TENSOMETRIC COMPARATOR

Type TENZ 2174D

CE

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1. General description of the tensometric comparator

The tensometric comparator TENZ2174 is a digital electronic device that converts signals from a tensometric bridge (sensor) on numerical data that are displayed on a 4-digit LED display. Measurement of the tensometric signals is performed by means of the 16-bit AD converter. The measured value is processed in the control microprocessor in dependence upon two calibration constants that have been obtained by calibration measurement.

The comparator includes two output relays, one with adjustable values for turning on/off and the other one in a function of a fault relay. Two outputs separated in a galvanic way allow device blocking when the last measured value remains on the display and value resetting when the currently measured value is assigned to zero value. All parameters are stored in the memory of the device and their adjustment can be performed using four pushbuttons.

The comparator is powered with direct current voltage of 24V. Control voltage supply is not protected with a fuse. The comparator is installed in a plastic box intended for installation on the strip DIN35.

2. Technical description of the tensometric comparator

Power supply voltage is to be connected to the terminals marked as **24V** and **GND.** The feeding circuits include a protection against power supply converting, over-voltage protection and an impulse stabilized supply. These elements provide an increased resistance of the device in industrial environment.

The tensometric sensor is connected through four wires marked as **+I** and **-I** for converter power supply and **+U** and **-U** for sensor output voltage. The power supply of the 5V sensor includes two resistors with a default value of 10Ω. Therefore, the

strain gauge voltage is lower. For common strain gauge bridges, its value is 4.75V. The gain of the measured signal from the sensor can be set using the **GAIN** parameter to 1, 2, 4, 8 or 16. These values correspond to the voltage inputs on the ± U terminals: 160, 80, 40, 20 or 10mV.

Further adjustment of the measured signal takes place at the numerical calculation in the microprocessor according to the formula: **Y = A.X + B**

where Y is the resulting value on the display

X is the measured value

A is a multiplication constant

B is an additive constant

Constants A and B are the calibration values obtained in the calibration measurement, the procedure of which will be described in a separate chapter.

The resulting value is displayed by means of four-digit seven-segment display with the height of characters of 14 mm that is complemented with the measured signal polarity sign. Measurement takes place in a bipolar range with the maximum values from –32767 to 32767 bits. The maximum range of displaying is between –9999 and 9999. When **exceeding the displayable range**, "nnnn" is shown on the display. When **exceeding the minimum value** of the AD converter, "LLLL" is shown on the display and when **exceeding the maximum value** of the AD converter, "HHHH" is shown on the display. It is also possible to set activation of any of four decimal points in the parameters.

The device has two **output relays**, which are used in the comparator function - they switch on a signal greater than the set point value and drop off at a signal less than the set value of the waste. A switching contact of each relay is available on the output terminals.

Two **logic inputs** with the voltage level of 24V are separated from other circuits of the device in a galvanic way. The first input (+In1 and –In1 terminals) is intended for device status **blocking**. In case of activation of this input, the last displayed value is retained on the display and the output relays will also remain in

the last status. The other input (+In2 and –In2 terminals) is intended for setting the **zero measured values**. By supplying impulse to this input, the current measured value is assigned to the zero value and zero is displayed on the display for this value.

All constants and parameters are stored in the EEPROM **memory** that retains the data even if power supply is turned off.

3. Operation of the tensometric comparator

After turning power supply on, "**2174**" is displayed on the display which specifies the type number of the device. If an error of parameter reading from the EEPROM memory is detected during device initialization, "**EEPr**" will be displayed for a short period. In such case, it is advisable to verify the parameter values. Then the device is converted in the standard measuring mode. A current measured value is displayed on the display. The parameter zero value is used from the last setting of zero value. If automatic setting of the zero value is required upon device turning on, it is necessary to interconnect the **TR** bridge with the neutral wire on a printed-circuit board.

Four pushbuttons marked with "**Menu**" , "**Set**" and down and up arrows are intended for **monitoring** and **setting parameters**. The principle of control follows the rules listed below:

a) Access in the parameter menu – "Menu" or "Set" pushbutton depressing for the period exceeding 10 s

b) Parameter list browsing – "Menu" pushbutton short depressing

c) Access to parameter value – "Set" pushbutton short depressing

d) Unit positive value change – "Up arrow" pushbutton short depressing

e) A bigger positive value change – "Up arrow" pushbutton long depressing

f) Unit negative value change – “Down arrow” pushbutton short depressing

g) A bigger negative value change – “Down arrow” pushbutton short depressing

h) Parameter browsing/modification termination – “Menu“ depressing for the period exceeding 5 s

i) Parameter storage – “Menu“ depressing shorter than 5 seconds

Value resetting can be carried out by simultaneous depressing the “Menu“ and “Set“ pushbuttons for the period exceeding 10 seconds. “**teSt**“ is displayed on the display during this period. After elapsing the testing period, “**tArA**“ is displayed and the resetting process including storage of the new value in the memory takes place.

The **basic parameters** are accessible after depressing the “**Menu**“ pushbutton for the period exceeding 5 seconds. The following parameters can be set gradually:

a) “**dELA**“: time constant of relay load delay

b) “**rE1P**“: if this value is exceeded, the relay 1 closes

c) “**rE1o**“: if a drop below this value occurs, the relay 1 opens

d) “**rE2P**“: if this value is exceeded, the relay 2 closes

e) “**rE2o**“: if a drop below this value occurs, the relay 2 opens

f) “**dESt**“: decimal point

g) „**tArA**“: enable tare after power is turned on

h) “**PASS**“: password for access to calibration constants

The value of the time delay of the relay load (**“dELA“)** can be set in seconds from 0 to 255. At value 0, the relay switches immediately after the switching value is exceeded, otherwise it switches only after the set time constant, which is common to both relays. In order for the relay to be switched on, the measured value must be greater than the set relay switching value for the entire time limit.

The values for **relay closing** and **opening** can be set in the range from 0 to 9999. The opening value must be lower than the closing one.

The value of the **decimal point** ranges between 0 and 4. If it equals to 0, no decimal point is displayed. If you require displaying with one decimal position, then it is necessary to set the decimal point to 2.

The **tare** of the measured value when the supply voltage is switched on is activated by "on" and deactivated by "oFF".

The **password** protects the access to the calibration constants. Protection of the calibration constants from unauthorized interventions is the purpose of the password. I you set the password value to 123, then the access to calibration is allowed, in case of any other value of the number, the access is denied. Procedure of parameter setting should be performed according to the following steps: select the required parameter by gradual depressing the “Menu” pushbutton. Then depress the “Set” pushbutton and the current value of the selected parameter will be displayed. Set a new value using short or long activations of the arrow pushbuttons. Then depress the “Menu“ pushbutton for the period exceeding 1 second. “**----**” will start flashing on the display. If you release the “Menu” pushbutton within 5 seconds, the new value is stored in the memory which is indicated by “**SAUE**“ displaying. If you hold the pushbutton depressed for the period exceeding 5 seconds, the new value is not stored and the name of the next parameter is displayed. After displaying the last parameter, the device is switched over in the standard measuring mode.

The **calibration parameters** are accessible after 5-second depressing the “Set” pushbutton if the password is set correctly. Otherwise, “**PASS**“ is displayed and standard measuring continues. The following parameters can be changed:

i) „**GAIn**“: means the value of the gain of the measured signal

j) “**CALL**“: calibration measurement lower value

k) “**CALH**“: calibration measurement upper value

The "**GAIN**" value allows you to set gains for values 1, 2, 4, 8 and 16. This gain must be set before calibration of the device. Its value depends on the parameters of the connected strain gauge and should be set by the manufacturer. Gain values correspond to input voltage ranges at ± U: 160 (Gain = 1), 80, 40, 20, or 10mV (Gain = 16).

When changing the type of sensor or otherwise changing the gain, the following procedure must be followed:

We first calculate **the gain value** according to the formula:

G = (32 . JH) / (32768 . CS)

where **G** is the gain value

JH is the nominal value (ie the required reading on the display without any decimal point at nominal load of the sensor).

CS is sensor sensitivity (for foil strain gauges, most often 2mV / V and for semiconductor strain gauges, most often 5mV / mA.

Example: *We have a strain gauge with a sensitivity of 2mV / V and at nominal load (100% load), we want to display 5000 on the display. G = (32.5000) / (32768.2) = 2.44. We set the next higher value in the device, ie 4. We can check the correctness of the calculation in the following way: Press any button before switching on power. The display shows "AdHo" when the power is turned on and, once the button is released, measurements are taken directly displaying the measured values as they are read by the AD converter without additional numerical calculations and without tare. We apply the strain gauge to the nominal value and the display should show the value: ZH = JH. G / 2.44 = 5000. 4 / 2.44 = 8197.*

We can also calibrate the device by setting two measured values. The first value should be best in the vicinity of the zero load, the second value around the nominal load of the sensor.

We set the "**CALL**" parameter. Use the "Set" button to access the value of this parameter, and set the display value to display for zero load. In most cases, this value will be zero. The procedure for storing the value in memory is different from the normal procedure used for setting the parameters. When the "Menu" button is pressed, the set value flashes. After the button is

released, the current value used to calculate new calibration constants is measured and all data stored in the memory. This is indicated by the "SAUE" on the display.

The device then switches to the next parameter "**CALH**". For the "CALH" parameter, the adjustment procedure is similar, with the sensor weighing the nominal value of the measured signal. For both calibration parameters, new calibration constants are always calculated, including their storage.

If you need to perform **measuring without calibration calculation**, depress one of the pushbuttons at power supply turning on. “AdHo“ value will be displayed and measuring with direct displaying of the measured values takes place after pushbutton releasing.

4. Technical specification

Power supply:	24V DC
Current consumption:	max. 60mA
Relay output contact:	max. 60VDC/125VAC/ 1A
Displaying range:	-9999 up to 9999
Box dimensions:	70 x 90 x 65 mm (w x h x d)
Device protection:	IP20
Tensometer power supply:	5V
Operational temperature:	5 to 40 °C

Service and production:

http://www.aterm.cz

Obr.1: Comparator TENZ2174T in the box DIN35

Box assembly and connecting terminal