

SIX-CHANNEL CONTROLLER

TR604



USER'S GUIDE

RING INJENERING

IMPORTANT!

This document is designed for users of 'Ring Injenering' TR604 controllers. Read the document carefully before using TR604. Keep this document and the relevant ones, so you can use them at any time, if you need.

The wrong utilization of this device can result in serious trouble, damage or injury.

Due to the wide varieties of temperature controllers, you have to be sure, that this device is suitable for your application.

Company "Ring engineering" is not liable for indirect damage or damage caused by use of this device.

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1. GENERAL DESCRIPTION.

TR604 is 6-channel microprocessor-based controller for regulation of systems for heating / cooling. Its main characteristics are:

6-channels for control

The controller allows the operation of up to 6 independent loops.

Separate indication and keys for each channel

Can simultaneously monitor the values of the input parameter on the 6-channels of the regulator.

Ease of adjustment and configuration

The parameters adjustment is carried out by a hierarchy menu system. The parameters are saved in a non-volatile memory.

Universal switching power supply

Switching power supply has a wide input voltage range, making it protected from brief industrial disruptions.

Universal analog inputs

The Universal analog inputs of support TR604 6 thermocouple types, one type of thermistor and a voltage input. The type of input is set via the keyboard and does not require any change jumpers or other interventions. The analog inputs are galvanically isolated from the control part.

Two-position control with hysteresis

Each channel has an opportunity to work as a two-position controller with independent settings for the reference, type of input, etc.

PID Control Law

PID control law allows for a better control - zero error occurred while correct parameter setting. TR604 has a built-in PID controller settings for "fast" and "slow" objects.

Built-in timer for each channel (option)

For each zone there is a possibility to turn off the regulator after a certain time.

Processing of alarm events

The built-in alarm output (one for the six channels) responds when a failure event occurs in one of the channels. This allows for the TP604 to be used as an element for a sophisticated control system.

Built-in communication (option)

Models with RS232 or RS485 and RI485 protocol allows for connection to another controller of the company, and using a computer to set up and monitor the parameters of the controller.

These characteristics make it substantially a set of six single-channel regulators in a single housing and a single power supply but at a lower cost..

The regulator is suitable for applications requiring regulation of the three to six temperature zones, e. with injectors, blast-machines, molds, hot runner systems and others.

2. SAFETY PRECAUTIONS.

2.1 General information.

Ensuring a safe working equipment for men and machines is the most important task and responsibility of designers and contractors in the implementation of automation systems. Damage to the regulator could result in personal injury or destruction of equipment.

2.2 Guidelines.

TR604 is designed for use in industrial environments, but not in systems that can harm human health.

Upon installation, connection, maintenance and use TR604 is assumed that the user has basic concepts of industrial automation devices and their application. If TR604 is used incorrectly, it is possible to obtain electrical shock, injury or fire.

Refer to "Ring engineering" if you have any questions about this document.

2.3 Installation.

Mount TR604 and related equipment, according to the recommendations in this document. If the controller works on temperature, humidity, dust or gas environment than those specified in the technical characteristics, it is possible to obtain electrical shock, injury or fire.

Mount TR604 away from sources of static electricity (pipes to upload material). Otherwise could be obtained a failure or malfunction of the TR604.

Disconnect power before installation or disassembly of any block, module, panel or connector. Otherwise there is chance of electric shock or failure of TR604 and equipment connected to it.

Falling into the controller wires, screws or other metal pieces can cause damage or fire. Take appropriate precautions when installing and wiring.

Immediately disconnect from power source, if smoke or burning smell is coming out from controller. In such cases controller operation may cause fire or electric shock. The same may occur when an unauthorized person is attempting to repair it.

Do not use excessive force when securing the controller to the panel, in order not to break the the fixing elements.

Do not attempt to repair TR604 controller yourself. Contact 'Ring Injenering' for repair.

2.4 Wiring.

Turn off the power before wiring to prevent the risk of electric shock.

The work of the regulator without grounding may cause electric shock or damage. Connect the ground terminal of the regulator to the grounding network.

The computer that is connected to the regulator must be grounded.

Submission of a higher voltage to the regulator can cause a fire. Supply voltage to the controller only within the specified range in the document.

Wrong wiring may cause fire, failure or electric shock. Observe the national regulations for electric installations and grounding.

The thermocouples must be connected to the inputs with the corresponding compensating wires. The thermoresistances must be connected to the inputs with equal wires (the impedance of the line to be symmetrical).

The wires connected to the inputs must be separated from those that are connected to the outputs and the power supply in order to avoid the mutual influence.

Check that wires and connectors are properly and securely connected to the regulator. Poor contact may cause malfunction, damage or fire of the regulator and related equipment.

2.5 Working with the controller.

When replacing the fuse, turn off the power.

Fuse replacement should be done only with new of the same type and value.

Use the controller only as directed.

Do not try to change hardware or software of the controller. This can result in electric shock fire or damage.

2.6 Maintenance.

Turn the power off before disconnecting or replacing units, modules, connectors and wires. Otherwise, it is possible to obtain electrical shock or damage to the regulator and related equipment.

In case of replacement of modules, be especially careful to avoid wrong re wiring.

Replace blown fuses only with the same in value and type. Failure to observe this rule can lead to injury or fire in the regulator.

Perform necessary daily and periodic inspection and cleaning in order to maintain the system in normal working conditions and avoid unwanted problems.

Refer to "Ring Engineering" for repair in case of failure of the regulator. Company "Ring Engineering" does not guarantee correct operation and safety repair by unauthorized persons.

3. TECHNICAL SPECIFICATIONS.

3.1 Working conditions.

operating temperature	0 - 60 °C
relative humidity	0 - 70 % RH without condensation
protection level	IP54 of the front panel IP40 of the rest

3.2 Storage Conditions.

storage temperature	-20 - 80 °C
relative humidity	0 - 95 % RH without condensation

3.3 Dimensions.

dimensions (w, h, d)	96mm x 96mm x 177 mm
mounting hole	91 x 91 mm ±1 mm
installation	Panel with thickness of 1-3 mm

3.4 Power supply.

power supply	100 - 250 VAC
consumption	5 VA max

3.5 Analog inputs.

Type of input signal	Range	Selection code
Thermocouple E	0 – 800 °C	E
Thermocouple J	0 – 1000 °C	J
Thermocouple K	0 – 1000 °C	K
Thermocouple R	0 – 1000 °C	r
Thermocouple S	0 – 1000 °C	S
Thermocouple T	0 – 400 °C	t
Thermoresistance Pt100	-100 – 650 °C	Pt
Voltage	-50 +50 mV	U
Voltage or current	0 +50 mV or 0 – 20 mA	Ui
Current (with external resistor 2,5 Ω)	0(4) – 20 mA	i

Main error:	
- when measuring a thermocouple, RTD, voltage and current;	0,2 % ±1LSB
- when measuring the ambient temperature for cold junction compensation for thermocouples	±1°C max
Temperature error	0,01 %/ °C
Resistance of the source when measuring thermocouple and voltage (including wires)	50 Ω max

Resistance of the wires when measuring RTD	60 Ω max
Indication of sensor failure	Indicates an error
Time for measuring of the inputs	1,2 s
Digital filter on inputs	13 Hz
Resolution	12 bits
Isolation between the the inputs and the digital part	1500 VDC
Cold junction compensation	internal

3.6 Outputs.

Groups:

- for control outputs each output is a separate or in 2 groups of 3 outputs
- for alarm output independent relay with normally open contact

3.6.1 Control outputs of the zones.

NPN open-collector transistor	40mA / 30VDC
Relay with normally open contact	5A / 220VAC / 30VDC
Triac with zero-crossing	0,5A / 220VAC
Isolation between the outputs and the digital part	1500 VDC

3.6.2 Alarm output.

Relay	250 V AC or 30 V DC / 2A
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3.7 Control algorithm.

3.7.1 Two-position law.

Hysteresis	from 0 to 255 °C
Output control time	1 s
Operating modes	3

3.7.2 PID law.

Hysteresis	from 0 to 100 %
Output control time	1 s
Scan time	from 1 s to 255 s
Method of control of the output	PWM (resolution 10 ms, accuracy 1%)

3.8 Shut-down Timer after reaching set point (optional).

Time range	from 1 to 999 minutes
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3.9 Front panel.

At each channel there is an:

Indication	three digit 7-segment
Buttons	three buttons

LEDs:

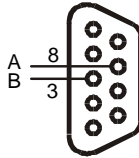
- | | |
|-------------|-------|
| - output | green |
| - alarm | red |
| - set point | green |

3.10 Serial interface (option).

3.10.1 RS485.

Protocol	RS485
Speed	9600 or 38400 B/s
Node number	1..31
Maximum line length	200 m
Method for access to the line	token similar
Maximum message length	32 bytes
Time for rotating of the token:	1,5s on 31 nodes and 9,6kB/s

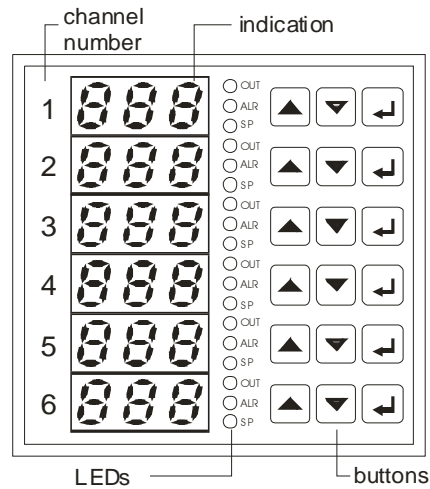
Location of the signals on the connector for RS485:



3.10.2 RS232.

Physical level	RS232C
Speed	9600 / 38400 bit/s
Maximum line length	15m
Node number	2
message format:	
- Start bit	1 bit
- data	8 bits
- parity	1 bit
- stop bit	1 bit

4. DESCRIPTION OF THE FRONT PANEL.



4.1 Indication.

Every channel has a three digit 7-segment LED display. Indicator flashes when setting parameter values.




4.2 LEDs.

Every channel has a three LEDs:

- OUT – green – lights when the output of the channel is ON;
- ALR – red – lights when the alarm for a channel is ON;
- SP – green – lights when set the reference.

4.3 Buttons.

Every channel has a three buttons:

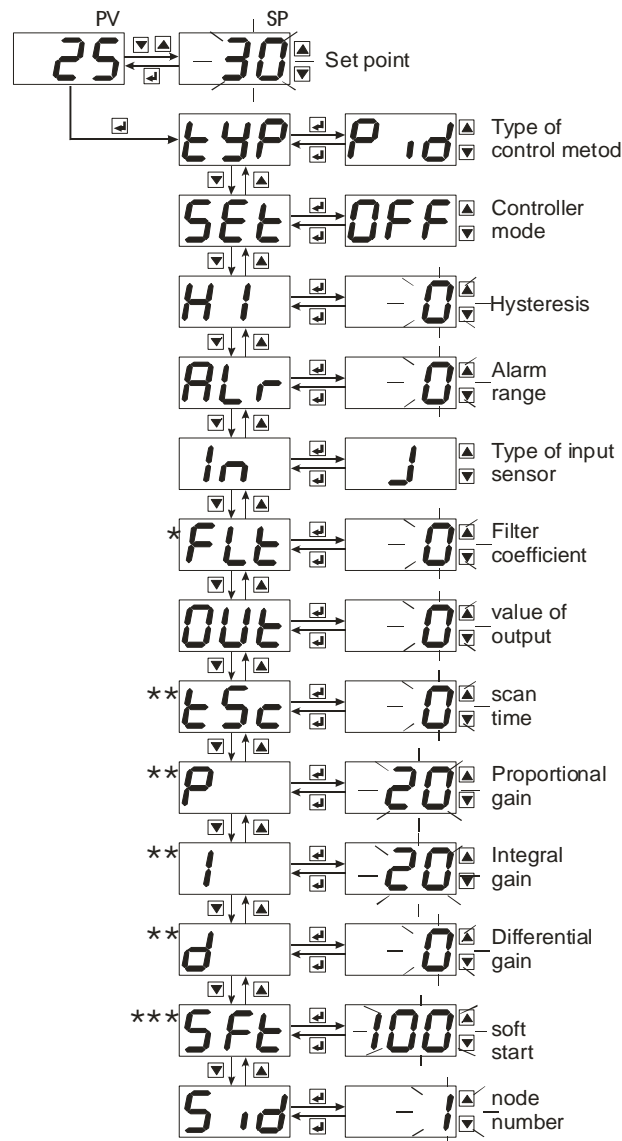
-  increases the value of the parameter or move to the previous parameter;
-  decreases the value of the parameter or move to the next parameter;
-  remembers the assigned value or goes to the menu options.

The channel indication goes back to the previous level without saving the changes introduced if a remember key is not pressed for more than 5 seconds in setting mode.

5. DESCRIPTION OF THE MENUS AND MODIFYING PARAMETERS.

Written here applies to all 6 channels individually.

5.1 Main menu.



* Valid only for Two-position control law

** Valid only for PID control law

*** Valid only for fast PID, slow PID or PID.

Normally the indicators show the value measured. The set point setting mode is immediately opened by means of the arrows with the corresponding diode lighting up. If a key is not kept pressed for more than 5 seconds, an upper indication level is reached without saving the change.

The values shown in the above scheme have been programmed by the factory.

5.2 Changing the set point of a zone.

Usual indicators show the measured value of the channel.

To change the assignment of a zone perform the following actions:

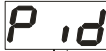
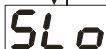
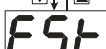


1. Press button up or down arrow (the screen displays set point) until obtaining desired temperature value. At the same time SP LED lights up.

2. Press the ENT, to remember the value. SP LED goes off and the display shows the measured value.

If you do not pressing a key for more than 5 seconds an upper indication level is reached without saving the change.




5.3 Changing the control law.

Each channel allows individual setting the type of regulation. The setting is made through the parameter *tYP*.

	PID control law
	slow PID control law
	fast PID control law
	two-position control law
	the output is OFF

5.4 Changing the mode of control.

Each channel allows individual setting of the regulation mode. The setting is made through the parameter *Set*.

	Automatic mode
	Manual mode
	Switched of

- **Automatic mode.**

Automatic mode is selected by setting the text **Aut** in parameter specifying mode **SEt**.

This is the basic mode of operation of the zone. On It is measuring the temperature of zone and is comparing with a reference value and is changing an output in order to maintain the set temperature. The Control of zone is done by PID (proportional integral derivative) or positional law. Setting the coefficients of the PID controller may be made by the user, but in TR604 are recorded standard settings, which provides optimal regulation in most cases. These settings are selected by setting type of zone **FSt** ("FAST" PID) or **Slo** ("slow" PID). For more details on PID regulation see p.8.2.

- **Manual mode.**

The manual mode is selected by setting the text **On** for controller mode.

- In case of PID law.

In this mode the output of the zone is switched -on for specified amount of scan time (in %, set by the parameter **Out**). The implementation of the manual mode is done with PWM (pulse width modulation). For example, if the scan time (parameter **tSc**) is 3 seconds, and the output percentage (parameter **Out**) is 60, then the output (heater respectively) is switched-on for 1.8 seconds and off for 1.2 seconds.

It should be emphasized that the inherently manual mode does not ensure maintenance of the temperature. He can not respond to disturbances (e.g. change of the supply voltage, load change, etc.).

- In case of two-position low.


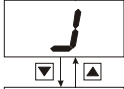
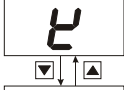
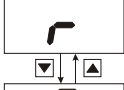

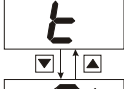

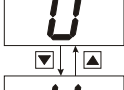
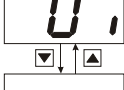

In this mode the output of the zone is always on.

- **Switched off.**

The mode is selected by setting the text **OFF** for controller mode. In this mode, the output of the zone is permanently switched off.

5.5 Changing the type of the input sensor.

Changing the type of input sensor is performed by menu **In**.

	Thermocouple type E
	Thermocouple type J
	Thermocouple type K
	Thermocouple type R
	Thermocouple type S
	Thermocouple type T
	RDT type Pt100
	Voltage -50+50 mV
	Voltage / current -050 mV / 020 mA
	Current 420 mA

6. TABLE WITH THE PARAMETERS.

Parameter	Indication	Function	Factory set	Range	Units
Set point	-	Sets the value for regulation	30	-99..999	°C
Type of regulation law	<i>tYP</i>	Sets the type of regulation law: <i>nO</i> – output is not controlled; <i>POS</i> – two-position control law; <i>FSt</i> – fast PID control law; <i>SLo</i> – slow PID control law; <i>Pid</i> - PID control law.	<i>SLo</i>	<i>nO</i> , <i>POS</i> , <i>FSt</i> <i>SLo</i> <i>Pid</i>	-
Control mode	<i>SEt</i>	Sets control mode. There are 3 possible modes: <i>OFF</i> - output is off; <i>On</i> – manual mode; <i>Aut</i> – automatic mode.	<i>OFF</i>	<i>OFF</i> , <i>On</i> , <i>Aut</i>	-
Hysteresis	<i>HI</i>	Sets the value of the hysteresis. When the value is 0 the hysteresis is excluded.	0	0.255 0.100	<i>POS</i> -°C <i>Pid</i> - %
Alarm range	<i>ALr</i>	Value of the alert limit. Set the maximum deviation of the measured value from the set point over which this channel causes fault indication. A value of 0 does not cause an accident .	0	0.255	°C
Type of input sensor	<i>In</i>	Sets the type of input sensor.	<i>J</i>	See tech spec	-
Filter*	<i>FLt</i>	Specifies the degree of smoothing of the input signal. At 0 - no smoothing at 999 - maximum smoothing.	0	0.999	-
Value of output	<i>OUt</i>	Sets the value of output in manual mode or monitor the value of output in automatic mode.	0	<i>POS</i> - 0..1 <i>PID</i> - 0..100	- %
Scan time**	<i>tSc</i>	Sets the interval in seconds during which calculates the value of output for PID regulation law.	10	1.255	sec
Proportional gain **	<i>P</i>	Sets the value of the proportional gain.	20	0.999	-
Integral gain **	<i>I</i>	Sets the value of the integral gain.	20	0.999	-
Differential gain **	<i>d</i>	Sets the value of the differential gain.	0	0.999	-
Soft start	<i>SFt</i>	Sets the maximum output until the temperature reaches 100 °C. A value of 100 will not limit the output, at a lower value heating to 100 °C will last longer.	100	0.100	%
Node number	<i>Sid</i>	Sets the number of node in the network RI485.	1	1..31	-

* The parameter is available only with set control law *nO* or *POS* (parameter *tYP*)

** The parameter is available only with set control law *Pid* (parameter *tYP*)

7. CHOICE OF CONTROL LAW.

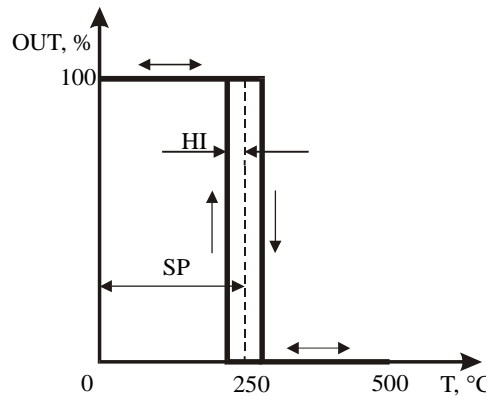
TR604 has programmed two types of regulators - two-position and PID.

Two-position control law is characterized by two states of control output - on or off. Output (OUT) is switched on, if the measured value (denoted below as PV) is less than the reference (denoted below as SP) - equation 1.

If $SP < PV$ then $OUT = 1$ (1)

If $SP > PV$ then $OUT = 0$

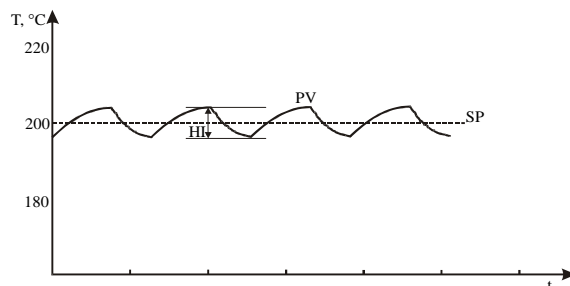
These are the equations of ideal controller. In a real two-position controller is entered another parameter - hysteresis. The hysteresis allows to reduce the switching frequency of the actuator. Transfer characteristic of this type of regulator is given in the figure below, and the equation - Equation 2.



If $|SP - PV| > HI$ and $SP - PV > 0$, then $OUT = 0$ (2)

If $|SP - PV| > HI$ and $SP - PV < 0$, then $OUT = 1$

The following figure is an example of PV depending the time. It can be seen that the two-position controller has a hesitation around set point as the absolute size of the deviation depends on the characteristics of the object and set hysteresis. In a subject without a pure delay magnitude of the deviation is equal to the hysteresis.



As an advantage of two-position regulator can include its simplicity and ease of tuning of control parameters - in practice must be assigned the appropriate value of the hysteresis. Disadvantage of a two position regulator is the presence of a static error, making it not applicable for certain purposes.

This disadvantage is avoided by PID control law. In this law output value is calculated as the result of sum of proportional, integral and a differential component. Equation of the PID algorithm applied in TR604 is:

$$\Delta k_n = P.(SP - PV_n) + I.(PV_{n-1} - PV_n) + d.(2PV_{n-1} - PV_{n-2} - PV_n)$$

$$k_n = k_{n-1} + \Delta k_n$$

k_{n-1} - output value in moment n-1

Δk_n - the change in value of the output at the moment n

P – integral gain

I – proportional gain

d – differential gain

PV, PV_{n-1}, PV_{n-2} - processing value at the moments n, n-1, n-2

In digital regulators value of the output is calculated once per specified time interval. The size of the interval is one of the setting parameters (**tSc**). The other three important parameters to set are **P, I и d**.

In PID algorithm the output is controlled by a PWM (pulse width modulation). This means that the output is turned on for a certain percentage from the time set as the period of regulation (also called the scan time). For example, if the period of scanning (parameter **tSc**) is 10 sec and output (parameter **Out**) is set to 60%, then the output will be turned on for 6 sec and off for 4 sec.

Advantage of the PID control law is zero error in steady-state, and the ability to respond quickly to disturbances. Disadvantage is a more difficult setting.

8. SETTING PARAMETERS OF THE CONTROLLER.

8.1 For two-position controller.

To adjust the two-position controller must be set the following parameters:

- Type of control (menu **tYP**) - Set to **POS**.
- Control mode (menu **SEt**) - Set to **Aut**.
- Type of input sensor (menu **In**) - Sets the type of sensor that measures the regulated value. Possible types are given in the section Parameter setting.
- Set point - adjust the required set point.

The following parameters are optional:

- Hysteresis (menu **Hl**) - Sets hysteresis. Normal value of this field is 0. In a subject with a little delay (not inert object) however can occur very frequently switching of output. Then it is recommended for this parameter be entered a value other than 0.
- Alert Limit (menu **Air**) - sets the value of the alert limit (see section Faults and errors). Normally, this parameter is 0. User sets it if he wishes to obtain an indication for exit of the regulated value outside limits.

8.2 For PID regulator.

When tuning PID controller must be entered the following parameters:

- Type of control (menu tYP) - set to Pid.
- Control mode (menu SEt) - Sets Aut.
- Type of input sensor (menu **In**) - Sets the type of sensor that measures the regulated value. Possible types are given in the section Parameter setting.
- scan time (**tSc**) - specifies the time interval in sec, during which recalculates value of the output rate. The choice depends on the value of the pure delay of the object (i.e., the interval of time from supply output pulse to change the controlled variable). In larger delay value of this parameter must be greater. For the majority of objects the value of this parameter is from 5 to 25.
- Proportional gain (menu **P**) - sets the value of the proportional component. Its choice is made depending on the characteristics of the object. For the majority of the objects the value of this parameter is from 10 to 100.
- Integral gain (menu **I**)- sets the value of the integral component. Its choice is made depending on the characteristics of the object. For the majority of the objects the value of this parameter is from 10 to 100.
- Differential gain (menu **d**)- sets the value of the differential component. Its choice is made depending on the characteristics of the object. For the majority of the objects the value of this parameter is 0.
- Set point - adjust the required set point.

The following parameters are optional:

- Hysteresis (menu **Hl**) - Sets hysteresis. Normal value of this field is 0. In a subject with a little delay (not inert object) however can occur very frequently switching of output. Then it is recommended for this parameter be entered a value other than 0. In case of PID control law hysteresis is set in% (0 to 100).

The factory programmed values of coefficient. **P**, **I**, **d**, and the timing of the scan (**tSc**) do a job for a large percentage of the objects for the regulation of temperature. For convenience, the device has a built-in presets for the parameters of PID controller etc. "Fast" and "slow" object. They are selected by setting the parameter

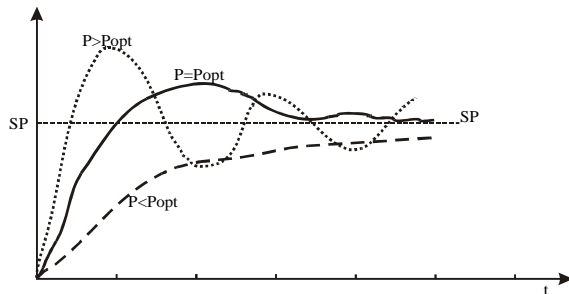
tYP in **FSt** (for fast object) or **SLo** (for slow object). Fast is an object that within a short time after switching on the heat, its temperature increases (e.g., arrays of nozzles of thermal gating system). Slow is an object, of which its temperature does not change more than 15 seconds after switch on of the heater. This type are the areas of screw of sprits.

When selecting one of these modes (**FSt** or **SLo**), the coefficients of the PID parameters are automatically set with values that allow optimal management of such objects:

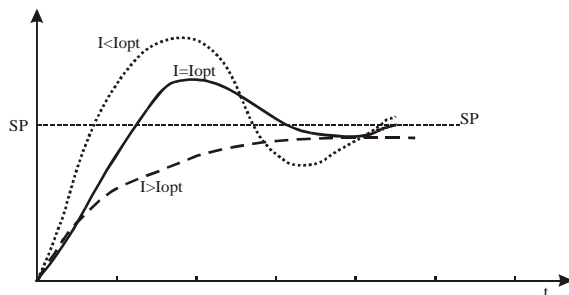
Parameter	FSt	SLo
tSc – scan time, sec.	3	20
P – Proportional gain	2	2
I – Integral gain	0.2	0.2
d – Differential gain	0	0

If it appears that these settings do not lead to accurate and stable maintaining the setting temperature, it is necessary to manually change the parameters of PID controller using the following graphs.

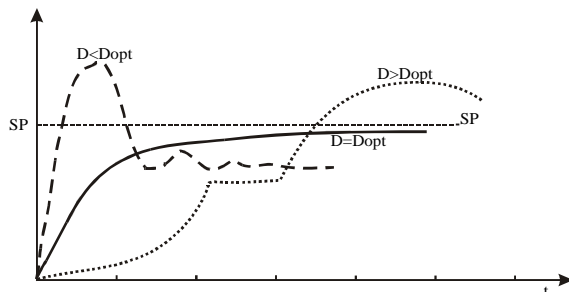
for proportional gain



for integral gain



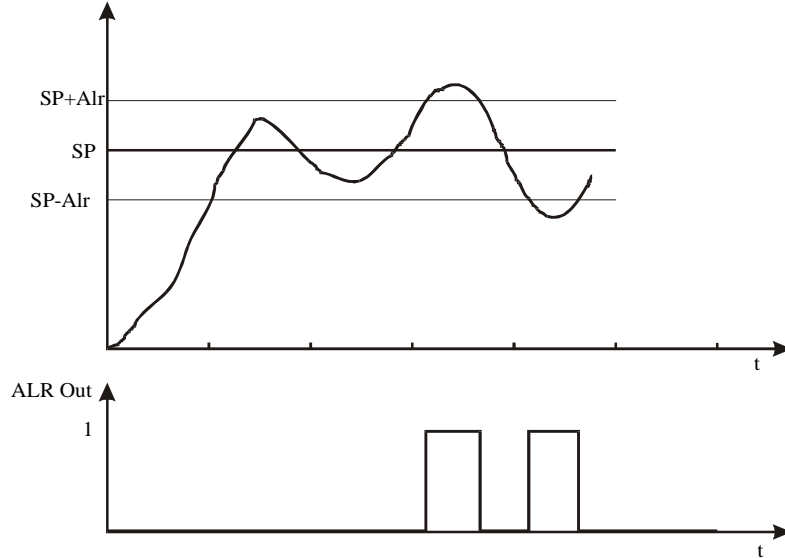
for differential gain



Time of scanning (menu **tSc**) is set equal to the time taken from the switch on of the heating to change the temperature by 1 degree (for e.g. reference equal to 100 C)°.

8.3 Emergency limits.

The parameter alarm limit (menu **Alr**) is set if the user wishes to display the exit of the regulated value beyond certain limits. Factory this parameter is 0. Alarm is not issued until the regulated value does not enter at least once in the specified range. The effect of this parameter is shown below:



8.4 Communication.

In the version of the TR604 with communication should be set parameter unit number (menu **Sid**) - sets the number of RI485 communication node. Node number must be a number from 1 to 31, as specified number must not be repeated with the number of other devices in the network.

9. ADVANCED FEATURES OF TR604.

Besides the main function associated with autonomous temperature control, TR604 has additional opportunities.

9.1 Communication.

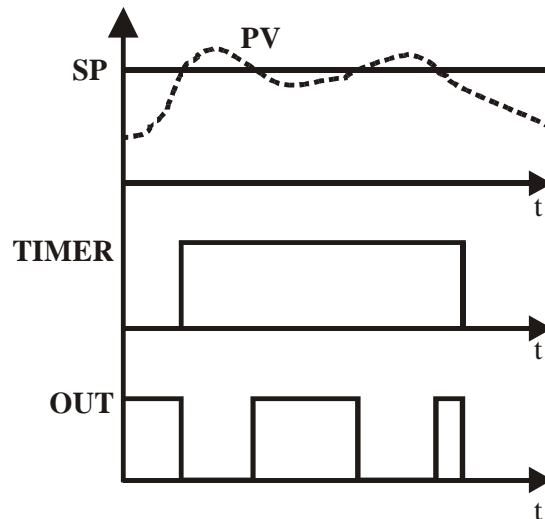
TR604 supports communication protocols for connecting multiple devices to a network. In the current version of the software supports the RI485.

On the rear panel of the device is displayed the connector Canon 9 (see 12.1.5). Connecting multiple devices in the network going through this connector.

RI485 communication allows connection to a computer for monitoring and storing of temperatures.

9.2 Off Timer after reaching reference.

For each zone there is a possibility to turn off the controller after a certain time. The parameter is named **tOF**. Through this is setting the time in minutes (1 to 999) since reaching reference till switching off of the regulator (switch to mode **OFF**). To switch back to automatic mode the parameter **SEt** must be made **Aut**. The timer does not work if it is set to 0. The graphic below shows the action of the timer.



10. INITIAL STARTUP OF THE DEVICE.

10.1 Installation.

TR604 device is attached to a flat, stable surface without vibration, away from heat, dust and static (operating conditions are described in the technical data) with a free space for air circulation around the box.

10.2 Connecting the cables and power on.

Before switching power supply of the device, it is necessary to connect the cables to temperature sensors, heaters and power source.

For signals to temperature sensors must be used short wires. Thermocouples can be connected directly or through appropriate extension wires. Signals distribution on the connectors is given in the chapter of electrical connection.

The device is powered through 3-wire system-230VAC and grounding. Check compliance of supply voltage before you join power cables.

After powering the device TR604, light up all segments of LED and display segments for about 3 seconds. During this time, you can check the condition of the LED and segments. Factory is set the zones to be in stop for initial power up to not go the heating before were performed the necessary adjustments by the user.

10.3 Initial settings of zones.

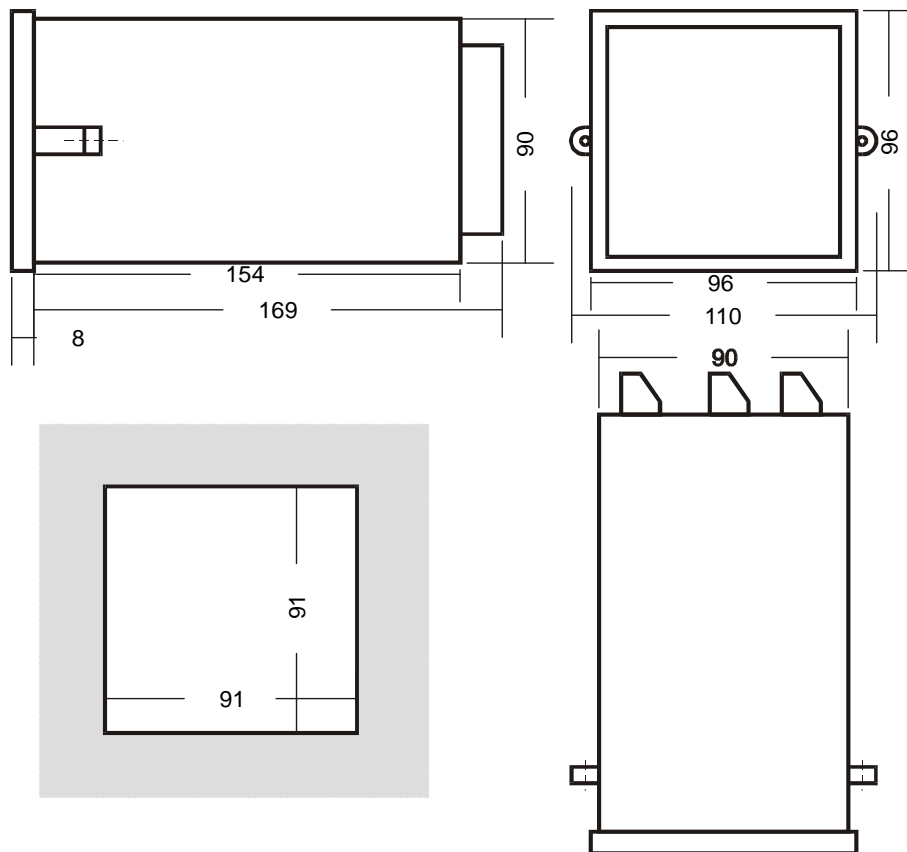
Review the default settings of the parameters in the respective tables. Check signalling of the device for the absence of Thermal sensor-on the LED display shows the measured temperature or **nC** in the absence of sensor. For the initial start of the heating (if existance of Thermal sensor) is usually enough to set the type of temperature sensors, modes and set-points.

10.4 Setting the basic parameters.

Factory settings of the device TR604 are such as to ensure performance in a high percentage of cases. However, the consumer before the first start as a minimum, must set the following parameters:

- *Type of input sensors.* Default is selected thermocouple type J. If your sensors are another type, you must specify in the menu **In** the true value (see 5.5).
- *Regime of zones.* Default all zones are in the mode OFF. It is possible to set a different mode of zones who will work (see section5.4).
- *Type of the regulator.* Factory is set type SLo - PID algorithm with settings for "slow" object. If you use two-position controller or have experience with PID controller, you can change this setting (see section5.3).

11. MECHANICAL DIMENSIONS AND INSTALLATION.

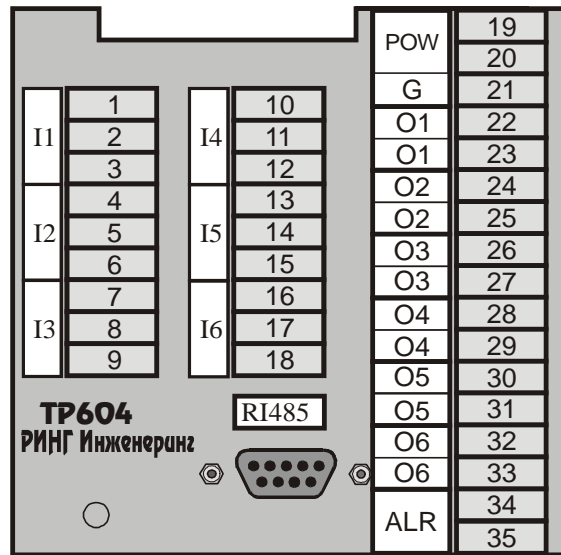


The permissible thickness of the panel for mounting is from 1 to 3 mm.

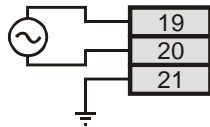
12. ELECTRICAL CONNECTION.

12.1 Version TR604.

The pin assignments of the connectors on the rear panel:

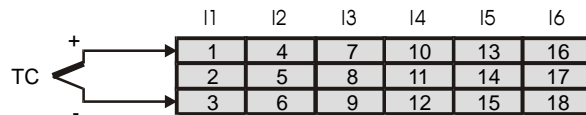


12.1.1 Power supply.

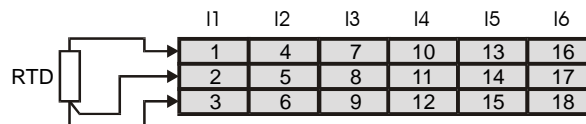


12.1.2 Analog inputs.

termocouple

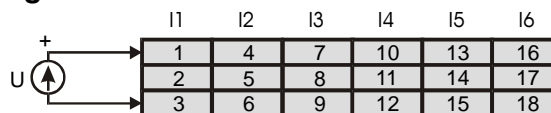


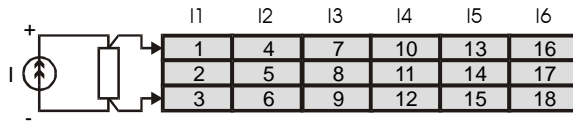
termoresistance



Thermoresistance is connected via a three-wire line with software compensation of line resistance.

voltage and current

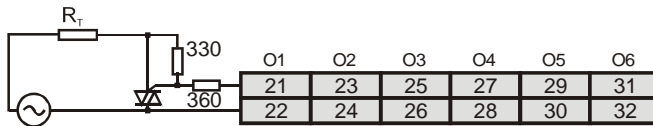




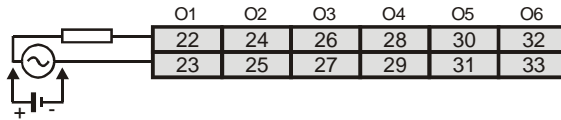
To measure the current 0(4)-20mA is necessary to add an external resistor with a value 2,5 Ω .

12.1.3 Control outputs.

triac

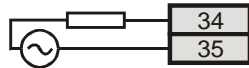


relay or transistor



The outputs are divided into six groups, unrelated to each other.

12.1.4 Alarm output.

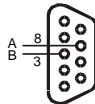


The alarm output is a relay with an independent normally open contact.

12.1.5 Serial interface.

There are two versions of the physical layer:

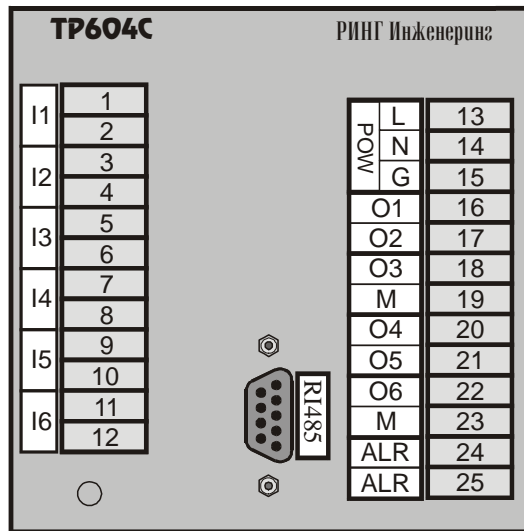
- RS232 standard serial interface, while TR604 using only signals TXD, RXD and DTR
- RS485 - signals distribution is given in the following diagram:



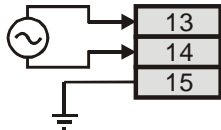
Both versions use the company network protocol RI485, which lets you connect up to 31 devices at a rate of 9600 or 38400 b/s.

12.2 Version TR604S.

The pin assignments of the connectors on the rear panel:

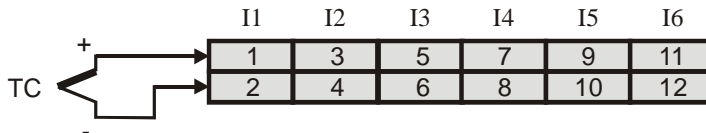


12.2.1 Power supply.

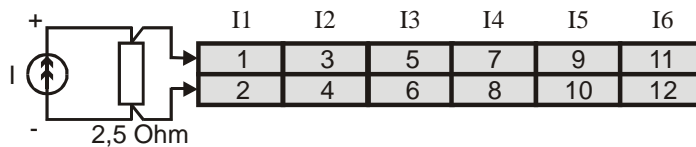
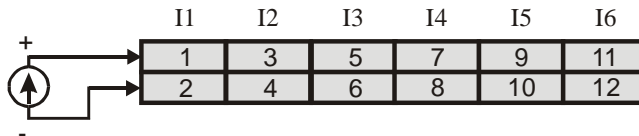


12.2.2 Analog inputs.

termocouple



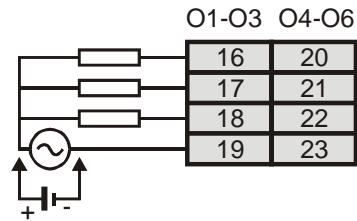
voltage and current



To measure the current 0(4)-20mA is necessary to add an external resistor with a value 2,5 Ω .

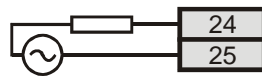
12.2.3 Control outputs.

Outputs can be *relay or transistor*.



The outputs are divided into two groups, unrelated to each other.

12.2.4 Alarm output.

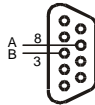


The alarm output is a relay with an independent normally open contact.

12.2.5 Serial interface.

There are two versions of the physical layer:

- RS232 standard serial interface, while TR604 using only signals TXD, RXD and DTR
- RS485 - signals distribution is given in the following diagram:



- Both versions use the company network protocol RI485, which lets you connect up to 31 devices at a rate of 9600 or 38400 b/s.

13. ALARMS.

– *Description.*

An alarm is obtained in case of emergency. For individual channels the possible emergencies are:

- when the measured value differs from reference more than the alarm parameter;
- when disconnected sensor;
- when the measured value, comes out of the range of the input.

Upon the occurrence of such situations lit diode **ALR** of the channel and on the indicator error message appears. If for the parameter is set **ALr** number other than 0, it turns the alarm relay.






For the entire TR604 the possible emergencies are:

- false measurements of inputs;
- memory error.

Upon the occurrence of these two situations turns alarm relay and error message appears on all channels.

- *Indication in case of accident.*

Upon detection of a malfunction, instead of the measured value on the display indicates any error messages:

	the measured value is less than the range
	the measured value is greater than the range
	missing sensor or disconnected sensor
	measurement error or malfunction of the measuring part
	memory error

Upon receipt of the last two errors, the power of the regulator must be turned on and off. If the error occurs again, the controller must be sent for repair.

If the fuse of the unit is fine and have a voltage, and on the front panel is not lit any indication, it is an internal problem and must contact the service for repair.

14. ORDER NUMBER.

We offer two versions of the regulator in various locations of the pins of the connectors on the rear panel.

14.1 Version TR604.

For variant TR604 (with Pt100 and individual terminals for all outputs) code request is composed as follows:

TR604 I P
 1 2 3 4

1. Output:
 - D - NPN transistor;
 - R - relay;
 - A - triac.
3. Communication.
 - C - RS232;
 - M - RS485;
 - N – no communication.

Example:

TR604 DINP - regulator with transistor outputs without communication.

14.2 Version TR604S.

For variant TR604S (no Pt100 and triac output and has a simplified wiring on the rear panel) code request is composed as follows:

TR604S I P
 1 2 3 4

1. Output:
 - D - NPN transistor;
 - R - relay.
3. Communication.
 - C - RS232;
 - M - RS485;
 - N – no communication.

Example:

TR604S DINP - regulator with transistor outputs without communication.