

## User instruction

# AR911



## Setter - analog signal measuring device

*Thank you for choosing our product.*

*This instruction is intended to facilitate correct operation, safe use, and taking full advantage of the setter's functionalities.*

*Before you start the device, please read and understand this instruction.*

*In the event of any additional questions, please contact our technical adviser.*

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Please pay particular attention to the text marked with this sign.

The manufacturer reserves the right to make changes to the design and the programming of the device without any deterioration of the technical parameters.

## 1. PRINCIPLES OF SAFE USE



- before you start to use the device, become familiar with the present instructions;
- make sure that all wires are connected properly to the tested item;
- wire connections must be modified only with voltage switched off; ensure proper operating conditions compliant with the technical specification of the device (signal level, humidity, temperature, etc.; see chapter 4);


The device is designed so as to ensure an appropriate level of immunity to most interferences that may occur in industrial environments. In environments of unknown level of interferences, it is recommended to implement the following measures so as to prevent potential interference with the operation of the device:

- avoid running signal cables in the direct vicinity of and parallel to power and supply cables;
- it is recommended to use twisted pair signal cables;
- avoid proximity of remotely controlled devices, electromagnetic meters, high power loads, loads with phase or group power control, and other devices that cause high impulse disturbances;
- use shielded signal cables, whereby the earthing of the shield should be single-point and located as close to the device as possible;
- ground or zero metal rails on which rail-mounted devices are installed.

Make sure to remove the protective film from the LCD display before the first use of the device.

## 2. GENERAL CHARACTERISTICS OF THE SETTER

- the device is intended for setting or measuring standard current and voltage signals;
- analog output/input (setter or measuring device):
  - current  $0/4\div 20$  mA (active output, may not be supplied in a two-wire current loop)
  - current  $4\div 20$  mA (passive) for 2-wire current loop
  - voltage  $0/2\div 10$  V
- the output enables controlling or testing of equipment with current or voltage inputs (proportional valves, actuators, inverters, motors, etc.)
- the ability to test 2-wire current loop  $4\div 20$  mA
- soft start/stop (ramping) or triangular wave generator released and stopped manually
- programmable configuration parameters (range of indication, range and increment of output signal changes, soft start/stop options, time of automatic activation of the instrument, zero calibration, and amplification of the measured or set signal, etc.)
- quick and simple readout of the real value of the output or measured signal (mA, V, or calculated as programmable indication range), type of set signal, operating direction;
- diagnostic messages presented on the display that facilitate detection of defects in the tested system, e.g. short circuits in the voltage signal circuit, breaks in the current loop circuit
- possible password protection of access to configuration parameters
- ergonomic manual enclosure with rubberized side grips
- simple and reliable laboratory banana connectors
- a clearly visible LCD display (without background illumination) and a functional keyboard
- power supply from two AA (R6) (rechargeable) batteries
- automatic shutdown after a preset idle time
- integrated battery charging system (power supply provided)
- automatic power supply cutoff at low battery charging level
- high resistance to interferences present in industrial environments
- available accessories - power supply for battery charging

**NOTE:**  Before you start working with the setter, make sure to become familiar with this operating instruction and perform correct configuration of the parameters and make electrical connections.

### 3. CONTENTS OF THE SET

- setter with batteries, power supply for battery charging, measuring wires, case, operating instructions, a warranty card.

### 4. TECHNICAL DATA

|   |                          |  |
|---|--------------------------|--|
| <b>Number of analog inputs/outputs</b>  |                          | 1/1 (operation modes - setting or measurement)   |
| current signal<br>0/4÷20 mA - note (1)<br><b>active</b> output 1-3<br>input 1-2 | full range of changes    | 3,8÷21 mA / 0÷21 mA / 21÷3.8 mA / 21÷0 mA  |
|   | load resistance          | $R_0 \leq 500 \Omega$ (output), $R_0 = 65 \Omega$ (input)  |
|   | resolution               | 2 $\mu$ A (maximum programmable),<br>10 $\mu$ A standard (for the scale expressed in [mA])                 |
| current signal<br>4÷20mA<br><b>passive</b> output 2-4                           | full range of changes    | 3,8÷21 mA  |
|   | supply, load resistance  | $U_{sup} = 5,0 \div 40Vdc$ , $R_0 \leq (U_{sup}-5V)/21mA \leq 1500 \Omega$                                 |
|   | resolution               | 2 $\mu$ A (maximum programmable),<br>10 $\mu$ A standard (for the scale expressed in [mA])                 |
| voltage signal<br>0/2÷10V<br>output 1-3<br>input 1-2                            | full range of changes    | 0÷10,5V / 1,9÷10,5V / 10,5÷0V / 10,5÷1,9V  |
|   | load resistance          | $R_0 > 2.7 k\Omega$ (output), $R_0 > 100 k\Omega$ (input)  |
|   | resolution               | 1 mV (maximum programmable),<br>10 mV standard (for the scale expressed in [V])                            |
| 2-wire transducer test  | full range of changes    | 3,8÷21 mA  |
|   | supply for transducer    | <11Vdc   |
| <b>Processing errors :</b>  |                          |  |
| basic (at ambient temperature of 25 °C)   |                          | 0.15 % (output), 0.2% (input) for the full signal variability range $\pm 1$ digit                          |
| additional from ambient temperature changes                                     |                          | < 0.005% of the input range /°C  |
| <b>Output/input response time</b> (10-90%)                                      |                          | 0.36 s (output), 0.32 ÷ 1.3 s<br>(input, programmable with parameter 6: <b>FILE</b> )                      |
| <b>7-segment LCD display</b><br>(without backlight)                             | number of digits, height | 4, 10 mm   |
|   | range of indications     | -1999 ÷ 9999 (maximum programmable),<br>0.00÷21.00 mA or 0.00÷10.50 V standard                             |
| <b>Power supply</b> batteries (rechargeable batteries) - note (2)               |                          | 2 x 1.5 V (2 x 1.2 V NiMH, 2,000 mAh), type AA (R6)  |
| <b>Charging</b> - note (3)  |                          | current < 500 mA, time < 320 min., micro USB socket  |
| <b>Operation time</b> (2,000 mAh batteries) - note (4)                          |                          | 9÷400 hours, depend on the operation mode and load   |
| <b>Rated operating conditions</b>   |                          | 0 ÷ 50 °C, <90% RH (no condensation)   |
| <b>Operating environment</b>  |                          | air and neutral gases  |
| <b>Protection rating</b>  |                          | IP43 (IP20 on the connection side)   |
| <b>Weight</b> (with batteries, without charging power supply)                   |                          | approx. 230 g  |
| <b>Electromagnetic compatibility (EMC)</b>                                      |                          | immunity: according to the PN-EN 61000-6-2 standard<br>emission: according to the PN-EN 61000-6-4 standard |

#### Notes:


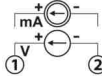



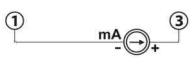

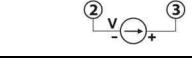

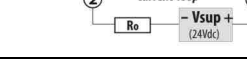
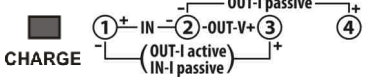
- (1) active output, may not be supplied in a two-wire current loop 4÷20mA
- (2) when replacing the batteries, pay attention to the polarity shown in the battery compartment
- (3) the instrument should not be used when being charged as this may lead to undercharging of the batteries  
do not connect the power supply to the instrument without the batteries installed  
do not charge regular batteries (only rechargeable batteries may be charged)
- (4) the estimated time of operation with new fully charged rechargeable batteries is >9 hours in the setting mode for continuous current value of 20 mA, >40 hours for continuous voltage value of 10 V, and >400 hours in the testing mode


## 5. THE ENCLOSURE AND DESCRIPTION OF CONNECTIONS AND EXTERNAL ELEMENTS

### 1. Enclosure

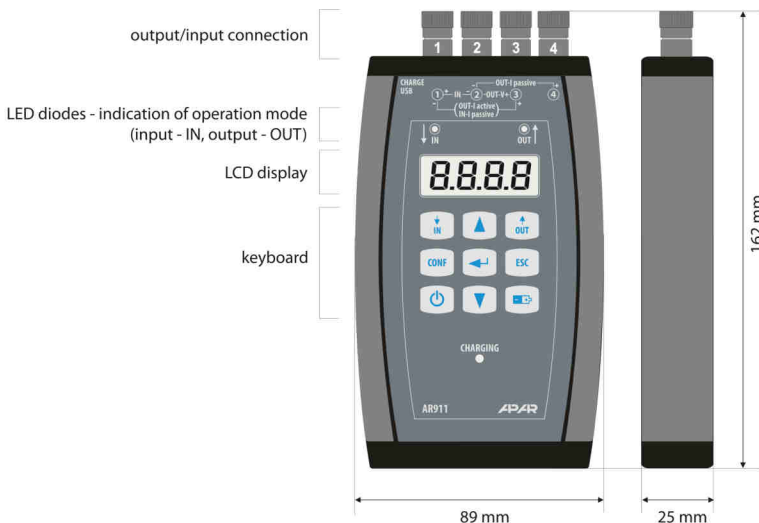
|                      |                                    |
|----------------------|------------------------------------|
| Enclosure type       | manual, portable, MBMO series      |
| Material             | ABS                                |
| Enclosure dimensions | 162 x 89 x 25 mm                   |
| Protection rating    | IP43 (IP20 on the connection side) |

### 2. Description of connections

| Terminals               | Operating direction   | Description   | Wiring diagrams  |
|-------------------------|---|---|--|
| 1-2<br>IN               |  IN <b>input</b>   | current input 0/4÷20mA or voltage input 0/2÷10V                 | or  |
| 1-3<br>IN-I<br>passive  |  IN <b>input</b>   | measurement / testing<br>2-wire transducers                     |     |
| 1-3<br>OUT-I<br>active  |  OUT <b>output</b> | active current output<br>0/4÷20mA                               |     |
| 2-3<br>OUT-V            |  OUT <b>output</b> | voltage output 0/2÷10V  |     |
| 2-4<br>OUT-I<br>passive |  OUT <b>output</b> | passive current output<br>4÷20mA<br>for 2-wire current loop     |    |
| CHARGE                  | <b>CHARGE input</b>   | micro USB socket<br>of the power supply<br>for battery charging |    |

**NOTE:**  The current output is an active output and may not be supplied in the two-wire 4÷20 mA loop.

### 3. Description of the external elements and dimensions of the enclosure



#### 4. Installation of batteries in the compartment







View from the bottom of the device after the cover is opened

## 6. BUTTON FUNCTIONS

a) button functions in the set/measured value display mode (normal mode)

| Button       | Description [and marking in the contents of the instructions]  |
|--------------|--|
|              | <b>[PWR]:</b><br>- switches the device on/off (press for more than 1 second)   |
| or           | <b>[IN] or [OUT]:</b><br>- sets the operating mode: input - IN (measurement) or output - OUT (setting)   |
|              | <b>[CONF]:</b><br>- view of the type of sensor set<br>- input in the parameter configuration menu (after holding for more than 2 seconds)<br>If parameter 18 <b>PPPrd = on</b> (password protection is activated) enter the password (chap. 8) |
| or           | <b>[UP] or [DOWN]:</b><br>- increase or decrease of the set value of the output signal by a preset increment (parameter 10: <b>SEEP</b> , chapter 8)   |
| +            | <b>[SET] + [UP]:</b><br>- a stepwise (limit) change of the set value of the output signal - upper value of the indication range (20 mA, 10 V, parameter 4: <b>FEOP</b> ) or setting range reduction (8: <b>LILb</b> )                          |
| +            | <b>[SET] + [DOWN]:</b><br>- a stepwise (limit) change of the set value of the output signal - lower value of the indication range (0/4 mA, 0/2 V, parameter 3: <b>FEOP</b> ) or setting range reduction (9: <b>LILd</b> )                      |
|              | <b>[BAT]:</b><br>- view of the battery voltage: 0% - low level, 100% - high level  |
| +            | <b>[SET] + [ESC]:</b><br>- view of the current or voltage value expressed in [mA] and [V], respectively (depending on the type of set signal - parameter 1: <b>SEYP</b> ), resolution of indications equal to 10 µA or 10 mV                   |
| <b>[SET]</b> | - starting/stopping the soft/start function (after holding time longer than 1.5 second). If parameter 12: <b>FLSE</b> and 13: <b>FRLL = OFF</b> the function is inactive (chapter 9)   |

b) button functions in the parameter configuration menu (chapter 8)

| Button  | Description  |
|---|--|
|   | - edits of the current parameter<br>- approves and saves the edited parameter value  |
|  or  | <b>[UP]</b> or <b>[DOWN]</b> :<br>- moves to the next or previous parameter name<br>- changes the value of the edited parameter  |
|   | <b>[ESC]</b> :<br>- cancels the change of the edited value (and displays the parameter name again)<br>- displays again the set/measured value (after holding time > 1 s) |

## 7. RANGE OF INDICATIONS. CHANGE OF A VALUE SET FOR AN OUTPUT

1. Depending on the setting of parameter 2: **d.irA** (chapter 8, Table 8), the value of the set/measured signal may be presented directly in real values (mA or V, when 2: **d.irA** = **unit**) or may be calculated to any programmable range of indications suitable for the specific application (parameters 3: **r.bob** and 4: **r.top**, when 2: **d.irA** = **bot**).

2. In the set value display mode, when the **[UP]** or **[DOWN]** button is pressed, the value is changed by a preset step (parameter 10: **step**). The changes of the output signal are proportional to the changes of the displayed value. When the **[SET]** and the **[DOWN]** buttons are pressed simultaneously, the output is immediately set to any permissible value in the range (0/4 mA, 0/2 V, 3: **r.bot** or 8: **L.r.d**) while pressing the **[SET]** and the **[UP]** buttons simultaneously causes the output to be set at the upper permissible value of the range (20 mA, 10 V, 4: **r.top** or 9: **L.r.H**). Also, the output signal can be set in the parameter programming mode (parameter 11: **set**). Moreover, it is possible to set a value outside of the indication range resulting from parameters 3: **r.bot** and 4: **r.top**. The value of this overload is equal to  $\pm 5\%$  in accordance with full range of changes of the output signal described in chapter 4.

## 8. SETTING OF THE CONFIGURATION PARAMETERS

All the configuration parameters of the device are stored in the non-volatile EEPROM internal memory.

The parameters are set from the film keypad located on the front panel of the device:

- from the set/measured value display mode go to the configuration menu (press **[CONF]** and hold it for more than 2 seconds) If parameter 18: **Prot** = **on** (password protection is on) the display will show the message **Code**, and then **0000** with the first digit blinking, use the buttons **[UP]** or **[DOWN]** to enter the password (default parameter 17: **PASS** = **1111**), to move to successive items and to approve the code, use the **[SET]** button

- after you enter the configuration menu, the mnemonic names of the parameters are displayed (**STEP** <-> **d.irA** <-> **r.bot** <-> etc.); press the **[UP]** button to go to the next parameter and the **[DOWN]** button to go to the previous parameter (a complete list of configuration parameters is presented in Table 8)

- to change or view the value of the current parameter, press **[SET]**

- use buttons **[UP]** or **[DOWN]** to change the value of the edited parameter;

- approve the changed value of the parameter by pressing **[SET]** or cancel it by pressing **[ESC]**; then return to the parameter name display

- exit the configuration by long pressing (>1 s) the **[ESC]** button; otherwise, the system exits the menu automatically after approx. 2 minutes of idle condition

In the event of indications different from the actual value of the input/output signal, the zero and the sensitivity of the sensor can be tuned to the specific signal: parameters 14: **zRL** (zero) and 15: **sRL** (sensitivity).

To restore the factory settings, when the device is switched on press button **[CONF]** and hold it until the password menu appears (**Code**), and then enter the following code **0112**.

Table 8. Configuration parameters

| Parameter  | Range of variability of the parameter and description  |   | Settings default        |
|--|--|---|-------------------------|
| 1: <b>SEYA</b> type of output/input signal   | <b>0-20</b>  | current (active) 0÷20mA, OUT output 1-3, IN input 1-2   | <b>0-20</b>             |
|  | <b>4-20</b>  | current (active) 4÷20mA, OUT output 1-3, IN input 1-2   |                         |
|  | <b>4-20P</b>   | current (passive) 4÷20mA, OUT output 2-4 measurement/testing 2-wire current loop, IN input 1-3  |                         |
|  | <b>0-10</b>  | voltage in the 0÷10 V standard (full range 0÷10.5 V)  |                         |
|  | <b>2-10</b>  | voltage in the 2÷10 V standard (full range 1.9÷10.5 V)  |                         |
| 2: <b>DIRA</b> type of the scale displayed   | <b>units</b>   | direct in real units (mA or V)  | <b>units</b>            |
|  | <b>bofo</b>  | programmable with parameters 3: <b>fofo</b> and 4: <b>fofoP</b>   |                         |
| 3: <b>fofo</b><br>bottom of the indication range   | <b>4999 ÷ 9999</b> units – indication for 0/4 mA, 0/2 V - start of the output scale  |   | <b>00</b>               |
| 4: <b>fofoP</b><br>top of the indication range   | <b>4999 ÷ 9999</b> units - indication for 20 mA, 10 V - end of the output scale  |   | <b>1000</b>             |
| 5: <b>fofo</b> position of the point for the programmable scale (when parameter 2: <b>DIRA</b> = <b>bofo</b> ) | <b>0</b>   | no point  | <b>1</b><br><b>(00)</b> |
|  | <b>1</b>   | <b>00</b> (0.0)   |                         |
|  | <b>2</b>   | <b>000</b> (0.00)   |                         |
|  | <b>3</b>   | <b>0000</b> (0.000)   |                         |
| 6: <b>FLF</b> degree of filtration   | <b>4 ÷ 15</b>  | digital filtration of measurements (response time) for <b>FLF</b> = <b>4</b> the response time is equal to approx. 0.3 s, for <b>FLF</b> = <b>15</b> approx. 1.3 s. A higher filtration rate means a smoother measurement value and a longer response time. | <b>4</b>                |
| 7: <b>fofo</b> operation mode  | <b>in</b>  | input (measurement), mode also set using the <b>[IN]</b> button   |                         |
|  | <b>out</b>   | output (setting), mode also set using the <b>[OUT]</b> button   |                         |
| 8: <b>LO</b><br>lower setting limit  | <b>4999 ÷ 9999</b> units, lower limit of the set value (parameter 11: <b>SEB</b> ) when setting using the setter buttons   |   | <b>4999</b>             |
| 9: <b>UH</b><br>upper setting limit  | <b>4999 ÷ 9999</b> units, upper limit of the set value (parameter 11: <b>SEB</b> ) when setting using the setter buttons   |   | <b>9999</b>             |
| 10: <b>SEEP</b><br>change increment  | <b>0 ÷ 2000</b> units, change increment for set value (parameter 11: <b>SEB</b> ) when setting using the setter buttons  |   | <b>0.10</b>             |
| 11: <b>SEB</b><br>set value for the output   | lower setting limit: 0/4 mA, 0/2 V, parameter 3: <b>fofo</b> or 8: <b>LO</b> , upper setting limit: 20 mA, 10 V, parameter 4: <b>fofoP</b> or 9: <b>UH</b> , change increment: 10: <b>SEEP</b> , applies to setting using buttons in the normal mode (chapter 6) |   | <b>000</b>              |
| 12: <b>rSE</b><br>soft start time  | <b>off</b><br><b>1 ÷ 1800</b> s  | duration of increasing slope (ramp) for the value <b>off</b> the function is off, description in chapter 9  | <b>off</b><br>off       |
| 13: <b>FRFL</b><br>soft stop time  | <b>off</b><br><b>1 ÷ 1800</b> s  | duration of decreasing slope (ramp) for the value <b>off</b> the function is off, description in chapter 9  | <b>off</b><br>off       |
| 14: <b>ERLO</b> calibration of the zero  | moving the zero for measurements and setting <b>-500 ÷ 500</b> units   |   | <b>000</b>              |
| 15: <b>ERLO</b> gain   | <b>050 ÷ 1150</b><br>%   | calibration of inclination (sensitivity) for measurements and setting   | <b>1000</b> %           |



|   |   |   |                   |
|---|---|---|-------------------|
| 16: <b>block</b> block of keyboard keys <b>[IN]</b> , <b>[OUT]</b> and the set value 11: <b>SET</b> | <b>OFF</b>                              | off (no blocks)   | <b>OFF</b><br>off |
|   | <b>on</b>                               | block of keyboard keys <b>[IN]</b> and <b>[OUT]</b> is on                                     |                   |
|   | <b>SET</b>                              | block of changes to set value changes 11 is on: <b>SET</b>                                    |                   |
|   | <b>ALL</b>                              | block of keyboard keys <b>[IN]</b> and <b>[OUT]</b> and value 11 is on: <b>SET</b>            |                   |
| 17: <b>PASS</b> password  | <b>0000</b> ÷ <b>9999</b>               | password for the configuration menu (when 18: <b>Prot</b> = <b>on</b> )                       | <b>1111</b>       |
| 18: <b>Prot</b> protection of the configuration with a password                                     | <b>OFF</b>                              | entry into the configuration menu is <b>not</b> password-protected                            | <b>OFF</b><br>off |
|   | <b>on</b>                               | entry into the configuration menu is password-protected                                       |                   |
| 19: <b>LoFF</b> auto-off time   | <b>OFF</b><br><b>1</b> ÷ <b>240</b> min | time calculated from the time of last use of any keyboard key, <b>OFF</b> the function is off | <b>OFF</b>        |

## 9. SOFT START/STOP AND TRIANGULAR WAVE GENERATOR

The device has a ramp function (soft start and stop) that works as shown in the diagrams below (figures 9.1, 9.2, and 9.3). In order to start the function, configure the duration of the soft start (the increasing slope, parameter 12: **RISE**, chapter 8) or the soft stop (the decreasing slope, parameter 13: **FALL**). If both times are different than zero (12: **RISE** and 13: **FALL**) a periodic triangular signal is generated on the outputs. The limit values (amplitudes) of the output signal are equal to the limit values of the signal used (which depend on parameter 1: **SETPT**) or may be restricted with the lower limit 8: **LILO** and the upper limit 9: **LIHI**. The indications of the display are expressed in real units (mA or V when 2: **DIRA** = **on**) or by parameters 3: **ROBT**, 4: **ROTP** (when 2: **DIRA** = **off**). The function is started with the manual button **[SET]** after holding time longer than 1.5 seconds. The ramp can be stopped and restarted at any time using the **[SET]** button (a momentary message appears **START** - start or **STOP** - stop). The status of the outputs in the operation mode is updated automatically approx. 6 times a second.

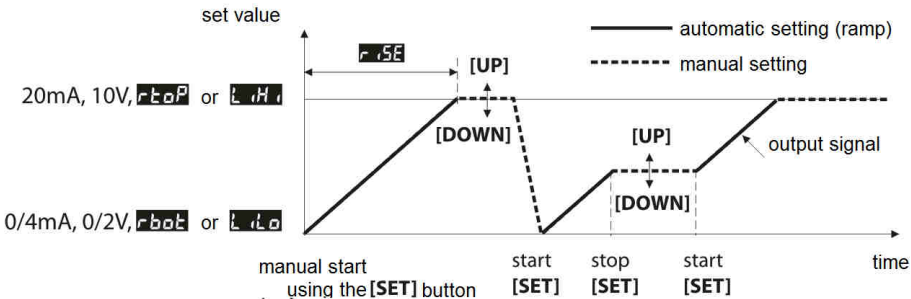


Figure 9.1. The principle of operation of outputs in the **soft start** mode (parameter **RISE** > 0, **FALL** = **OFF**).

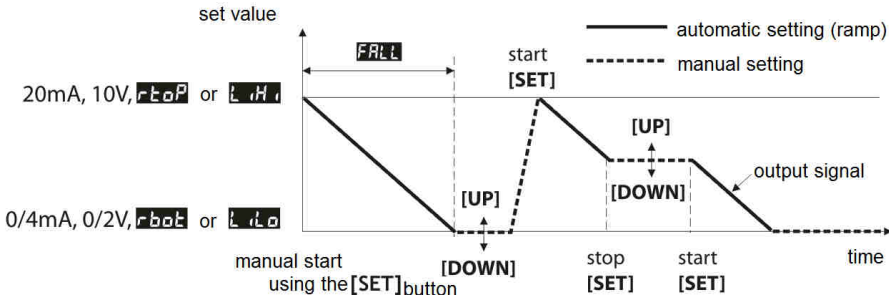


Figure 9.2. The principle of operation of outputs in the **soft stop** mode (parameter **RISE** = **OFF**, **FALL** > 0).

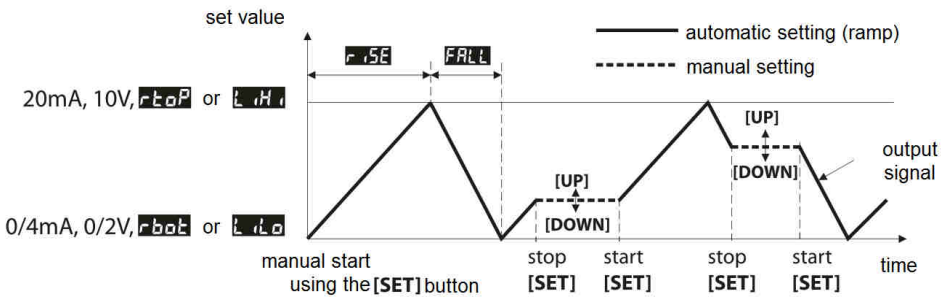


Figure 9.3. The principle of operation of outputs in the **triangular wave generator mode** (parameter  $r_{RISE} > 0$ ,  $r_{FALL} > 0$ ).

## 10. MESSAGE AND ERROR SIGNALING. DIAGNOSTIC FUNCTIONS.

a) measurement and setting errors (diagnostic functions):

| Code | Possible causes of error  |
|------|---|
| ---- | - the permissible measurement range/set signal is exceeded from above (----) or from below (----)<br>- the signal that is connected is different than the one that is set in the configuration (chapter 8, parameter 1: <b>SETP</b> )   |
| 4.00 | - the set value blinks - a break in the current loop circuit or a short-circuit in the voltage signal circuit.<br>A message is shown when the expected value of the set signal is different from the measured real value by more than 1% of the total range of variability of the signal. |

b) temporary messages and errors (one-time and recurring):

| Code | Description of message   |
|------|--|
| ---- | the operating mode was initiated (input/output),   |
| POFF | the calibrator was switched off (manually or automatically due to low battery voltage),  |
| CODE | the mode for entering the password for access to the configuration parameters is entered (chapter 8),  |
| ERR  | the password is invalid,   |
| CONF | the parameter configuration menu was accessed,   |
| BLoc | the value settings or the <b>[IN]</b> and <b>[OUT]</b> buttons block is switched on (using parameter 16: <b>BLoc</b> , chapter 8)  |
| FRAP | the value setting block is switched on due to the performance of the ramp function (chapter 9),  |
| STAR | the soft start/stop function was started up manually (using the <b>[SET]</b> button),  |
| STOP | the soft start/stop function was stopped manually (using the <b>[SET]</b> button),   |
| LBAT | the voltage level of the power supply batteries is too low (the batteries must be charged using the enclosed power supply or the batteries must be changed to new ones), |
| SAVE | saving of factory parameter values (chapter 8).  |

## 11. USER'S NOTES