EMSYST, spol. s r. o., Súvoz 111, 911 01 Trenčín

Universal digital signal conditioner

EMS720

User manual

Document version: 260406

INTRODUCTION

This manual describes in detail the use of the digital signal conditioner EMS720. It has three parts:

- ***A HARDWARE*** is a description of the signal conditioner inputs and sensor connections.

- ***B SOFTWARE*** is a description of the software with which the signal conditioner can be set up and data can be read from it.

- ***C EXAMPLES*** is the signal conditioner settings on specific examples.

Additional information is available on the manufacturer's website, in case of specific technical questions it is also possible to write an email or call the manufacturer.

The warranty period is 2 years from the date of purchase of the device. If you require warranty or post-warranty service, please contact the supplier or the manufacturer directly.

Manufacturer contact:

EMSYST, spol. s r. o.

Súvoz 111

911 01 Trenčín

Tel. +421 32 7432400

mail@emsyst.sk

www.emsyst.sk

CONTENT

A HARDWARE

1 Safety instructions

Before installing the signal conditioner, read and follow these instructions.

The EMS720 signal conditioner is designed to process signals from strain gauge force sensors or other signals defined in this document. Do not use the signal conditioner for other purposes.

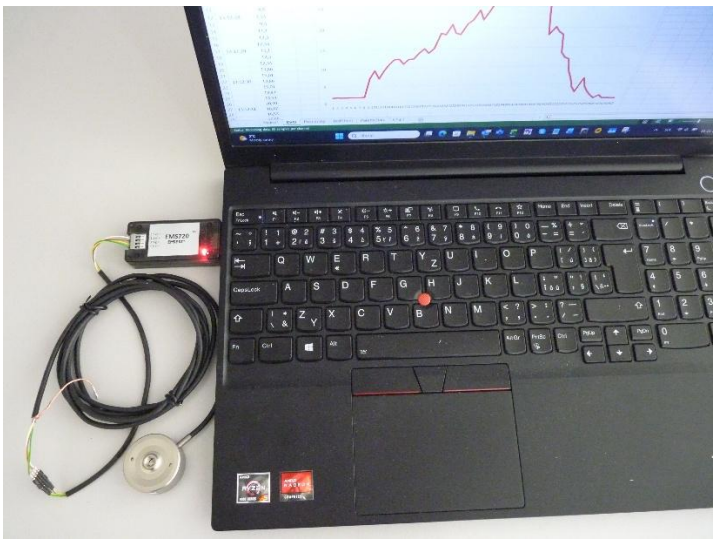
Do not exceed the input signal level above 10 V (voltage inputs) or above 20 mA (current inputs).

Observe the ambient conditions: max temperature +50 °C, relative humidity (non-condensing) up to 95%.

It is prohibited to change or modify anything on the signal conditioner without the manufacturer's consent. In case of problems with installation, adjustment, etc., contact the manufacturer.

2 Mounting (installation) of the signal conditioner

Mounting (installation) is carried out by simply inserting the signal conditioner into the USB connector, type A. The optimal connection is directly into the computer connector. If an expansion module (USB – hub) is used, this may cause problems with data transfer with a higher sampling frequency. It is not recommended to use it near contactors and other high-current devices, especially due to the interference that such devices cause. The working position of the signal conditioner is arbitrary. The signal conditioner connected to the computer is shown in Fig. A.1.



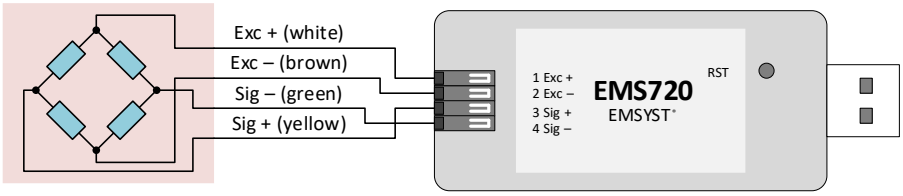
Obr. A.1 Connecting the EMS720 to a computer

3 Configuring the EMS720 Transmitter

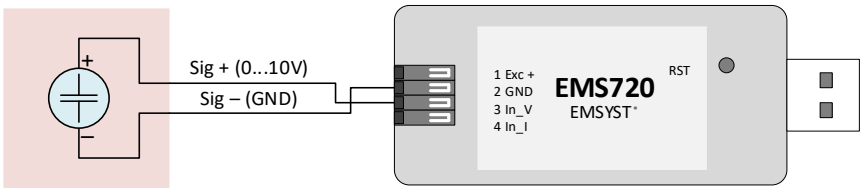
Configuration refers to setting up the transmitter inputs to measure different types of signals. ***Hardware*** configuration involves connecting the sensor to the correct terminals and is described in this section (Part A). ***Software*** configuration can be performed after connecting the transmitter to a computer using the utility menu (Part B).

4 User hardware configuration

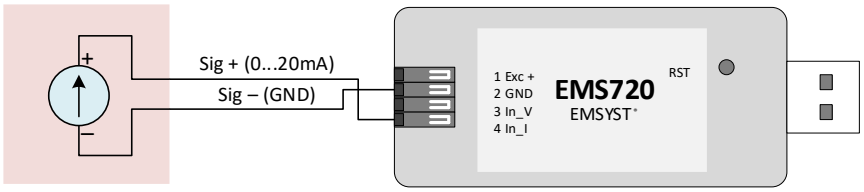
The EMS720 signal conditioner is designed to process three types of signals. This means that some terminals have multiple functions. The terminal functions are set in hardware, on the printed circuit board and also in software. Hardware settings can only be made ***by the manufacturer***, software settings are made by the user using the ***Control700*** software. Therefore, it is necessary to specify the hardware settings when ordering. The three types of settings designed to process the three types of signals are shown in the figures.



Obr. A.2 Connecting a strain gauge force sensor



Obr. A.3 Connecting the voltage signal source



Obr. A.4 Connecting the current source

5 Other Configuration

The EMS720 signal conditioner can be configured for other signal sources, but you must contact the manufacturer with your request.

6 Technical specifications

Electronic specifications	
Inputs [1]	
Differential input for a strain gauge sensor	0 ... ± 7 mV/V
Voltage input	0 ... 10 V
Current input	0 ... 20 mA
Sensor excitation	2.5 V / 60 mA
ADC	Sigma-Delta, 24-bit internal resolution
Temperature coefficient	
On input voltage (offset drift)	0.5 µV / °C
On gain	20 ppm / °C
On-line data transmitting (monitor)	
Sampling rate	1 sample pre second
Recording data in an Excel spreadsheet	
Sampling rate	1 ... 100 samples pre second
Max recording capacity	1.000.000 samples
Power supply	
Voltage (USB)	5 VDC
Max current draw including the sensor	50 mA
Connecting to a PC	
Connection type	USB 2.0 (virtual Com Port)
Parameters	115200 Bd, 8 bit, no parity,1 stop
Protocol	JSON protocol
Operating conditions and mechanical design	
Working temperature	0 ... + 50 °C
IP	IP40
dimensions (d x š x h)	65 x 30 x 15.5 mm

Notes
1 The converter has only one input, the required type must be specified in the order.

B SOFTWARE

1 Control700 Program

The ***Control700*** program was created as an Excel ***Add-in*** for setting up the EMS700 series signal conditioner and collecting data. It only works in the Excel environment (from version 2019) and must be installed before first use as described below.

It is also possible to communicate with the signal conditioner using other programs, provided that the correct communication protocol is used. For more information, contact the manufacturer.

1.1 Control700 Installation

When installing for the first time, the add-in is first saved to a folder where it will remain for the entire period of its use. The add-in is then registered in Excel. This ensures that it is automatically launched each time Excel is opened.

Installation procedure:

- Create a folder to save the add-in. ***Example: This computer > Documents > EMS700***
- Download or copy the ***Control700.xlam*** add-in and save it to the created folder.
- Open Excel and a ***blank workbook*** or any other file in it.
- Load the add-in in the standard way. Example: ***File - Open - Browse - This computer > Documents > EMS700 > Control700.xlam***
- Note. In some versions of Excel, the message ***File is blocked*** may appear when opening the add-in. In this case, the file must be unblocked as follows. Right-click on the Control700 file and open the Properties menu. There is an Unblock checkbox in the menu. Check the checkbox and confirm by pressing OK.
- After loading the add-in, a new tab called ***Control700*** will be created on the ribbon.
- Click on ***File – Options – Add-Ins*** and then on the ***Go…*** button. The ***Add-ins*** window will appear.
- In the window click on ***Browse*** and find the ***Control700.xlam***. Select it and confirm by pressing OK.
- Control700.xalm will be added to the ***Available Add-Ins*** list. Check the checkbox, the Add-in is now installed and can be used.

1.2 Deactivating and activating the add-in

Deactivating the add-in removes the Control700 tab on the ribbon. However, the add-in itself remains in Excel, and it can be activated later.

Deactivation procedure:

- Open Excel and switch to the list of add-ins: ***File – Options – Add-ins***. Then press the ***Go...*** button to open the ***Add-ins window***.
- In the window, uncheck the ***Control700.xalm*** checkbox and confirm by pressing OK.
- Close Excel (no saving of changes is required).
- The next time you open Excel, the ***Control700*** tab will no longer be on the ribbon.

When ***activating*** the add-in later, proceed in the same way, i.e. open the Add-ins window. Then check the check box next to Control700 to activate the add-in.

1.3 Uninstalling an Add-in

Uninstalling is done simply by deleting or renaming the add-in. However, when opening Excel, an error message appears stating ***Sorry, we couldn't find...***, including a question as to whether you wish to remove it. Confirm the message by pressing OK, which will unregister it in Excel.

2 Control700, description of functions

The description assumes that the Control700 add-on is installed and the Control700 tab is open. This basic setting is shown in Fig. B-1.

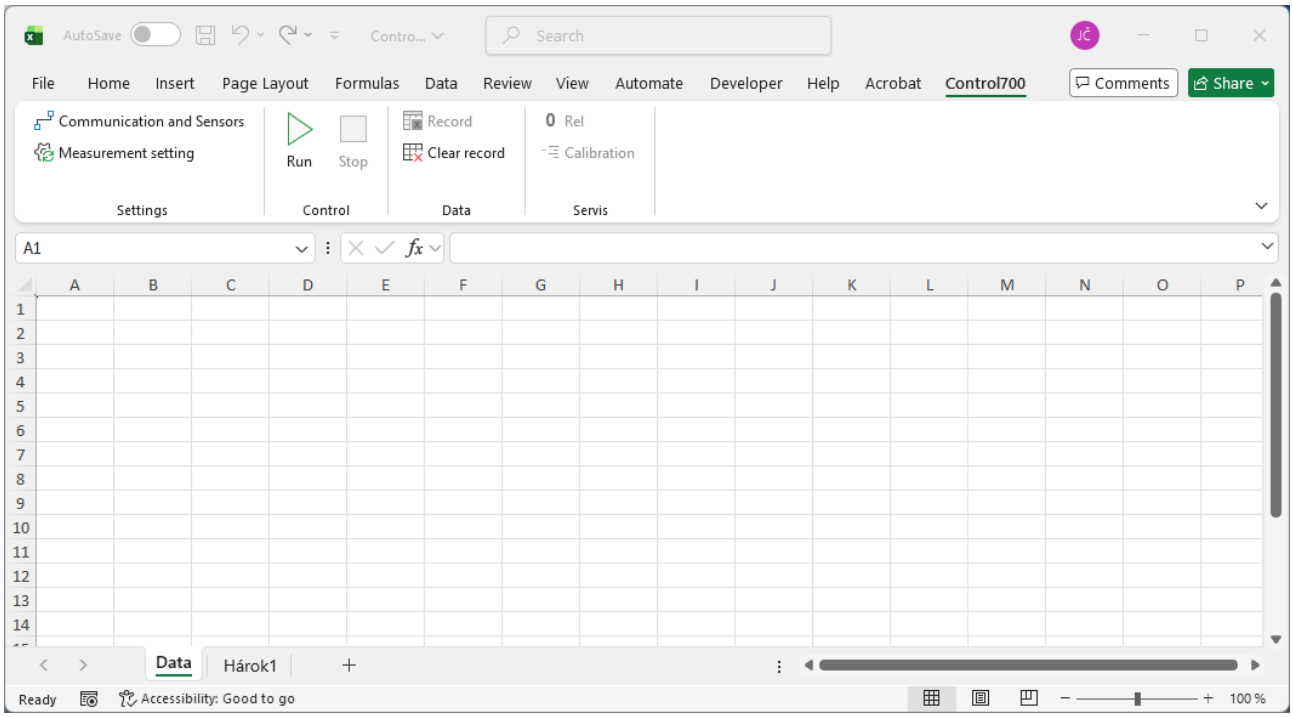


Fig B-1 Tab Control700

2.1 Connecting to communication ports

The menu for connecting transducers to communication ports is displayed after clicking on ***Communication and Sensors***. A window will appear (Fig.B-2) that allows you to connect 4 transducers. The transducers are marked A, B, C, D.

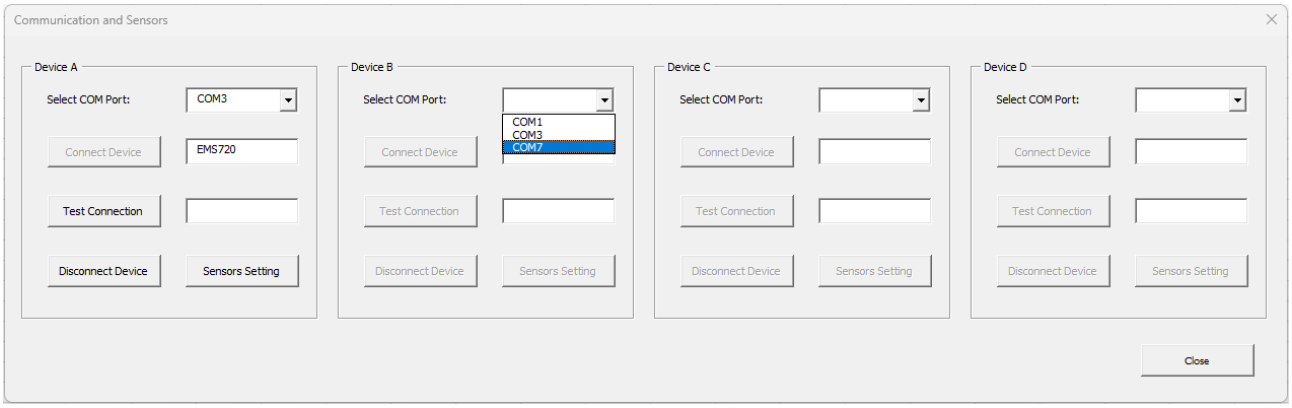


Fig B-2 Menu for connecting to communication ports

Communication port connection procedure

- Select the signal conditioner (A, B, C, D) and click on the ***Select COM Port*** drop-down menu. All free communication ports will be displayed.
- Select the communication port and click on the ***Connect Device*** button. After a short time, the type of connected signal conditioner will be displayed in the secondary window.
- The ***Test Connection*** button allows you to test the connection. It is suitable for identifying the signal conditioner if more than one is connected.
- The ***Disconnect Device*** button can be used to disconnect the connected signal conditioner, thereby freeing up the communication port. However, the menu must be closed with the ***Close*** button and reopened because the list of free ports is created only when the menu is opened.
- After setting the ports, you can proceed to setting the sensors using the ***Sensor Setting*** button (described below). If they have already been set in the previous operation, the menu is closed with the ***Close*** button. This saves the settings in the signal conditioners. If the menu is closed only with the cross in the upper right, the window is closed but the set parameters are not saved.

2.2 Connecting the sensor

The sensor can only be set for one transducer at a time. Select the transducer according to the marking A, B, C or D and press the ***Sensor Setting*** button. (Fig.B-2). The window according to Fig. B-3 will open.

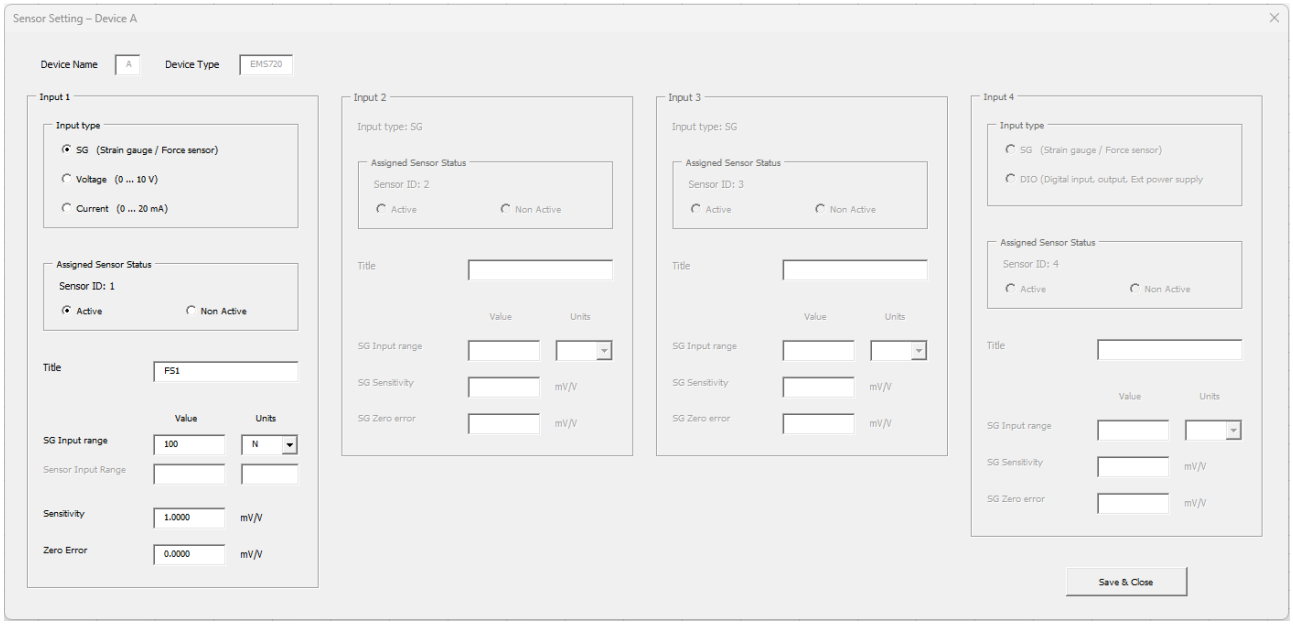


Fig B-3 Sensor setting

Setup procedure

- A sensor with voltage or current output can only be connected to ***Input 1***, strain gauge force sensors can be connected to any input. Depending on which sensor is connected, the Input type is set. Please note that it is also necessary to set the hardware jumper in the signal conditioner correctly - see section A.
- In the ***Assigned Sensor Status*** section, select ***Active***.
- ***Title***: a concise name for the sensor function, e.g. ***Total force***, etc.

Setting other parameters depends on the type of sensor connected.

- ***SG type sensor***
- ***SG Input Range***: sensor range in units of force or weight
- ***Units***: sensor range units, in this case force or weight
- ***SG Sensitivity***: sensor sensitivity in mV/V
- ***SG Zero error***: sensor zero error in mV/V

- ***Voltage or Current type sensor***
- ***Sensor Input Range***: sensor range in physical units, e.g. bar, m/s, etc. The unit can be any, but can have a maximum of 5 characters.
- ***Output max***: maximum value of the sensor output in V or mA units
- ***Output min***: minimum value of the sensor output in V or mA units
- Only a strain gauge force sensor can be connected to inputs 2, 3 and 4, it is set in the same way as the SG type sensor in the previous section.
- Input 4 can be used for external power supply of the signal conditioner. In this case, ***Non Active*** is set in ***Assigned Sensor Status***.

More detailed information on setting sensor parameters is given in the examples in section C.

2.3 Setting measurement parameters

After connecting at least one signal conditioner, the ***Measurement setting*** item on the ***Control700*** tab becomes available. After clicking on the item, the window according to Fig. B-4 opens. The menu allows you to set some measurement parameters.

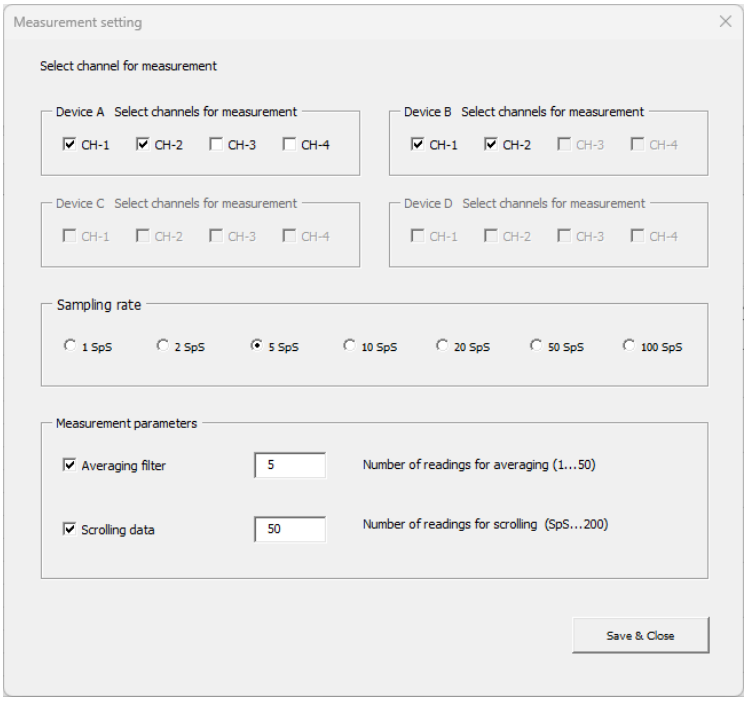


Fig B-4 Measurement setting

Select channel for measurement. From the inputs to which sensors were connected, it allows you to select those that will be actually measured. After saving this menu, the headers of the channels that will be measured will be displayed on the sheet.

Sampling rate. The sampling rate (number of samples per second) is set independently of the number of measured channels.

Averaging filer. Averaging of input data, the number of values for the average can be selected in the range 1 ... 50.

Scrolling data. If this option is set, in Record mode the measured data will be scrolled depending on the number of measured data set.

2.4 Measurement Mode

Press the ***Run*** button to start the measurement. In measurement mode, all active channels are sampled every second and the data is written to the columns for each channel (Fig. B-5).

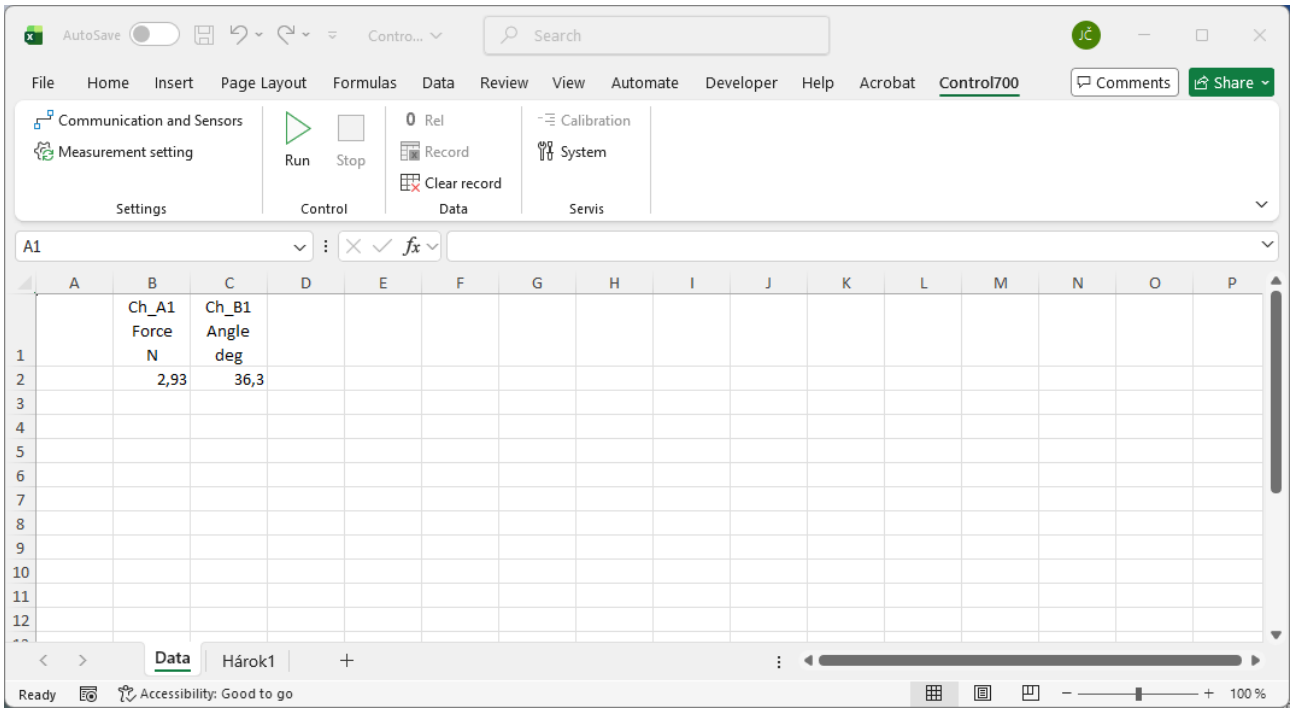


Fig B-5 Mode Run

The following buttons are active in measurement mode.

Stop measurement.

Rel Press this button to reset the measured channels. Press it again to cancel resetting.

Record data on a sheet, described below.

Calibration of individual channels, described below.

2.5 Recording measurements

Pressing the ***Record*** button starts recording data on the Data sheet. The signal conditioner starts measuring at the speed set in the ***Sampling rate*** parameter and writing to the sheet. Data transfer and therefore writing are done every second. The maximum number of recorded data can be ***1,000,000***.

If the ***Scrolling data option*** parameter is set, only the set number of scrolled data is written.

2.6 Calibration

A significantly more accurate measurement can be achieved by calibration. When calibrating, we recommend that the averaging filter be turned on and the number of values for the filter should be at least 10. Calibration can only be performed in measurement mode and only if one measurement channel is active. If these conditions are met, calibration is started by pressing the ***Calibration*** button. The calibration menu is displayed, Fig.B-6.

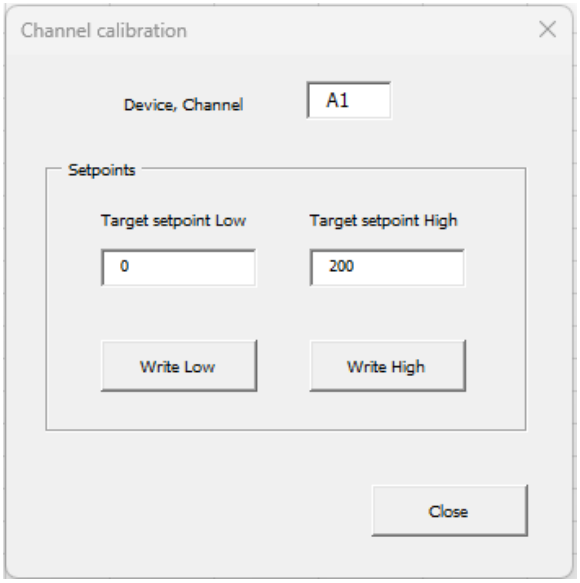


Fig B-6 Calibration menu

Calibration procedure

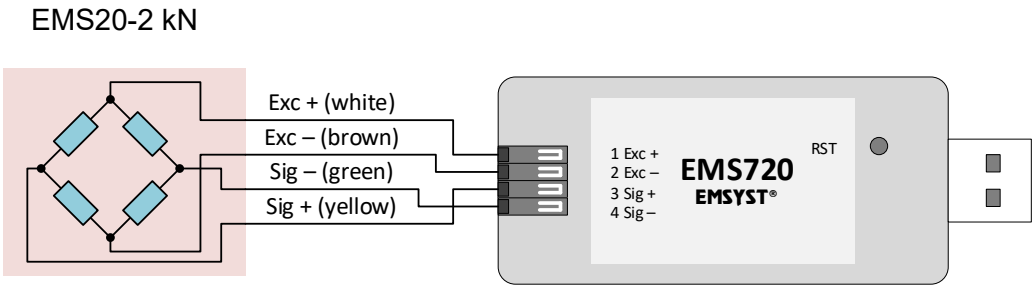
- Unload the force sensor or set it to the initial position if it is not a force sensor.
- If the unloaded (initial) position is zero, write zero in the ***Target setpoint Low*** box. If it is not zero, write the actual value. After writing, press ***Write Low***.
- Load the sensor with a value close to the nominal value and wait until the data stabilizes. The measured value is displayed on the sheet as in the standard ***Run*** mode.
- Enter the value with which you loaded the sensor in the ***Target setpoint High*** box, then press ***Write High***.
- Calibration is complete, the displayed data will become Target setpoint High, the menu can be closed with the ***Close*** button.

C APPLICATION EXAMPLES

1 Strain gauge force sensor

A signal conditioner needs to be set up for measuring a strain gauge force sensor EMS20-2kN with a sensitivity of 1.495 mV/V and a zero error of 0.032 mV/V.

Connection



Setting

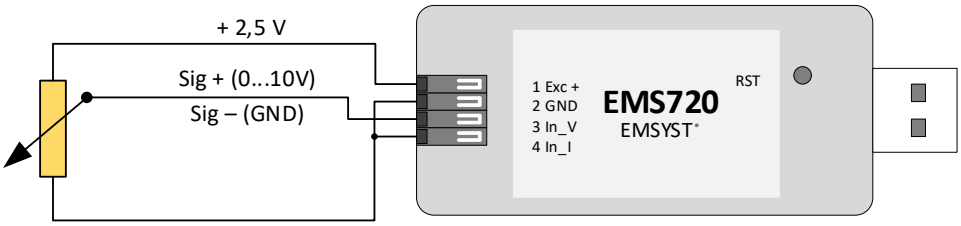
- Input type: SG
- SG Input range: 2
- Units: kN
- Sensitivity: 1.495
- Zero Error: 0.032

2 Resistive distance sensor

A potentiometric distance sensor with a range of 150 mm must be connected to the EMS720 signal conditioner so that it measures the distance via the runner.

Connection

The potentiometer is connected to the signal conditioner terminals according to the figure, the voltage for powering force sensors with a nominal value of 2.5 V is used to power the potentiometer. Only the EMS720-Volt converter can be connected in this way.



.

Setting

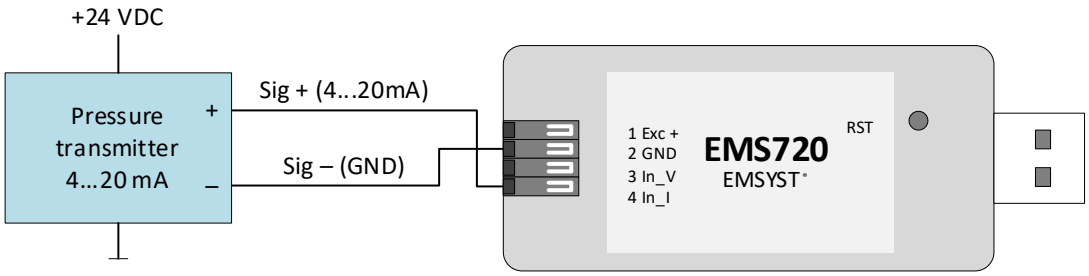
- Input type: Voltage
- Sensor Input Range: 150
- Units: mm
- Output Max 2,5 V
- Output Min 0,0 V

3 Pressure sensor with current output

A pressure sensor with a range of 250 bar and a current output of 4 – 20 mA is to be connected to the EMS720 transmitter. The supply voltage of the sensor is 24 V.

Connection

This is a current source that can only be connected to the EMS720-Curr converter. The pressure sensor must have a separate 24 VDC power supply in this case. Terminals 1 and 2 are unused in this case.



Setting

- Input type: Current
- Sensor Input Range: 250
- Units: bar
- Output Max 20
- Output Min 4