : noF = No Function tune= Start Autotuning or Selftuning OPLO= Manual Control (open loop) Aac= Reset Alarms latch ASi= Acknowledged Alarms OFF= Control OFF	noF / tunE / OPLO / Aac / ASi / CHSP / OFF	noF
62	<b>diSP</b>	Variable visualized on the display: dEF= Process Value Pou= Control Power SP.F= Active Set SP.o = Operative Set AL1 = AL1 threshold AL2 = AL2 threshold	dEF / Pou / SP.F / SP.o / AL1 / AL2	dEF
63	<b>AdE</b>	Shift value for the shift index functioning	OFF...9999	2
64	<b>Edit</b>	Set Fast program.: SE= Active Set can be modified while the alarm thresholds cannot be modified AE= Active Set cannot be modified while the alarm thresholds can be modified SAE= Active Set and alarm thresholds can be modified SAnE= Active Set and alarm thresholds cannot be modified	SE / AE / SAE / SAnE	SAE

## 6 - PROBLEMS, MAINTENANCE AND GUARANTEE

### 6.1 - ERROR SIGNALLING

Error	Reason	Action
----	Probe interrupted	Verify the correct connection between probe and instrument and then verify the correct functioning of the probe
uuuu	The measured variable is under the probe's limits (under-range)	
oooo	The measured variable is over the probe's limits (over-range)	
ErAt	Auto-tuning not possible because the process value is too higher or too lower	Push key "P" in order to make the error message disappear. Once the error has been found, try to repeat the auto-tuning.
noAt	Auto-tuning not finished within 12 hours	Check the functioning of probe and actuator and try to repeat the auto-tuning.
LbA	Loop control interrupted (Loop break alarm)	Check the working of probe and actuator and swap the instrument to (rEG) control
ErEP	Possible anomaly of the EEPROM memory	Push key "P"

In error conditions, the instrument provides an output power as programmed on par. "OPE" and activates the desired alarms, if the relative parameters "ALni" have been programmed = yES.

### 6.2 - CLEANING

We recommend cleaning of the instrument with a slightly wet cloth using water and not abrasive cleaners or solvents which may damage the instrument.

### 6.3 - GUARANTEE AND REPAIRS

The instrument is under warranty against manufacturing flaws or faulty material, that are found within 12 months from delivery date. The guarantee is limited to repairs or to the replacement of the instrument. The eventual opening of the housing, the violation of the instrument or the improper use and installation of the product will bring about the immediate withdrawal of the warranty's effects. In the event of a faulty instrument, either within the period of warranty, or further to its expiry, please contact our sales department to obtain authorisation for sending the instrument to our company. The faulty product must be shipped to us with a detailed description of the faults found, without any fees or charge for us, except in the event of alternative agreements.

## 7 - TECHNICAL DATA

### 7.1 - ELECTRICAL DATA

Power supply: 12 VAC/VDC, 24 VAC/VDC, 100.. 240 VAC +/- 10%  
Frequency AC: 50/60 Hz  
Power consumption: 4 VA approx.  
Input/s: 1 input for temperature probes: tc J,K,S ; infrared sensors IRS J e K; RTD Pt 100 IEC; PTC KTY 81-121 (990 Ω @ 25 °C); NTC 103AT-2 (10KΩ @ 25 °C) or mV signals 0...50 mV, 0...60 mV, 12 ...60 mV or normalized signals 0/4...20 mA, 0..1 V, 0/1...5 V, 0/2...10 V.  
Normalized signals input impedance: 0/4...20 mA: 51 Ω; mV and V: 1 MΩ  
Output/s: Up to 2 outputs. Relay SPDT (8 A-AC1, 3 A-AC3 / 250 VAC) ; or in tension to drive SSR (8mA/ 8VDC).  
Auxiliary supply output: 10 VDC / 20 mA Max.  
Electrical life for relay outputs: 100000 operat.  
Installation category: II  
Measurement category: I  
Protection class against electric shock: Class II for Front panel  
Insulation: Reinforced insulation between the low voltage part (power supply 115 / 230 V and relay outputs) and front panel; Reinforced insulation between the low voltage section (Supply 115 / 230 V and relay outputs) and the extra low voltage section (input,

SSR outputs); Reinforced between power supply and relay; No insulation between supply 12 V and input. No insulation between input and SSR outputs.

## 7.2 - MECHANICAL DATA

**Housing:** Self-extinguishing plastic, UL 94 V0

**Dimensions:** 33 x 75 mm, depth 64 mm

**Weight:** 110 g approx.

**Mounting:** Flush in panel in 29 x 71 mm hole

**Connections:** 2,5 mm<sup>2</sup> screw terminals block

**Degree of front panel protection :** IP 65 mounted in panel with gasket

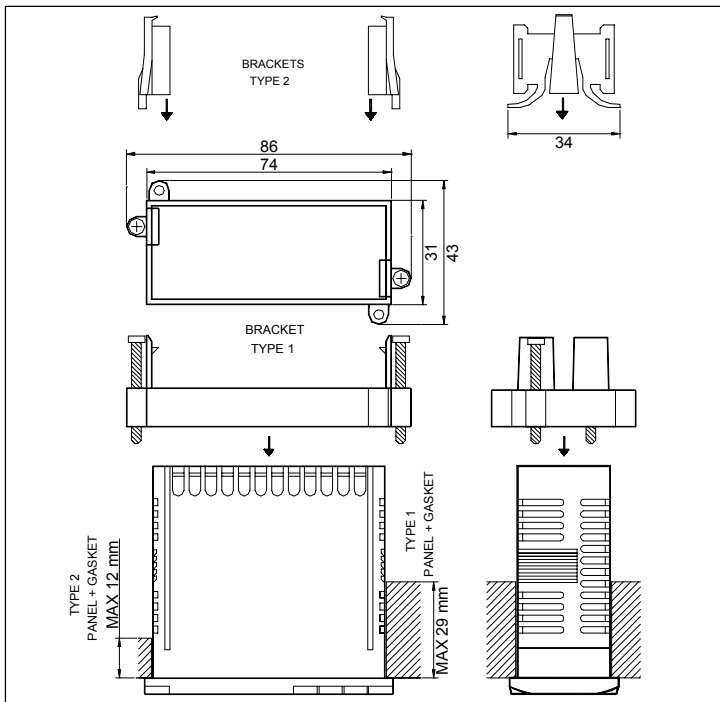
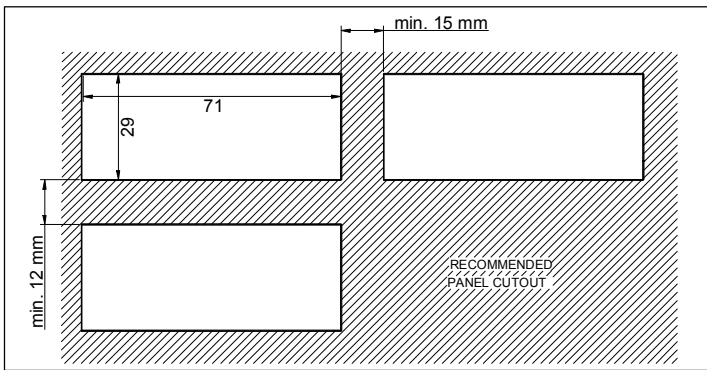
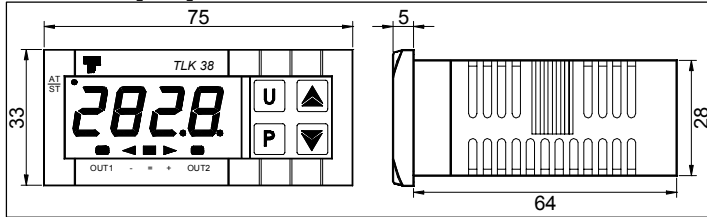
**Pollution situation:** 2

**Operating temperature:** 0 ... 50 °C

**Operating humidity:** 30 ... 95 RH% without condensation

**Storage temperature:** -10 ... +60 °C

## 7.3 - MECHANICAL DIMENSIONS, PANEL CUT-OUT AND MOUNTING [mm]



## 7.4 - FUNCTIONAL FEATURES

**Control:** ON/OFF, ON/OFF Neutral Zone, PID single Action, PID double action.

**Measurement range:** according to the used probe (see range table)

**Display resolution:** according to the probe used 1/0,1/0,01/0,001

**Overall accuracy:** +/- 0,5 % fs (tc S: +/- 1 % fs)

**Sampling rate:** 130 ms.

**Display:** 4 Digit Red h 12 mm

**Compliance:** ECC directive EMC 89/336 (EN 61326), ECC directive LV 73/23 and 93/68 (EN 61010-1)

**Approvals:** C-UL (file n. E206847)

## 7.5 - MEASURING RANGE TABLE

INPUT	"dP" = 0	"dP" = 1, 2, 3
tc J "SEnS" = J	0 ... 1000 °C 32 ... 1832 °F	----
tc K "SEnS" = CrAl	0 ... 1370 °C 32 ... 2498 °F	----
tc S "SEnS" = S	0 ... 1760 °C 32 ... 3200 °F	----
Pt100 (IEC) "SEnS" = Pt1	-200 ... 850 °C -328 ... 1562 °F	-199.9 ... 850.0 °C -199.9 ... 999.9 °F
PTC (KTY81-121) "SEnS" = Ptc	-55 ... 150 °C -67 ... 302 °F	-55.0 ... 150.0 °C -67.0 ... 302.0 °F
NTC (103-AT2) "SEnS" = ntc	-50 ... 110 °C -58 ... 230 °F	-50.0 ... 110.0 °C -58.0 ... 230.0 °F
0..20 mA "SEnS" = 0.20		
4..20 mA "SEnS" = 4.20		
0 ... 50 mV "SEnS" = 0.50		
0 ... 60 mV "SEnS" = 0.60		
12 ... 60 mV "SEnS" = 12.60	-1999 ... 9999	-199.9 ... 999.9 -19.99 ... 99.99 -1.999 ... 9.999
0 ... 1 V "SEnS" = 0.1		
0 ... 5 V "SEnS" = 0.5		
1 ... 5 V "SEnS" = 1.5		
0 ... 10 V "SEnS" = 0.10		
2 ... 10 V "SEnS" = 2.10		

## 7.6 - INSTRUMENT ORDERING CODE

TLK38 a b c d ee f

### a : POWER SUPPLY

F = 12 VAC/VDC

L = 24 VAC/VDC

H = 100... 240 VAC

### b : INPUT

C = thermocouples (J, K, S, I.R.), mV, thermoresistances (Pt100)

E = thermocouples (J, K, S, I.R.), mV, thermistors (PTC, NTC)

I = normalized signals 0/4..20 mA

V = normalized signals 0..1 V, 0/1..5 V, 0/2..10 V.

### c : OUTPUT OUT1

R = Relay

O = VDC for SSR

### d : OUTPUT OUT2

R = Relay

O = VDC for SSR

- = None

### ee: SPECIAL CODES

### f: SPECIAL VERSIONS

**PASSWORD = 381**