

INSTRUCTIONS FOR USE OF THE PRODUCTS

SERIES S



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Instructions for use of the products series S

1. CONTENTS:

1. CONTENTS:	2
2. DESCRIPTION.....	3
2.1. List of subtypes	3
3. MECHANICAL CONSTRUCTION.....	3
3.1. Main dimensions	4
3.2. Pressure connections.....	4
4. ELECTRIC CONNECTION	6
4.1. Table of outputs, assignment of terminal board and connector outputs	7
4.2. Diagrams.....	8
5. SOFTWARE.....	10
5.1. Communication adapter, installation	10
5.2. Service program.....	10
5.2.1. Installation.....	10
5.2.2. Description of functions and adjustment	10
5.2.2.1. Communication adapter connection.....	10
5.2.2.2. On-line measuring	12
5.2.2.3. Configuration parameters reading and saving.....	12
5.2.2.4. Physical unit adjustment.....	13
5.2.2.5. Display adjustment.....	13
5.2.2.6. Change of internal buttons function adjustment.....	14
5.2.2.7. Two-status outputs	15
5.2.2.8. Analogue outputs.....	15
5.2.2.9. Serial digital outputs.....	17
5.2.2.10. Damping adjustment	18
5.2.2.11. Datalogger	19
5.2.2.12. Automatic offset resetting.....	19
5.3. Communication protocol description	21
5.3.1. Description of commands	21
5.3.2. Checksum.....	24
5.4. Communication protocol Cressto	25
6. RECOMMENDATIONS FOR CORRECT APPLICATION	27

2. DESCRIPTION

The product range by the company Cress to with the common marking S has several common features:

- Full microcomputer control and signal processing
- Digital, analogue and two-status outputs
- Possibility of parameters configuration by means of PC
- Common sturdy and resistant mechanical construction
- High coverage IP 65
- Optional mounting of 4-figure LCD display with backlight
- Big variability

Each subtype has its own catalogue sheet where detailed descriptions and technical parameters are stated.

2.1. List of subtypes

This production range is not closed and is complemented gradually with new subtypes of devices. An own catalogue sheet is issued for each subtype where basic technical specifications can be found.

SP is a transmitter of low and very low pressures and pressure differences intended especially for air-conditioning, ventilation, combustion processes control, clean rooms monitoring, etc. It can also be supplied in the version for measuring absolute pressure or barometric pressure.

SV is a pressure transmitter with automatic offset resetting. It is a variation of pressure transmitter series SP which is supplemented with a program controlled valve which is used for periodical and non-periodical offset measuring controlled by the user and correction of the input data of the transmitter. The resetting phase lasts ca. 300ms and the period can be adjusted in the range from 10 minutes up to 256 hours. Thanks to this technical solution excellent long-term stability can be achieved even for the lowest pressure ranges.

SR is a transmitter of relative or absolute pressure for universal use. A silicone sensor with stainless separation membrane is used for pressure measuring. These transmitters are supplied standard with the thread G1/2" and are mounted in a made-to-order way.

SH a transmitter of differential pressure for liquid media. Two separate sensors with stainless separation membrane are used. It is intended especially for hot water heating systems with the static pressure up to 16 bars. It is connected to the pressure circuit by means of impulse piping.

SD is a multifunctional device intended for connection of any transmitter with an electric analogue output. It can be used as a programmable digital imager with a LCD display when power supplied from a two-wire loop 4-20mA. Display backlights can be used with a three-wire power-supply, moreover, it can be used as a digital comparator with the output type open collector or contact relay. It can also be used for the function of an A/D converter with serial communication.

ST a forthcoming variation of a signal converter from resistance thermometers with the resistance 1-5 kOHM. This device uses the same basic software and possibilities of configuration and communication as a pressure transmitter of this series.

3. MECHANICAL CONSTRUCTION

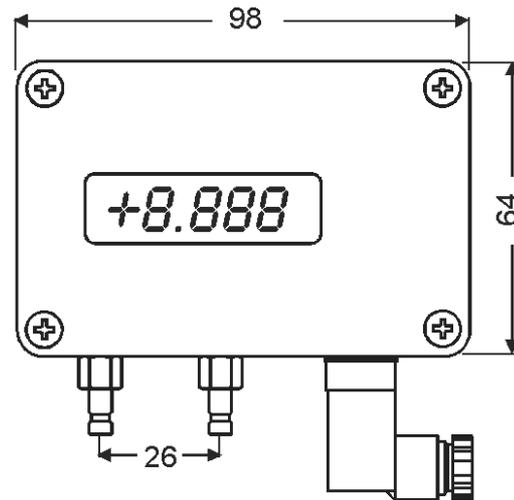
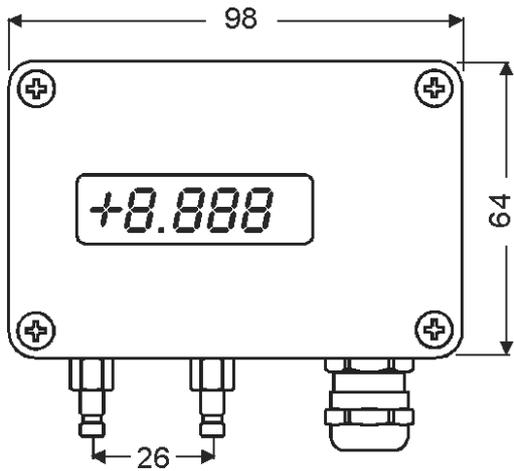
The devices series S are mounted into aluminium cases coated with varnish in blue colour. The dimensions of the case itself are 98 x 64 x 34 mm. The coverage, even when equipped with a display, is IP 65. The display is an optional attachment mounted for an additional charge.

It can be supplied with two types of electric connection:

- Metal bushing with an internal terminal block. This version is preferred.
- Sealed arrested connector for connecting only analogue outputs. It is supplied only based on a previous order.

The devices are fixed by means of two bolts accessible after removing the lid. These bolts are inside a sealed space.

3.1. Main dimensions



3.2. Pressure connections

Transmitters series SP and SV have variable fittings for connecting the pressure medium.



Basic pressure connection with the code **R**. It is used as a nipple for a quick coupler or an outlet for direct sliding on a tube for pressures smaller than 100kPa. The outer diameter is 5mm, the material is nickel plated brass.



Classical outlets with the outer diameter 6mm from nickel plated brass. Code marking **V**.



Connection by means of plug couplings. It is precise with guaranteed seal and pressure resistance up to 1MPa. Code parking **N** for tube with the outer diameter 4mm, **M** for tube with the outer diameter 6mm. The material is nickel plated brass and plastic, sealing O ring NBR.

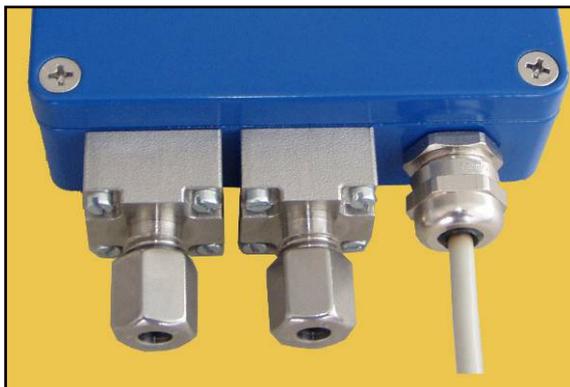


For measuring barometric pressure – marking **B** – the inlet hole is protected by a metal cover from nickel plated brass. Obviously, it is possible to equip a transmitter for measuring barometric pressure with any of the above mentioned fittings.

Other connecting fittings:



Standard connection of transmitters series SR is stainless with the thread G1/2". Mate-to-order ones can be supplied with other types of threads, etc.



Connection of a differential transmitter series SH by means of impulse piping with the outer diameter 6mm.



Converter for temperature sensors is equipped with second bushing, into which a pocket of a resistance thermometer can be directly mounted, see the picture, or connect a resistance sensor with a cable. Coverage remains unchanged.

The chosen type of connection must be specified in the order. As they are sealed by means of glue, their additional change is very problematic. If needed, it is also possible to agree on another type of connection.

4. ELECTRIC CONNECTION

The described series of devices has also very variable signal outputs or inputs. Classical analogue outputs two-wire 4-20mA, three-wire 0-20mA, 0-10V, 0-3V are available. These outputs can be software switched by the user and the range of measured pressures can also be assigned to them in a certain range. Moreover, it is possible to switch the linear transfer characteristic to the switching two-status one with analogue outputs and use for example the voltage output as an output of the logic level type with adjustable level log. 1. Unless otherwise specified, these analogue outputs are always available in the transmitters. In case that a transmitter works in a two-wire loop 4-20mA, it is not possible to use simultaneously any other outputs and functions besides a display without backlights.

TIP: *If there is a request for combination of functions and accessories with the current output 4÷20mA, it can be solved by adjusting a three-wire current output in this range. In case of doubt, contact the producer.*

WARNING: *Most electric circuits are always present in the transmitter and their inappropriate activation by means of the configuration software could cause that disturbing current peaks, created by consumption of these circuits, appear in the two-wire current signal.*

In other cases it is possible to combine analogue, digital and also two-status outputs and supplementary circuits.

Also serial digital outputs are available whose type cannot be additionally changed and they must be specified in the order. RS485 is standard fitted. It is possible to software configure only some communication parameters.

WARNING : *If some of the inputs on the terminal board or connector is not used, it must not be connected anywhere because it is electrically connected with the transmitter circuits and incorrect connection could cause error, malfunction or complete destruction of the transmitter. The description of single signals is always stated on the label.*

All the above mentioned facts are valid also for digital imagers series SD, only output No. 3 is an analogue input instead of an analogue output. It is not possible to software switch the type of electric input and it is necessary to specify it in the order.

All types of devices series S can be supplemented by a 4-figure display. The requirement of minimal power supply voltage 5V is not changed by the activation of the display even in transmitters with the output 4÷20mA. The display is equipped with backlights by means of white LED whose current consumption is ca. 20mA. Activation of the backlights is possible by means of software configuration or by means of a jumper on the printed circuit.

Transmitters can be additionally equipped with a switching outputs module. This module includes a small biteable relay with one switching contact plus two separately controlled transistors NPN with an open collector. Switching of the transistors is indicated by means of red LEDs which are visible outside the case. These LED are in operation also without connected load of the output transistors, so they can also be used only for optical signalization of the states. Adjustment of the switching, braking levels of hysteresis, etc. is software made.

TIP : *If you need to indicate switching of the relay contacts by means of built-in LED, program also switching of the transistor with the open collector with the same levels and do not connect its output.*

The devices can be supplied with internal memory type FLASH, in which can be recorded the measured data with a preselected period, which can then be read into a computer. The memory capacity is 8000 entries. But it is not a full datalogger because the transmitter does not have a battery and clock of the real time. This accessory is more suitable for diagnostic purposes.

Series S is made also with USB connection. In this case the USB cable is mounted directly at the producer, the device is power supplied from the USB port (including the display and backlights), communication with the user software is made through the mapped Com port of the computer. This solution is very practical for realization of mobile workplaces equipped with laptops or for work in laboratories.

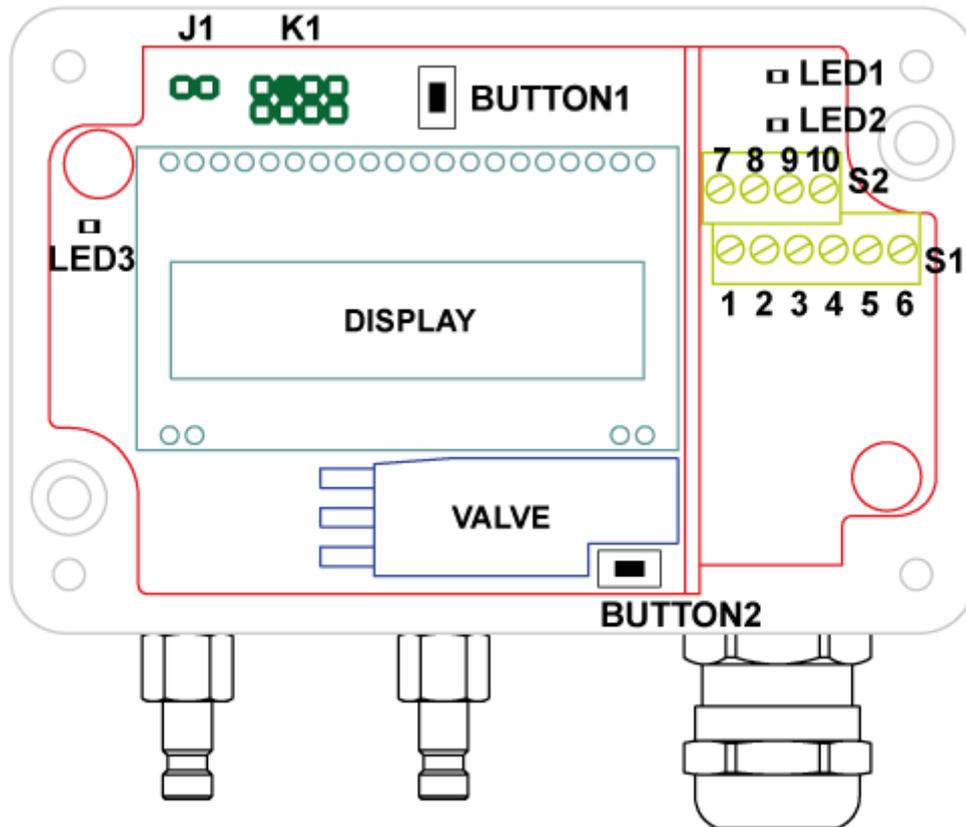
4.1. Table of outputs, assignment of terminal board and connector outputs

Connector	3	2	1			⊥				
Terminal board	1	2	3	4	5	6	7	8	9	10
4 ÷ 20mA	+Ucc	-Ucc				case				
0 ÷ 20mA	+Ucc	-Ucc	Out			case				
0 ÷ 10V	+Ucc	-Ucc	Out			case				
0 ÷ 3V	+Ucc	-Ucc	Out			case				
RS232	+Ucc	-Ucc		RxD	TxD	case				
RS485	+Ucc	-Ucc		B	A	case				
Switching outputs							Re1	Re2	OK1	OK2

Output No. 6 is connected with the metal case and is used as shielding of the whole transmitter. It is galvanic separated from the transmitter electronics, voltage strength 1000V sis is tested.

4.2. Diagrams

All devices series S are connected into the electric circuit in a usual way. They are always power supplied by direct current voltage in the range 5 to 36V. Especially with the two-wire connection it is necessary to take into account that this voltage must be available on the transmitter terminal, not for power supply of the whole loop. Transmitters are protected against reverse polarity of the power supply unit by a serial diode. ATTENTION when connecting more-conductor connection where for example change of the input and power supply conductor could cause damage of the transmitter.

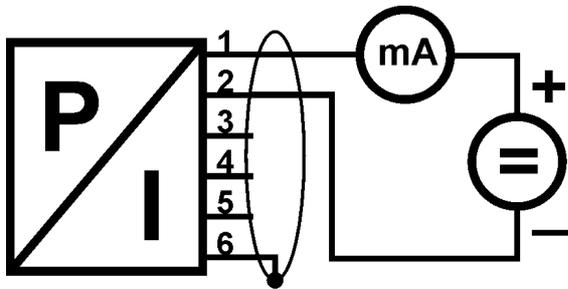


All circuits of the transmitter, analogue and also digital outputs are galvanic connected and work with common earth, inlet – Ucc. This requires thorough discretion, especially with the combination of analogue and digital outputs. All inlets are separated by means of inductors 33uH and protected by means of varistors again short high-voltage peaks.

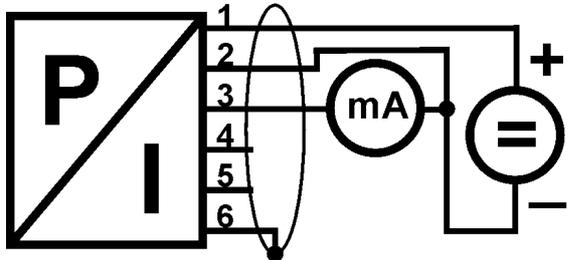
Main connecting and control elements under the transmitter cover

- **S1** Main connection terminal for connecting power supply, analogue and digital outputs
- **S2** Terminal box on the switching module for connection of relay and open collectors
- **LED1, LED2** Red LED for indication of operation of the switching transistors
- **LED3** LED for indication of INIT mode for adjusting of communication parameters
- **BUTTON1** Button with default function of the transmitter offset resetting
- **BUTTON2** Button with default function of the INIT mode activation
- **K1** Connector for connecting the communication tool CresProg
- **J1** Jumper for manual control of the display backlights
- **DISPLAY** 4-figure LCD display with a possibility of backlights- optional accessory
- **VALVE** 3-way electromagnetic valve for the offset automatic resetting-only for the SV series

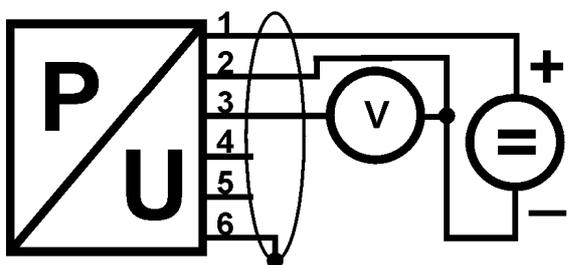
Inlets numbering in the following pictures corresponds with numbering of the internal terminal.



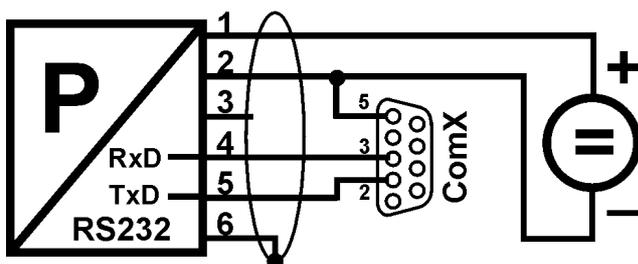
F 4 -20mA two-wire is the most commonly used analogue output. For the correct function, it is necessary to secure minimum power supply voltage 5V on the transmitter terminal. The transmitter has software and also hardware limiting of the maximum current by a look.



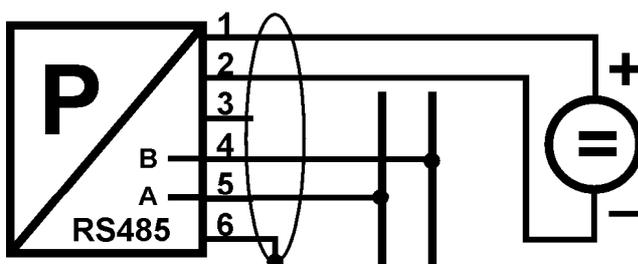
G 0-20mA free-wire. It can be adjusted to the range 4-20mA.
Maximum loaded impedance
 $R = (U_{cc} - 2) / 20\text{mA}$



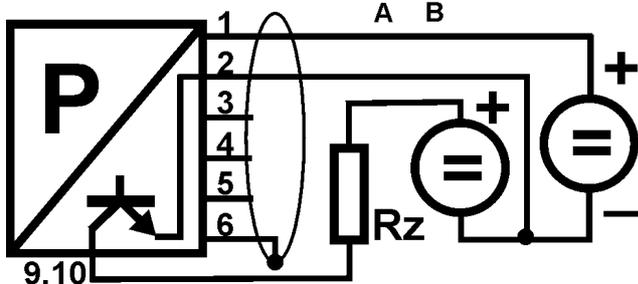
H 0 -10V, it is possible to adjust different ranges. For ranges smaller than 3V, it is more suitable to switch the transmitter output range for use of distinctiveness of the D/A converter. The minimum power supply voltage must be at least 2V higher the maximum output one. Maximum load current is 20mA.



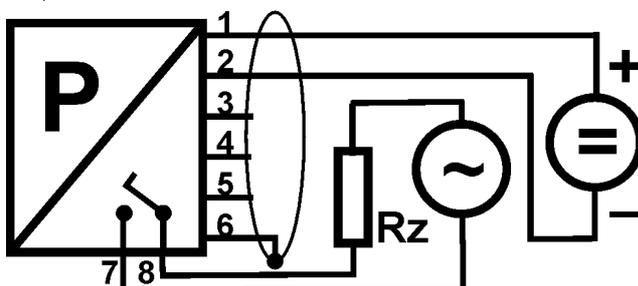
A digital output RS232. It is possible to connect it directly to the native and also mapped (USB, LAN) serial port of the computer. Only data signals Rx and Tx are used for communication. RS232 line is not galvanically separated.



B connection to the bus RS485. The device can be assigned an address in the range 00 up to FF and other communication parameters can be adjusted. The line is not galvanically separated, when power supplied from different voltage supply it is recommended to interconnect their earths.



L is a double switching output with NPN transistors with an open collector. It is possible to switch currents up to 100 mA and DC voltage up to 50V. The load can be a simple resistor, a bulb, LED relay, etc. The load is always galvanically connected with the transmitter power supply. The voltage supply for the transmitter power supply and load can be common. The switching levels, hysteresis, polarity are software adjusted. It is also possible to adjust a switching "window".

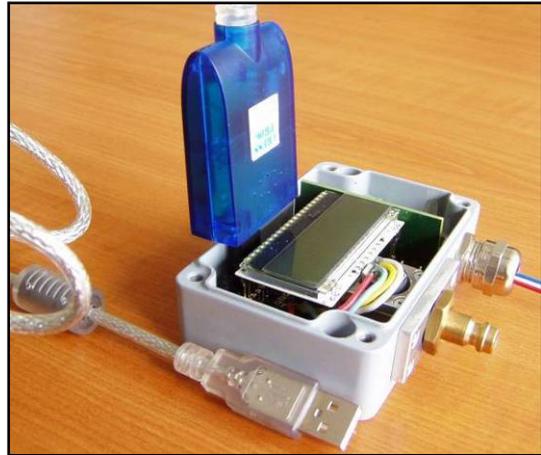


R is a switching output with a galvanically separated contact of the bistable relay. It is possible to switch DC and also AC voltage up to 40V voltage and maximum current 0.5A. The switching levels, hysteresis, polarity are software adjusted. It is also possible to adjust a switching "window".

5. SOFTWARE

5.1. Communication adapter, installation

It is possible to specify the transmitter programmable parameters in the order and it will be made by the producer or an authorized company. For the user's adjustment, it is possible to buy a configuration adapter CresProg which is connected to the USB port of the computer. A big advantage is that the transmitter can also be power supplied from this port so the user can make the configuration "on the table" without any other devices. The power supply is galvanic separated and thus, without any problems, the configuration adapter can also be connected to a transmitter which is already connected in the application and execute possible changes in its configuration in running. For connection of this adapter, it is necessary to remove the transmitter cap and slide it on to the internal connector whose position is keyed.



After the first connection of the adapter to the computer a new USB device is found which needs a driver to be installed. Let the system find the driver automatically on the CD. If you install an application downloaded from the Internet, guide the installer to the file C:\Program Files\Cressto. The driver is reported as CresProg.

5.2. Service program

5.2.1. Installation

For the transmitter configuration, there is a program which is installed under Windows XP or a newer version. The program is called **S-Config**. In the start menu a tab Cress to will appear and from that the program can be started. The Microsoft Framework environment must be installed to the computer for its operation. If it is not installed in the computer (it is used by many other programs), it will be installed automatically.

Installation of the S-Config program is started-up of S_Config_X.xx_Install.exe in the basic CD directory or by starting-up of this file downloaded from the Internet. If you just make an upgrade to a newer version, start-up the file S_Config_X.xx_Upgrade.exe. If you have the 3.10 or older version installed, uninstall it first and then install a new version again.

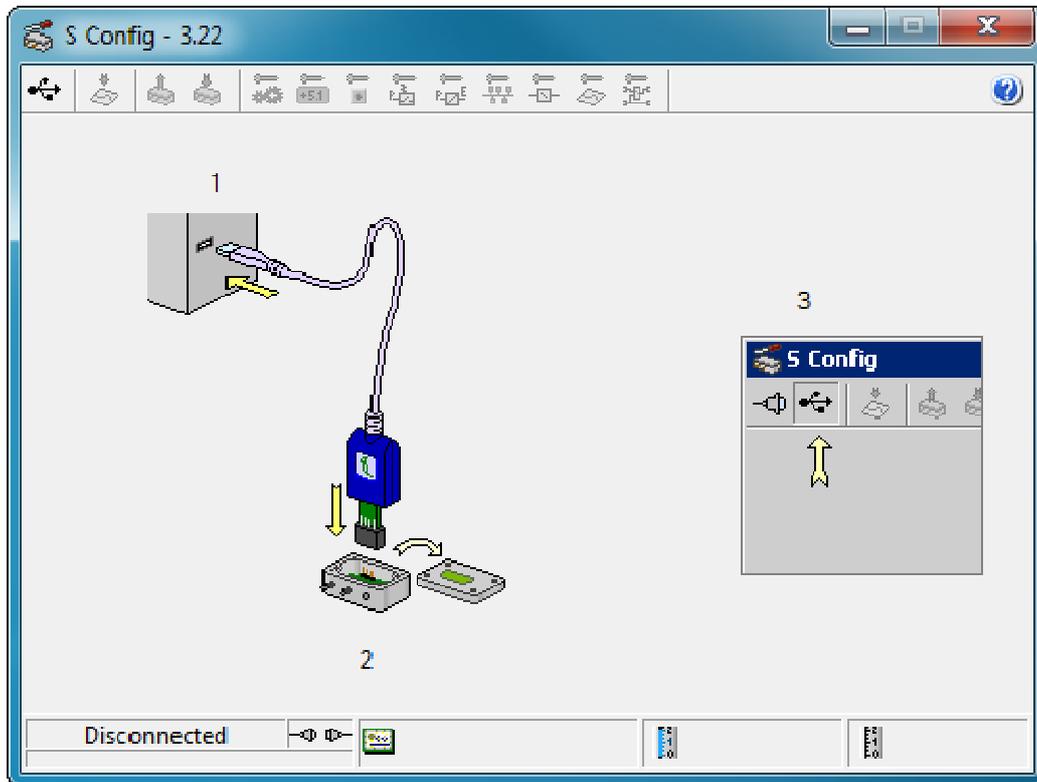
5.2.2. Description of functions and adjustment

5.2.2.1. Communication adapter connection

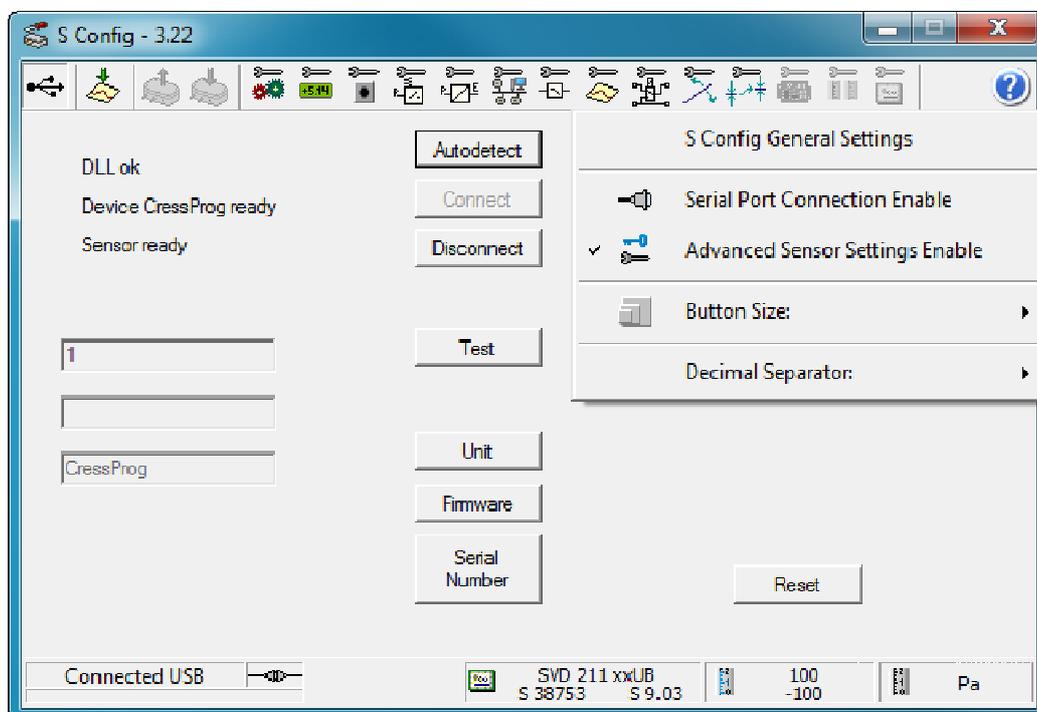
The program control is intuitive. The connected transmitter is automatically detected after connecting the communication adapter. If this is not connected, a prompt window will appear and after connecting it, it is necessary to click on the USB icon.

If the transmitter is equipped with the serial communication interface RS 485 or RS 232, it is possible to connect to it by means of the S-cogif program under these conditions:

- By clicking on the right mouse button on the toolbar and ticking the choice *Serial line connection*
- Just one transmitter will always be connected on the communication line
- Cress to communication protocol must be permitted, see chapter 5.2.2.9, which is not default adjustment
- Native or mapped serial port of the computer must have default communication parameters adjusted, see chapter 5.4
- by clicking on the serial port icon available ports are detected and by clicking on the Auto detect button the connected transmitter is found.



After the regular communication is established, the basic program window will appear. There is information about the transmitter identification number and the firmware version on the bottom toolbar. Also the calibrated transmitter range in the actually adjusted units and the actually adjusted unit are displayed. The most important control element is the upper toolbar with buttons which have a bubble prompter. Possibilities of the transmitter adjustment and control are opened by clicking on single icons. The menu will open after clicking by the right mouse button on this toolbar which will enable to adjust some of the SConfig configurations.

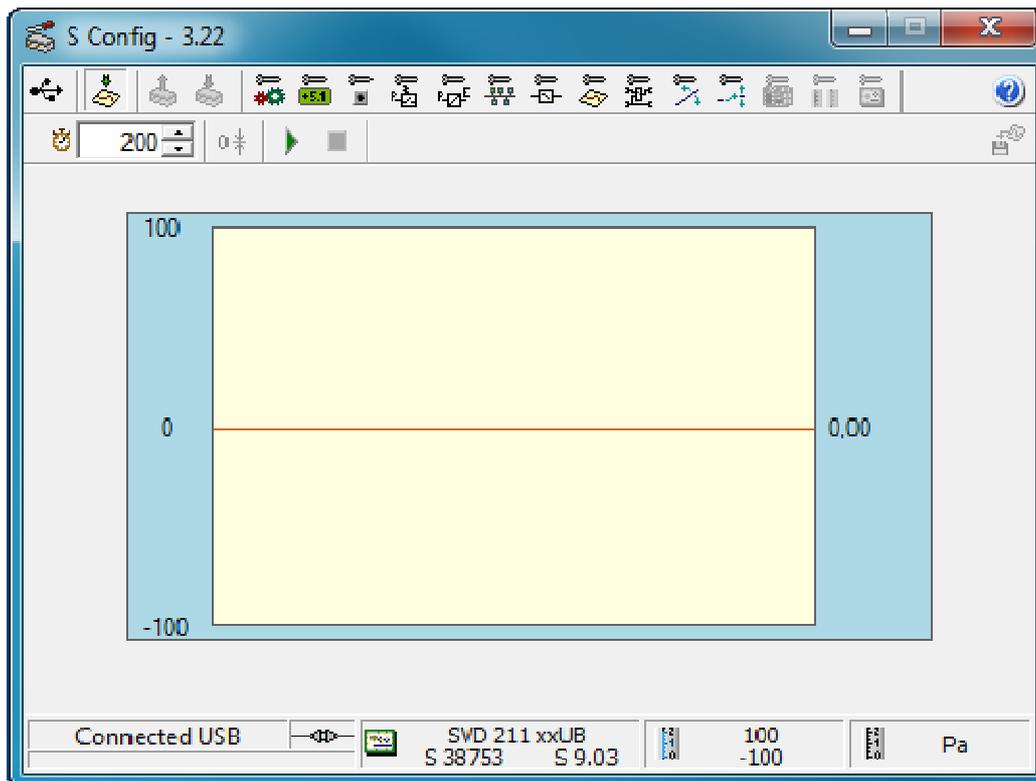


If you are not sure, rather do not change the configuration!

5.2.2.2. On-line measuring



This icon opens the on-line measuring panel and is used for the basic control of the device correct function. It is possible to adjust the communication period with the transmitter on the sub-toolbar. The graph range is adjusted automatically in the range of calibrated values. By clicking on  the START icon communication with the transmitter is started-up and currently measured values in the time procedure are displayed. The measured values are saved to the PC memory. By clicking on the STOP  icon the communication is finished.



The measured data are saved in the PC in the format cave through the  on the right side of the toolbar.

5.2.2.3. Configuration parameters reading and saving

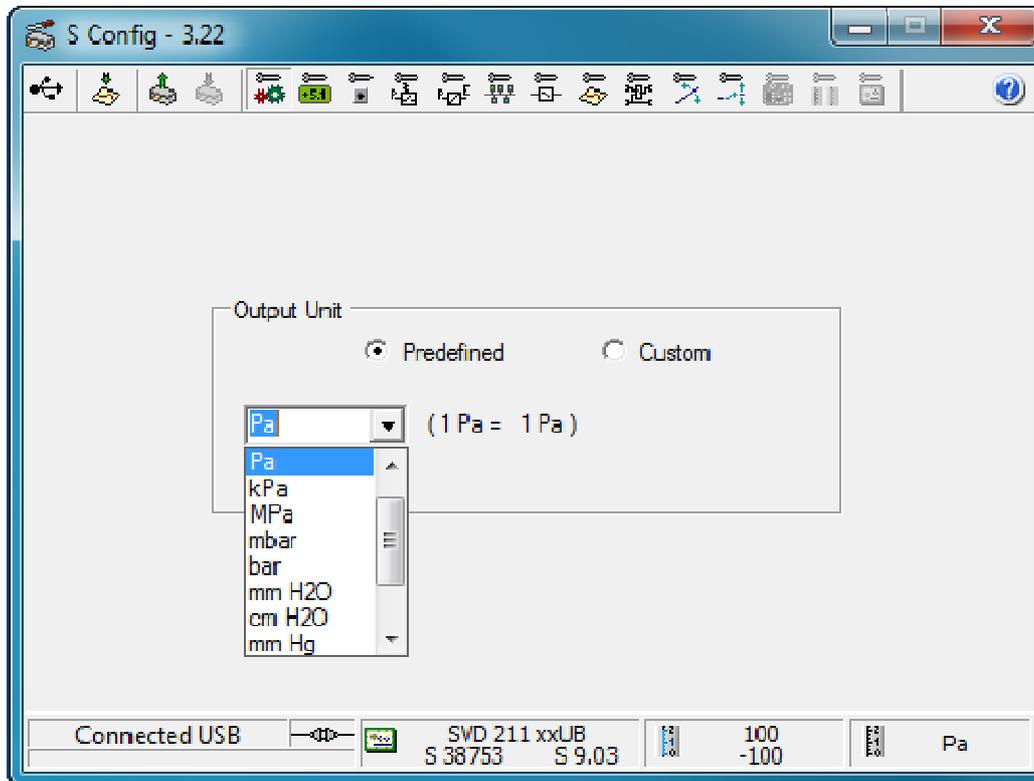


This icon is used for reading of the complete configuration from the transmitter Flash memory to the S-Config program. Some of the S-Config functions start –up reading the parameters automatically. After executing the required adjustments, these must be saved in the transmitter memory by means of the  icon. The transmitter processor will be restarted automatically. All executed adjustments are activated by this. Obviously, all configuration parameters are saved into an energetically independent memory and are saved even after the power supply switch-off. Other icons are used for the transmitter parameters adjustment. Not all of them are available all the time and the transmitter is not in the maximum configuration all the time, so some of the adjustments do not have any effect.

5.2.2.4. Physical unit adjustment



After the panel is activated by this icon, it is possible to adjust the physical unit which is used for operation of the transmitter and also the S-Config program. The value is transferred in the adjusted units on the communication lines or saved in the data internal memory and simultaneously, the same value is displayed on the display. If the analogue outputs are also adjusted by means of the S-Config program, it is necessary to work with these units again. Save the configuration to the transmitter after adjusting a new physical unit, so that all further adjustments are updated.



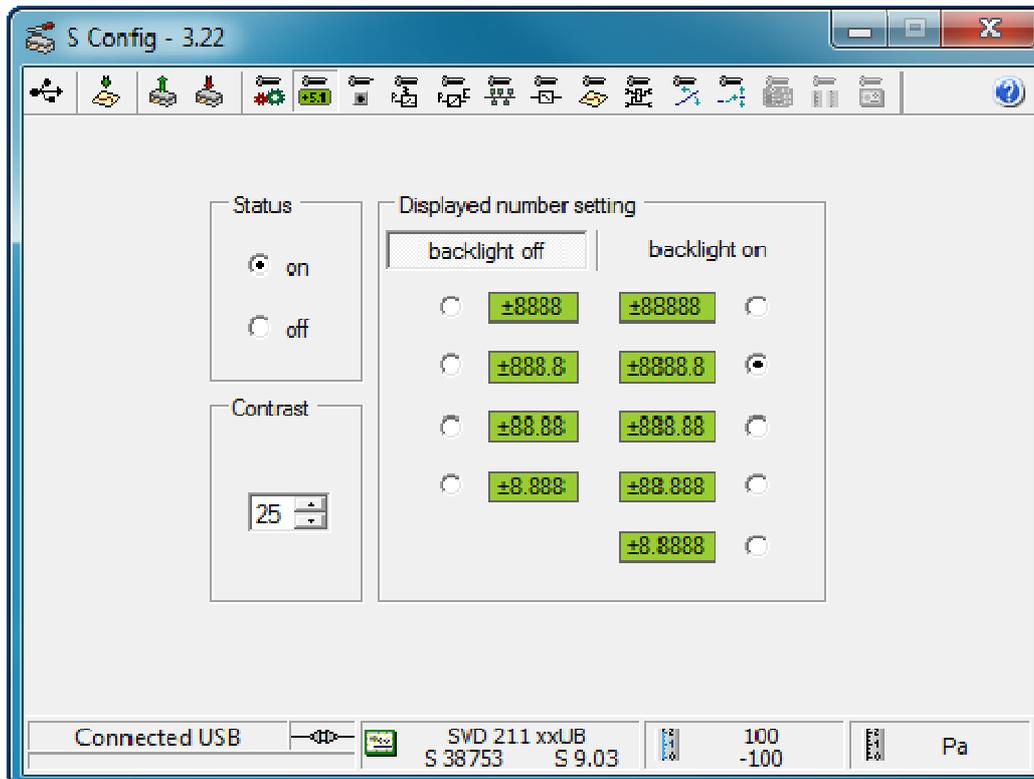
It is possible to choose a pre-set physical unit from the drop-down menu or to enter your own one, where it is necessary to enter also the converting constant between the entered unit and the basic unit 1Pa.

5.2.2.5. Display adjustment



If the transmitter is equipped with a display, it is necessary to adjust some parameters. First it is necessary to allow its function on the panel and choose the display format with regard to its expected measuring range. The format is fixed and the values are displayed in the pre-set physical units. If you change the physical unit, you have to change also the display format in a corresponding way.

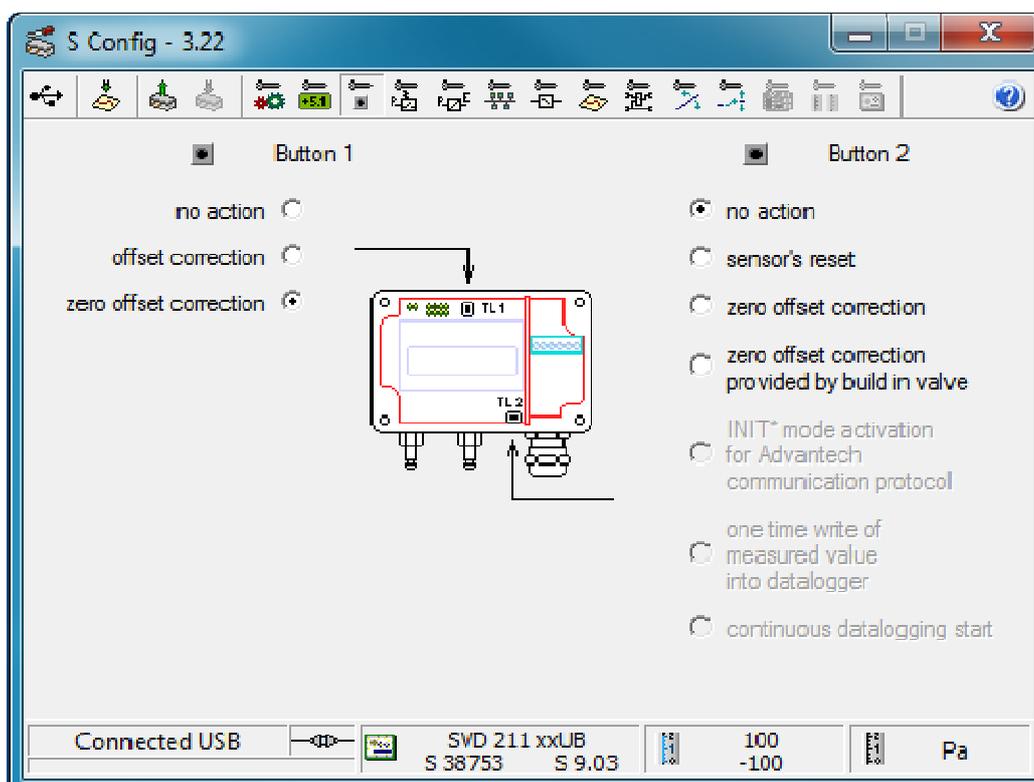
The display is equipped with backlights by means of white LEDs. The data on the display are well legible in external lighting without the backlights switched on. If the backlights are switched on, it is legible even in complete darkness. For the transmitter variation with the two-wire output 4-20mA, it is possible to use only display without backlights because current ca. 20mA is needed for the LEDs power supply. A solution is use of a three-wire output adjusted to the range 4-20mA. The backlights can be software switched by means of the control elements on the panel or, for the case that a PC with the configuration program is not available, hardware switched by means of a J1 jumper on the transmitter printed circuit. For the display backlights activation, there is the OR function between HW and SW control, which means that that it can be switched on by any way but it is switched off by both simultaneously.



The display enables software control of the LCD contrast. An optimal default value is adjusted in production, but the user can adjust own contrast value according to the actual light conditions.

5.2.2.6. Change of internal buttons function adjustment

For some special variations of transmitters, it can be useful to change the default functions of buttons located inside the transmitter on the printed circuit. The basic function of the TL1 button is the offset resetting. When ensuring zero conditions on the transmitter input – disconnection of the measuring tubes, etc. – the instantaneous offset value is read by pressing the button, which is subsequently mathematically distracted from all measured values.



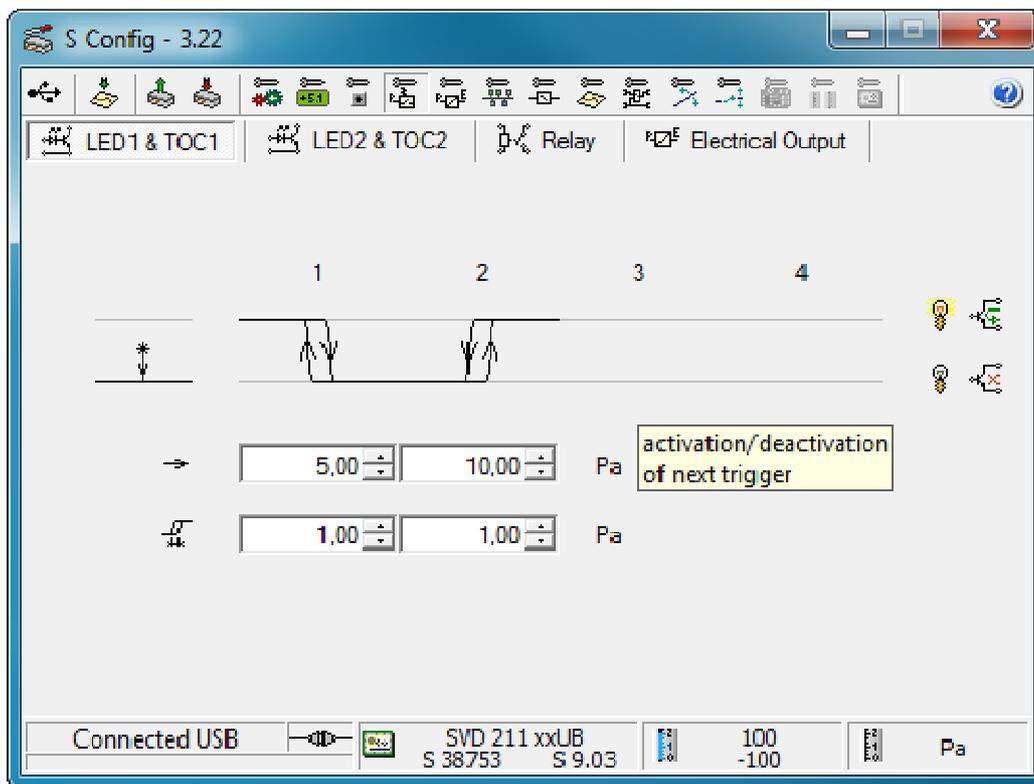
One of the possible functions of the TL2 button is the INIT mode adjustment for communication on the serial line. After the button is pressed, a red LED on the printed circuit is lit up and the 00 address and the communication speed 9600bd are adjusted. This mode is automatically exited by the processor resetting.

5.2.2.7. Two-status outputs



Devices series S can be supplemented with a switching module which enables realization of the switching function. There are two outputs available:

- Two independent outputs of the open connector type with an NPN transistor for currents up to 100mA and voltage 50V. It is possible to switch directly small loads by means of this output – relays, LED, sirens, bulbs, etc. When resistance is connected to the positive pole, it is possible to realize an output with the levels log “0” and log “1”. The transistors switching is indicated by means of red LEDs, which are visible outside the case. These LEDs are in operation even without connected load of the output transistors so it can also be used only for optical signalization of statuses.
- Biteable relay with one contact for the control of electric circuits, which require galvanic separation. The allowed voltage is 40V DC or AD, max. Current up to 0,5A.
- Linear analogue outputs can be switched on the analogue outputs adjustment panel to the two-status mode and realize for example the logic level function. Adjustment of the switching levels is made on this panel. This function can be realized without a supplementary switching module. Regularly it is not possible to operate these outputs in the transmitter two-wire connection. Adjustment of the switching characteristics of single two-status outputs is completely independent.



After choosing the required switching output on the sub-toolbar, it is possible to adjust the initial state after resetting by clicking between the two lines on the very left. By clicking between the lines under numbers 1 to 4, it is possible to choose up to 4 comparing levels. By repeating clicking, it is possible to change cyclically the switching direction in the given point, or its elimination. The change over level is entered into the controls in the upper line, hysteresis in the bottom line, everything in the actual physical units. By entering just one comparing level a simple comparator is realize, a window comparator by two levels. It is possible to define two switching windows by entering four levels. It is the user’s responsibility to adjust meaningful values, especially with regard to the hysteresis.

5.2.2.8. Analogue outputs



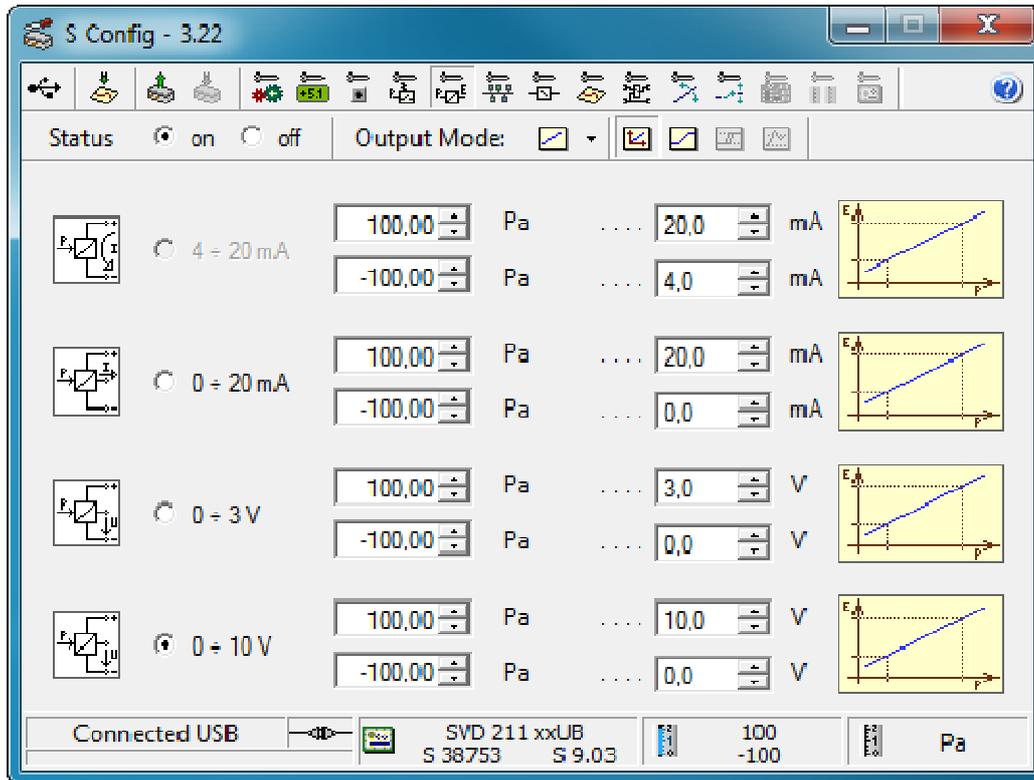
Transmitters series S are equipped with a unique circuit solution which enables software switching between different types of analogue outputs and at the same time change their range in a

certain range. To preserve the guaranteed accuracy, we do not recommend changing the pressure range in a bigger range than 1:3, though it is technically possible.

Keep in mind that you will not change the native range of the pressure sensor itself by software change of the range, especially its pressure overload capacity!!!

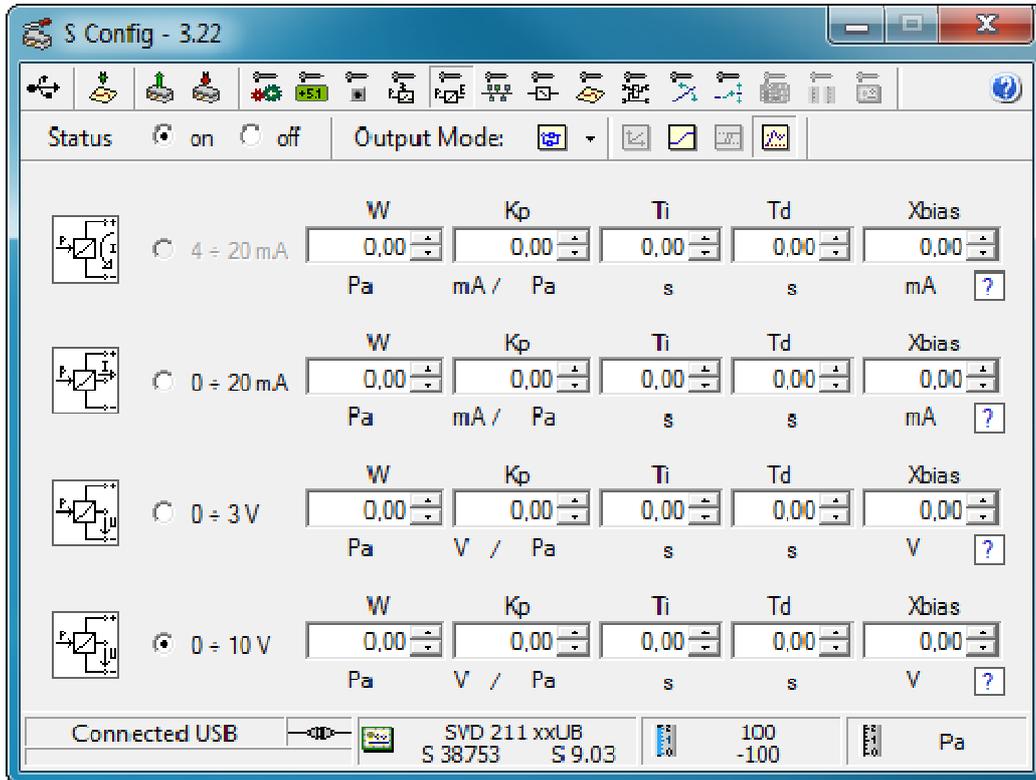
4 types of analogue outputs are available for the user:

- Current two-wire 4 - 20mA
- Current three-wire 0 – 20mA
- voltage 0 – 3V
- voltage 0 – 10V



Conversion to the analogue value is realized by a 12 bit D/A converter whose function is switched-on on the sub-toolbar by the ON choice. If any of the outputs is not available, for example by choosing the additional functions which are not technically compatible with this output, its choice on the panel is withheld. It is possible to adjust nearly arbitrary combinations in the transmitter calibrated range by entering two points of the conversion characteristic. Three-wire output can for example be adjusted in the range 4-20mA for the case when the transmitter cannot be power supplied directly from the two-wire loop because of accessories. It is recommended to use a 3V output for low-voltage measuring systems because of better distinctiveness of the D/A converter.

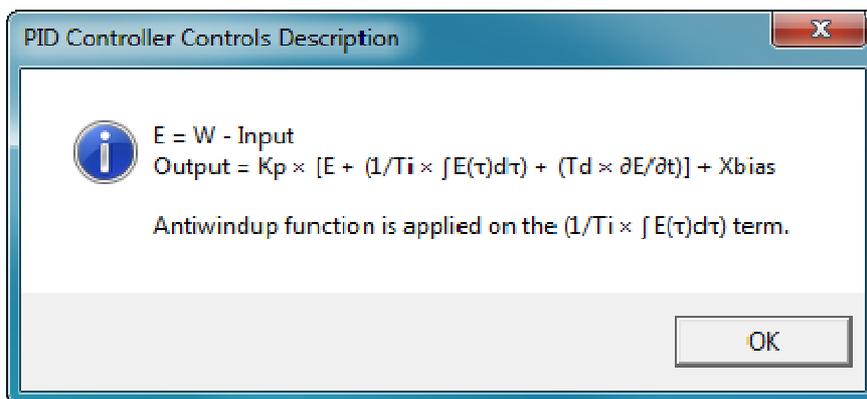
After clicking on the  icon on the sub-toolbar, it is possible, especially because of the protection of associated devices outputs, to adjust software limiting of single outputs range. If for example the output range is adjusted in compliance with the input range of the connected gauge, voltage 10V and more can appear on the output with the power supply 12V and more and with the transmitter pressure overload, which can damage the electric measuring output of the associated device. Adjust the limiting value a bit higher than the required max. output value so that it could be achieved in all circumstances. It is possible to switch it to the two-status mode by means of the output mode choice and enter levels for log. 0 and log.1 for an arbitrary output.



The analogue output mode can also be switched from the firmware 9.01 version to the PID controller mode and realize directly the closed-loop control circuit after connecting the power and actuator. The serial digital output and the display show the actual measured pressure value on the transmitter input all the time.

To avoid confusion of the dynamic parameters of the controller, it is necessary to switch off the limiting function, see chapter 5.2.2.10. The limiting function can also be used for limiting the output signal. The regulation constants are adjusted for each type of analogue output separately. The integral term in the controller equation is treated by the anti-windup function against the output signal "overload".

The analogue output value after switching the PID controller is calculated from the equation:

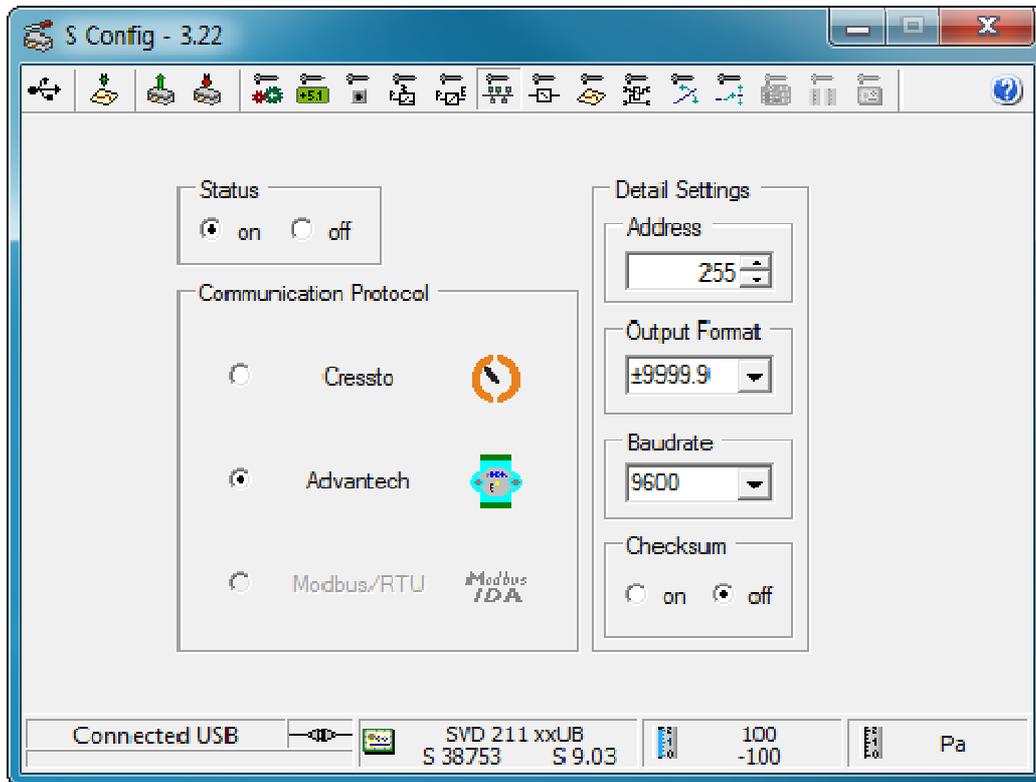


5.2.2.9. Serial digital outputs



Transmitters can also communicate digitally on the serial line. Line RS485 is standard, it is possible to supply made-to-order interface RS232 or USB with a mapped serial port. Except the two-wire type, it is possible to use simultaneously both analogue and digital outputs.

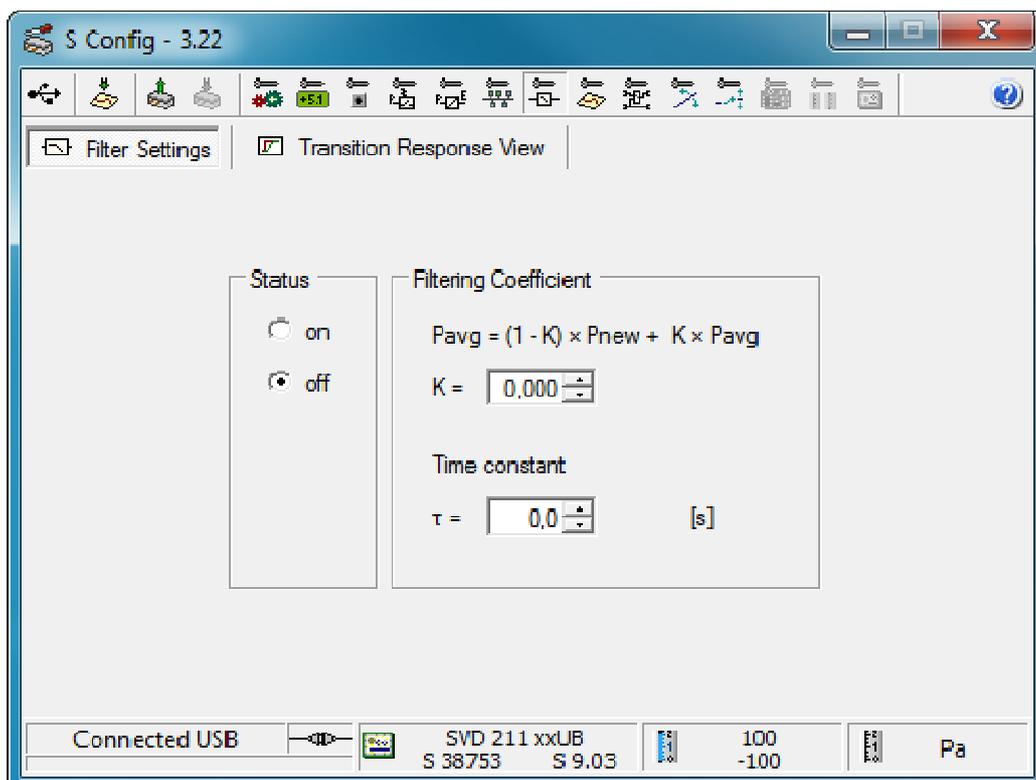
Serial communication must first be allowed by the ON choice. In case of the communication interface RS485, the communication on the line is automatically blocked after the CresProg adapter is plugged in. With the other interfaces the line is shared and it is recommended to disconnect it during configuration. Standardized protocol by the company Advantech is available for a common user. Basic parameters for communication can be adjusted by means of the configuration program. A detailed description of the communication protocol is in the chapter 5.3. The internal protocol Cress to is available only for qualified users. Protocol Modbus has not been implemented yet.



5.2.2.10. Damping adjustment

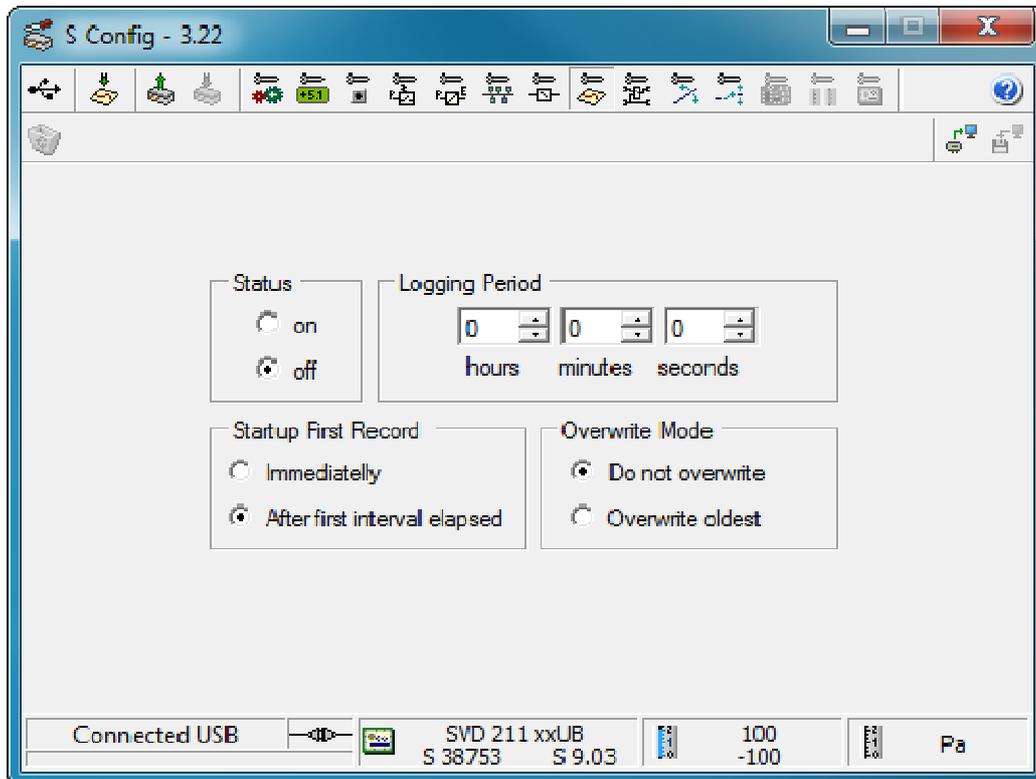
The output value from the transmitter can be damped by a time filter of 1. order. The damping coefficient can be chosen in the range 0 to 0.99. After switching on, selecting the coefficient and recording it to the transmitter, it is possible to check on the tab Step response its expected simplified profile. The coefficient selection is more an experimental matter depending on a particular application.

As the damping coefficient is applied on the central calculated pressure value, it influences equally the output analogue values, data on the display, the reference value for two-status outputs and the value transferred on the serial line.



5.2.2.11. Datalogger

 Devices series S can be equipped with a Flash memory for data recording. As the transmitter has neither a real time clock nor battery backup, it is not a real datalogger, because the records do not have indication about the absolute time. But a recording period can be adjusted. It is possible to save 8000 data to the memory which are available even after power supply is switched off. The recording function must be activated by the ON selection and the recording period must be adjusted into the memory. By selecting *Do not overwrite records*, recording is stopped after the memory is filled, so *the oldest* from the recording start-up are available. By selecting *Overwrite the oldest*, data are recorded to the memory all the time so *the newest* samples are available. If the memory is not overfilled, both types of records are available. All adjustments must be saved in the transmitter.



If recording to the memory is used with two-wire connection, short (ca. 1ms) current peaks with the amplitude up to 200uA can appear in the output signal at levels smaller than 5mA. If it causes problems, use three-wire connection.

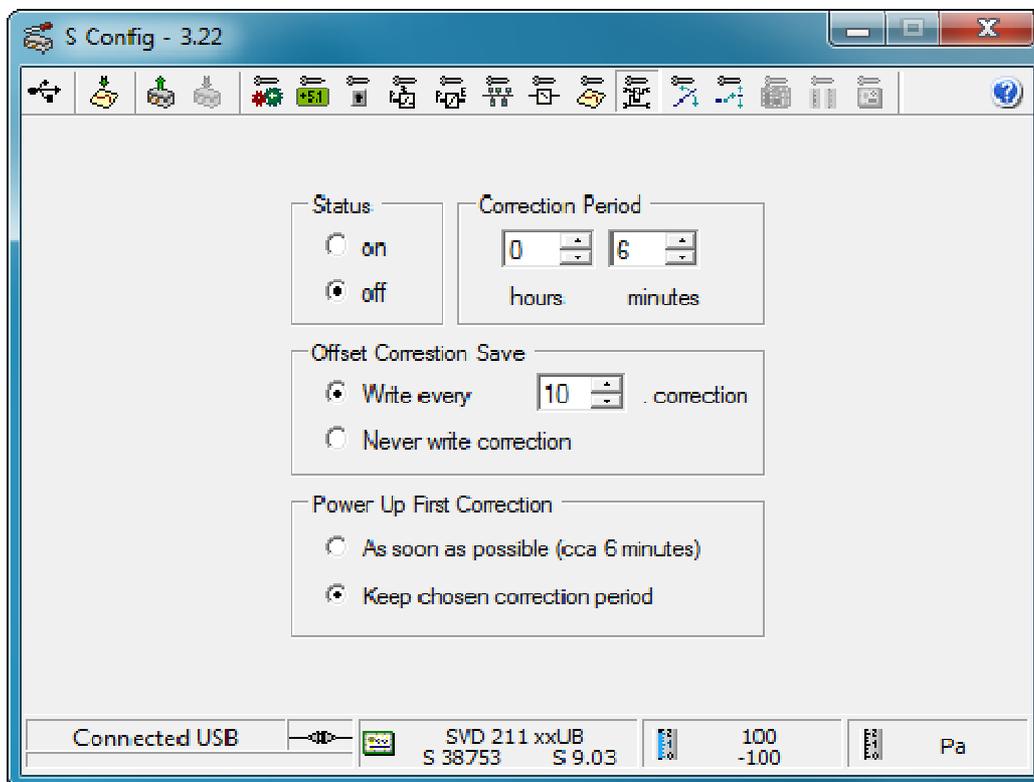
Data saved in the transmitter data memory can be read out to the PC memory by means of the tool on

the sub-toolbar under the  icon and then  saved to the computer disc in the csv format, which can subsequently be processed for example by Excel. By means of the program adjustment, see 5.2.2.1, it is possible to preset a decimal separator – comma or dot – for the transferred numbers. The time necessary for reading out the whole memory is ca. 2 minutes. Data are saved as a series of numbers without time stamps. If the processor is reset or power supply is switched off for unknown time during data recording, one blank line will appear in the data. All data saved in the data memory are deleted by means of this icon .

5.2.2.12. Automatic offset resetting

 Transmitters series SV have a built-in correction of the pressure sensor offset by means of solenoid valve, thereby providing excellent long-term offset stability at very low pressure ranges. By means of this three-way valve the negative pressure input of the transmitter is disconnected in the pre-set period and both pressure sensor inputs are interconnected. The offset value is read after a short stabilization, by which all further measuring are then rectified. All this resetting phase lasts for about 300ms. It is necessary to accrue energy in the electrolytic capacitors for opening the valve. This process takes ca. 6 minutes, it runs completely in the background and influences neither measuring nor other functions of the transmitter. This is related to other selections on this panel. The compensation value calculated during resetting is saved in the RAM memory, so after power supply is switched off and switched on again, it takes minimally 6 minutes before new rectification is measured

and calculated and the transmitter could measure with a certain error during this time. Thus the compensation values are stored to the Flash memory and immediately after the start-up, it is not calculated with zero, but with the last known rectification, which minimizes an error after the transmitter start-up. The problem is that Flash memories have a limited number of records in hundreds of thousands allowed during their lifetime. Thus it is necessary to record only some rectifications to the Flash memory especially when a short resetting period is adjusted, which is not a problem due to very slow processes like time drift of the offset. Rectifications with a period shorter than 1 hour can be made only in special cases. The recommended values are: period 1 hour, record every 10th resetting, reset after start-up immediately after the capacitor is charged.



It is possible to open up some other functions to experienced users by means of hidden functions but they can influence the measuring accuracy, etc. In case of need, contact the producer. The program is constantly improved and modified, new versions will be available for downloading on the web.

5.3. Communication protocol description

Communication is done over the serial line if the transmitter is equipped with it. Communication protocol Adam by the company Advantech is standard available for users.

Basic command syntax:

[delimiter][address][command][data][checksum][carriereturn]

Each command starts with a delimiter. These 4 symbols are allowed: \$, #, %, @. The delimiter is followed by two symbols of the destination module address in hexadecimal format. The following symbols specify the command itself. Data string can follow according to the command type. Then it is followed by an optional two-symbol checksum. Each command is finished with the symbol CR (0DH).

ALL COMMANDS MUST BE WRITTEN IN CAPITALS!

Command	Name	description
%AANNTTCCFF	Configuration adjustment	Adjusts the address, measured value format, communication speed, checksum
#AA	Measured value reading	Returns the measured value in the pre-set format
#**	Synchronized sampling	Commands all modules to measure and save the actual input value to the memory for later reading out
\$AA1	Offset resetting	Resets the actually measured value
\$AA2	Configuration reading	Lists the transmitter configuration
\$AA4	Synchronized value reading	Returns the saved value
\$AA5	reset status	Writes out if the transmitter has been restarted since the last request \$AA5
\$AAF	Transmitter firmware	Lists the firmware version
\$AAM	Transmitter name	Lists the transmitter type – string of 24 symbols
\$AAR	Transmitter range	Lists the transmitter calibrated range – string of 28 symbols

5.3.1. Description of commands

%AANNTTCCFF - configuration adjustment
 adjusts the address, measured value format, communication speed, checksum
AA – current address of the transmitter which you want to configure, the range is 00-FF
NN – new address of the configured transmitter, the range is 00-FF
TT – is a format where the measured value is listed

TT [hex]	Output format
01	±9.9999
02	±99.999
03	±999.99
04	±9999.9

CC – is the serial line communication speed

CC [hex]	baudrate [bps]
03	1200
04	2400
05	4800
06	9600
07	19200
08	38400

FF – allows transfer of the report checksum

FF [hex]	checksum

00	Switched off
40	Switched on

Transmitter response:

!AA(cr) – the command is valid and accepted by the transmitter.

?AA(cr) – the command includes invalid data

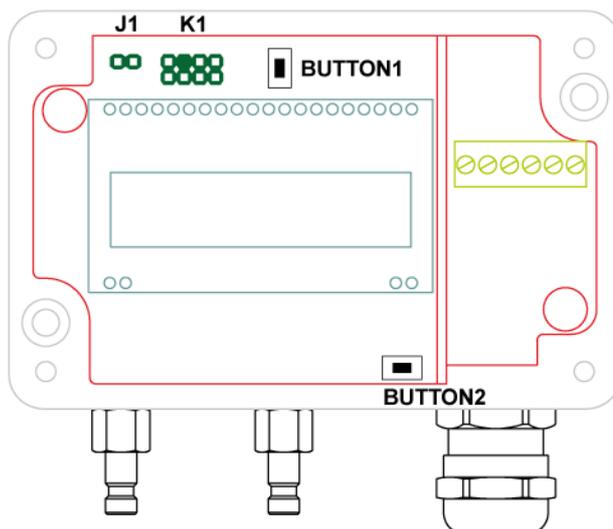
no response – syntax error, communication error or unknown address

Default values: AA = 00, TT = 04, CC = 06 (9600 bd), FF = 00

The configuration adjustment change can be done at any time but we have to know the actual address and the communication speed of the object transmitter. If these parameters are unknown, the communication program can be brought to the INIT* mode by pressing the TL2 button where the default parameters are adjusted. This mode is indicated by lighting LED on the transmitter printed circuit. After new configuration is recorded to the Flash memory, the transmitter will reset automatically and the INIT* mode is left.

Adjustment of other communication parameters for this transmitter type is fixed:

parity none
bit number 8
stop bit 1



- J1 – jumper for display backlights activation
- K1 – connector for connecting the service communication adapter
- TL1 – button for hardware resetting of the transmitter offset
- TL2 – button for the INIT* configuration mode activation

#AA – transmitter input value reading

The command returns the actual input value in the pre-set format from the transmitter with the address AA.

Transmitter response:

>(data)(cr) - input value including the sign
 no response – syntax error, communication error or unknown address

#** - synchronized sampling

This command instructs all modules with analogue inputs, which are connected to the communication line, to execute the input value measuring and save it to its special register. These values can then be gradually read out by means of the corresponding command \$AA4, see later.

Transmitters do not respond to this command in any way.

\$AA1 – transmitter offset resetting

The transmitter offset can be reset by means of this command. Actually measured value is recorded to the Flash memory and then deducted from each measured value. Before application of this command, it is absolutely necessary that the inputs are in the state in which the transmitter should transfer zero value. In case of transmitter of relative or differential pressure it means disconnection of pressure inputs, in case of measuring absolute pressure vacuum must be applied to the input.

Transmitter response:

!AA(cr) – the command is valid and accepted by the transmitter

?AA(cr) – the command was not accepted by the transmitter

no response – syntax error, communication error or unknown address

\$AA2 – transmitter configuration reading

By means of this command, it is possible to find out the actual transmitter configuration.

Transmitter response:

!AATTCCFF(cr) – the command is valid and accepted by the transmitter. Meaning of variables TT, CC, FF, see command for configuration adjustment %AANNTTCCFF

?AA(cr) – the command was not accepted by the transmitter

no response – syntax error, communication error or unknown address

\$AA4 – synchronized value reading

This command returns the value which was previously recorded to the special register after executing the synchronized sampling command.

Transmitter response:

!AA(status)(data)(cr) – the command is valid and accepted by the transmitter. The status parameter indicates whether the value has been sent at least once since the last synchronized sampling. If the status has value 1, the data are sent for the first time, if it has value 0, the data have been read out at least once. ATTENTION – status 0 can also mean that the previous command for synchronized sampling has not been executed by the transmitter!

?AA(cr) – the command was not accepted by the transmitter

no response – syntax error, communication error or unknown address

\$AA5 – reset status

By means of this command, it is possible to find out whether the transmitter has been reset since this last command.

Transmitter response:

!AA(Status)(cr) – the command is valid and accepted by the transmitter. Value 1 means that the transmitter has been reset or connected to power supply since the last request. Value 0 means that the transmitter has not been reset.

?AA(cr) – the command was not accepted by the transmitter

no response – syntax error, communication error or unknown address

\$AAF – firmware version reading

By means of this command, it is possible to find out the actual transmitter firmware version.

Transmitter response:

!AA(Version)(cr) – the command is valid and accepted by the transmitter. The parameter Version is a string which includes the firmware version code in the form S 1.00

no response – syntax error, communication error or unknown address

\$AAM – transmitter name reading

By means of this command, it is possible to find out the transmitter type.

Transmitter response:

!AA(Name)(cr) – the command is valid and accepted by the transmitter. The parameter Name is a string with fixed length of 24 signs which includes the transmitter type according to the marking system stated in the corresponding catalogue sheet. The actually adjusted physical unit is also a part of the string.

no response – syntax error, communication error or unknown address

\$AAR – transmitter range reading

By means of this command, it is possible to find out the range, in which the transmitter is calibrated.

Transmitter response:

!AA(Range)(cr) – the command is valid and accepted by the transmitter. The parameter Range is a string with fixed length of 28 signs, which includes the bottom and upper end of the transmitter calibrated range. The physical unit, in which the transmitter was calibrated, is also a part of the string.

no response – syntax error, communication error or unknown address

5.3.2. Checksum

helps to eliminate errors during communication between the server and the transmitter. This parameter will add two signs to the command for the server and also to the transmitter response. These signs are placed behind the report itself before the terminator. This character is activated in the configuration adjustment command, see above. It is necessary to stress that all elements of the system must work with the same communication speed and all of them must have the same adjustment or disabling of the checksum generation.

Checksum is represented by 2 signs in ASCII hexadecimal format. It is calculated as a simple sum of ASCII values of all report signs before the checksum signs including the start delimiter. This sum is modified by the function mod 256 (100H) – remainder after dividing. If the sum is absent or is incorrect, the transmitter will not respond.

Also other communication protocols can be supplemented into the firmware according to the user's request and interest.

5.4. Communication protocol Cresso

Transmitters enable the user to communicate over the serial line also by means of a simple ASCII protocol, which is on the serial communication adjustment panel, see chapter 5.2.2.9, selected by the Cress to icon. For this communication, it is necessary to adjust the communication speed in this firmware version to 9600 bauds, 8 data bits, no parity bit and 1 stop bit. The communication system is request – response.

PRESSURE – request for the main measured value, which is pressure in transmitters. It can also be a different physical value in simple display indicators.

Command : >**M (3EH 2AH 2AH 4DH)

Response :

s	s	m	m	m	m	m	m	#
sign		Number in hexa format with fixed decimal point mmmm,mm						terminator (23H)

sign: 00 (30H 30H) – positive number
 01 (30H 31H) – negative number

An example for a transmitter calibrated in kPa:
 0100A45F# = $-(0 \cdot 16^3 + 0 \cdot 16^2 + 10 \cdot 16^1 + 4 \cdot 16^0 + 5 \cdot 16^{-1} + 15 \cdot 16^{-2}) = -164,37$ [kPa]

TEMPERATURE – request for temperature. It is oriental temperature of the microcomputer chip inside the transmitter. Measuring accuracy is ca $\pm 1^\circ\text{C}$, moreover the chip is heated by its own consumption which can cause additional error ca 1 to 3 $^\circ\text{C}$.

Command : >**C (3EH 2AH 2AH 43H)

Response :

m	m	m	m	#
Gross value from the converter hexadecimal				terminator (23H)

Conversion of the value from the converter to temperature

$$\text{temperature } [^\circ\text{C}] = (\text{value from the converter} / 256) - 128$$

Response example:
 9E20# = $(40480)_{10} ; (40480/256) - 128 = 30,1^\circ\text{C}$

OFFSET RESETTING – command for the transmitter offset resetting execution. The user has to secure zero pressure conditions on the transmitter inputs. By execution of this command, the actual value is measured, saved to the Flash memory and then deducted from all measured values. This command is identical to pressing the reset button in the transmitter.

Command : >**Z (3EH 2AH 2AH 5AH)

Response : !# (21H 23H)

This command is blocked in absolute pressure transmitters and display indicators.

OFFSET CORRECTION – The command is similar to the previous one. The user has to secure zero pressure conditions on the transmitter inputs. By execution of this command, the actual value is measured, saved to the Flash memory and then deducted from all measured values and at the same time the Correction value is added. The Correction value can be adjusted by means of the SConfig program, 0 is adjusted by default. The command is used for the defined shift of the transmitter zero.

Command : >**N (3EH 2AH 2AH 4EH)

Response : !# (21H 23H)

OFFSET RESETTING WHEN PRESSURE IS CONNECTED BY MEANS OF A VALVE – the command has a sense only for transmitters series SV which are physically equipped with a valve. Resetting can be executed after the internal capacitors are charged, which can last up to ca 6 minutes. Consider for the use of this command that periodic resetting by the internal program is standard switched on in these transmitters.

Command : >**O (3EH 2AH 2AH 4FH)

Response : !# (21H 23H) for the case of executed resetting

Response : -# (2DH 23H) for the case of rejected resetting because of insufficient voltage on the capacitors or in transmitter version without a resetting valve.

FIRMWARE VERSION – request for the implemented version

Command : >**I (3EH 2AH 2AH 49H)

Response example : **S 6.09#**

NOTICE : *The transmitters themselves, their firmware and also service software SConfig are continuously improved and supplemented with parameters and functions, so some characteristics and procedures can be slightly different from those described here. If in doubt, always secure in advance the actual firmware version or the SConfig program version and then contact the producer with a request for help.*

6. RECOMMENDATIONS FOR CORRECT APPLICATION

- Before the transmitter is connected to the pressure circuit, it is necessary to check if the measured pressure corresponds with the nominal range of the transmitter. Even a short-term overload over the maximum allowed overpressure can cause destruction of the measuring membrane!
- Before connection to the pressure circuit, it is necessary to check resistance of the transmitter materials which come into contact with the measured medium.
- When sealed to the thread (Teflon, tow) for liquid media, it is necessary to take extra caution, because screwing into closed volume of liquid can cause uncontrolled pressure increase and thus destruction of the measuring membrane!
- Unless otherwise specified, transmitters series S are always fitted with a digital serial output, typically RS485, which does not have to be used and does not have to be hardware or software treated. The output type is marked on the product label.
- Unless otherwise specified, transmitters series S are always equipped with a universal analogue electric output. Particular output types and their ranges are software adjusted. If the user does not use any analogue output and uses other functions of the transmitter, the analogue output must not stay adjusted in the two-wire 4-20mA mode, otherwise correct function of the other circuits is not secured.
- The calibrated transmitter range is stated on the transmitter production label and in its range the user can adjust own measuring range. The measuring range and type of analogue output, which was adjusted in production, are also stated on the production label. It is the user's responsibility to record the actual values in their changes to the accompanying documentation or to inscribe them to vacant places on the label by means of a CentroFix. Actual adjustment can be detected by means of the communication product CresProg and software S-Config at any time.
- Maximum conductor cross section 1mm^2 is allowed for the used terminal blocks. Especially with a higher number of connected outputs, we recommend using conductors with smaller cross sections because of limited space.

Other recommendations are supplemented gradually.

Thank You for using CRESSTO s.r.o. products.