User Manual

Analog to digital converter

PM-AT13

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(021) 91009955
info@parsmega.com
www.parsmega.com
09981122566

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1 Introduction

1.1 The purpose of the manual

This manual contains all the information needed to set up, install, wiring and communicate with the PM-AT13 module.

1.2 Technical knowledge required

In order to understand this booklet, a basic acquaintance with electrical topics is required.

1.3 Manual validation

This booklet is valid for this specification.

MODEL	Hardware	Software
PM-AT13	V1.2	V1.5

1.4 Technical Support

To get technical support through the following contact:

- Email: **info@parsmega.com**
- Phone: **+98 21 91009955**
- WhatsApp: **+98 9981122566**

2 safety tips

- Starting the module by non-experts and ignoring the commands may cause serious damage to the module.
- This module does not directly pose a risk to human life.
- The use of this module is not approved for use in life-threatening devices.

3 Description

3.1 Basic description

PM-AT13 is an analog to digital converter that can connect and convert the following standard signals

- 0-10 volts
- +10 volts
- +20 mA
- 0-20 mA

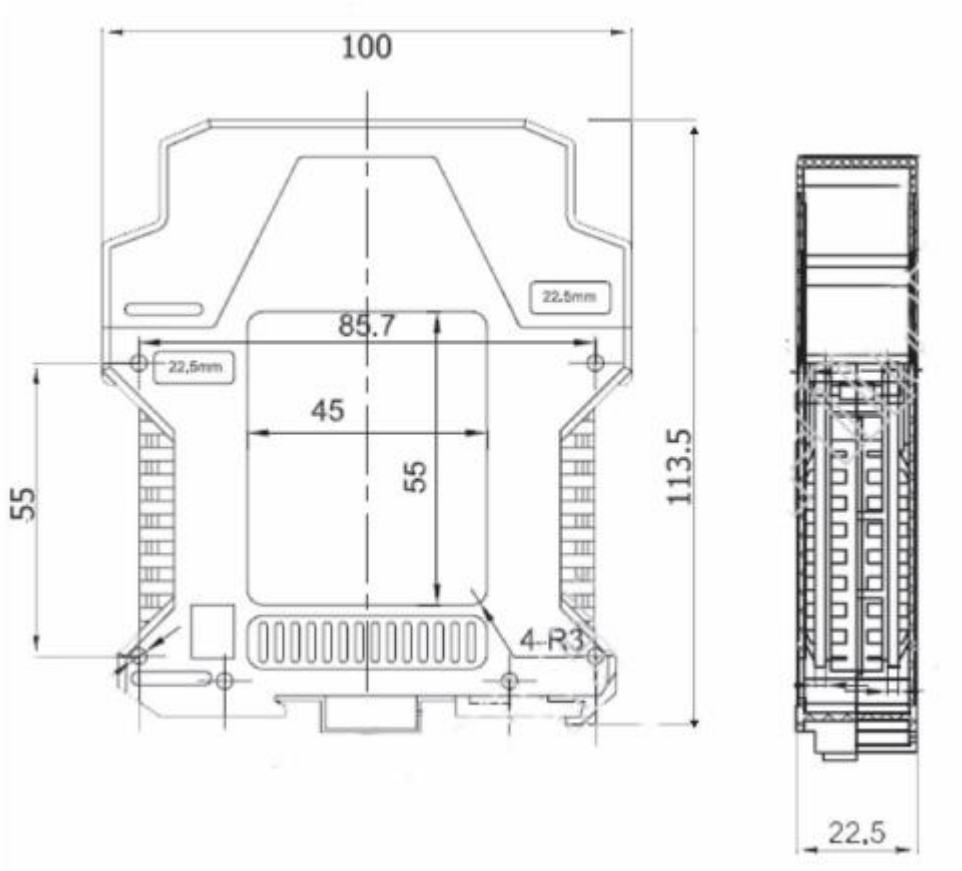
This module has the ability to connect to a computer and control equipment such as (HMI and PLC).

According to the features of the module, you can easily convert analog quantities into digital values.

3.2 Technical Specifications

- Wide range of port 485 baud rate (from 2400 to 230400)
- It has a module status display (LED).
- Determination of sampling speed
- 24-bit analog to digital converter
- Three analog input channels
- The working temperature range is +30 ~ +75 degrees Celsius
- RS485 serial communication with MODBUS protocol support

3.3 Module dimensions



4 Installation

4.1 Observe EMC items

This product is designed and manufactured to work in industrial environments. However, for proper operation, you should check and eliminate the issues that cause the module to malfunction.

4.2 Cases that cause system malfunctions

- Electromagnetic field
- Telecommunication cables
- Power circuit cables

4.3 Things to consider

4.3.1 Convenient ground connection

• When installing the module on the panel body, make sure that the panel body is connected to the ground.

• All ineffective metal parts are (firmly) grounded.

• When connecting varnished wires to ground connection, remove the varnish from that part.

4.3.2 Appropriate wiring method

• Divide your system cables into different groups (high voltage, power supply, and signal, analog).

• Always transfer the power cable from another duct.

• Always place your analog cables close to the body of the panel and rails (which are grounded).

4.3.3 Cable shield connection

• Make sure the shields are properly grounded.

• Try to keep a small part of the cable without a shield.

5 connections

All the connections of this module are screws

5.1 Connections group

The connections of this module include 3 main groups:

- Power
- Analog input
- RS485 serial

5.2 Power supply connection

The proper power supply for this module is 24 v dc, otherwise the device will not function properly.

Terminal 0 v

terminal 24 v

5.3 Analog input connection

PM-AT13 module has the ability to connect to three analog signals. The labels of the terminals as well as the function corresponding to each terminal are as follows:

Label	Function
VX	Input analog voltage
IX	Input analog current
CmX	Input analog ground connection
10V	The excitation voltage is10v which is , relative to the input ofCmX)150 mA (current capacity

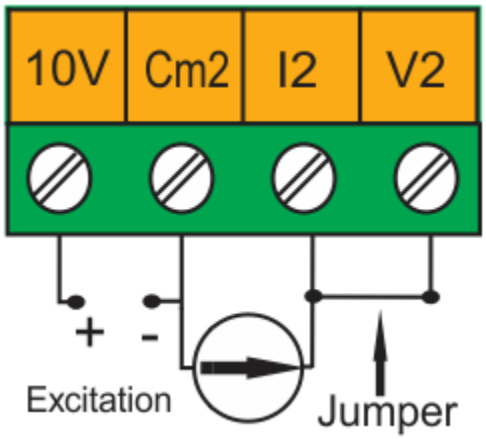
X represents the channel number (channels one, two, and three). For example, V1 is the analog input voltage of channel one, and I3 is the analog input current of channel three.

The type of analog input signal can be a current signal or a voltage signal, according to the type of signal, the method of connecting to the analog inputs is as follows:

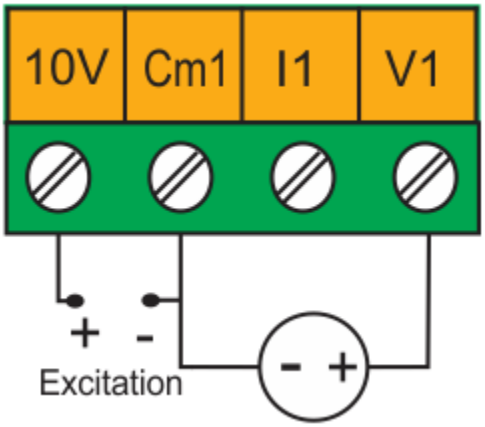
5.3.1 **Connecting the analog current signal:** To connect the analog current signal to the inputs of each channel of the device, connect the negative end of the input current signal to the CmX terminal of the corresponding channel, and connect the positive end of the input analog current signal to the input analog current terminal IX of the corresponding channel. and then I connect the input analog current terminal with a piece of wire to the VX input analog voltage terminal (X represents the channel

number). The 10V terminal acts like a 10V power supply in sensors that require excitation voltage.

For example, the following figure shows how to connect the input analog signal to channel two:



5.3.2 **Voltage analog signal connection:** for voltage analog signal connection; To the inputs of each channel of the device, we connect the negative end of the input voltage signal to the CmX terminal of the corresponding channel and the positive end of the input analog voltage signal to the VX input analog voltage terminal of the corresponding channel (X represents the channel number). The 10V terminal acts as a 10V power supply in sensors that require excitation voltage. For example, the following figure shows how to connect the input analog signal to channel one:

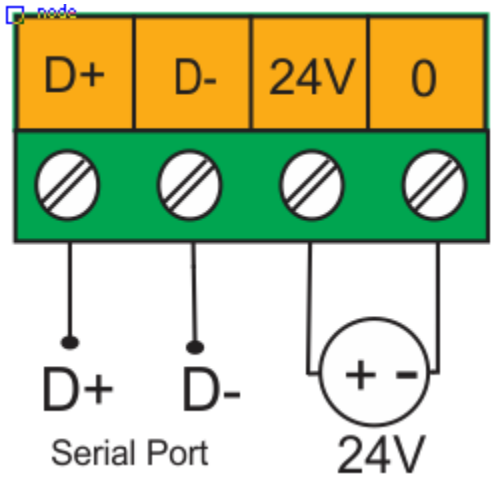


5.4 Isolated RS485 connection

This module is equipped with an RS485 serial port on which the MODBUS RTU protocol is implemented.

Function	Label
Positive data	D+
Negative data	D-

Below is how to connect the power supply and serial port to the module:



6 parameters

All parameters are set with default values at the time of purchase.

You can also do this with the reset to factory setting parameter.

For ease of work, the parameters are divided into different groups.

- The length of all variables is word
- Some parameters need to be restarted to apply changes.

6.1 Communication parameter

Title	Variable type	The length	Reading Writing	Address	explanation	Default
ID	Unsigned int	1	R/W	0 40001	1~247	1
Baud Rate	Unsigned int	1	R/W	1 40002	0~10 0=2400 1=4800 2=9600 3=14400 4=19200 5=28800 6=38400 7=57600 8=76800 9=115200 10=230400	2
parity	Unsigned int	1	R/W	2 40003	0=none 1=odd 2=even	2
Stop bit	Unsigned int	1	R/W	3 40004	0=1 1=2	0
Comm Mode	Unsigned int	1	R/W	4 40005	0=RTU 1=ASCII(8bit) 2=ASCII(7bit)	-
Reserve	Unsigned int	1	-	5 40006	-	-

Note that the converter is reset once to apply the above parameters.

6.2 Module information parameter

- All the following parameters are read only

Title	Variable type	the length	/Read Write	Address	Description	Assumption
Firmware ver	Float	2	R/W	6 40007		
Hardware ver	Float	2	R/W	8 40009		
Model	Unsigned int	1	R/W	10 40011		
Serial number	Unsigned long	2	R/W	11 40012		

6.3 Parameter of digital values of channels

Title	Variable type	length	Read/write	Address	Description	Default
Average Value Channel1	signed long	2	R	17 40018	Average value of channel one	-
Present Value Channel1	signed long	2	R	19 40020	Current value of channel one	-
Average Value Channel2	signed long	2	R	21 40022	Average value of channel two	-
Present Value Channel2	signed long	2	R	23 40024	Current value of channel two	-
Average Value Channel3	signed long	2	R	25 40026	Average value of channel three	-
Present Value Channel3	signed long	2	R	27 40028	Current value of channel three	-

- Average Value Channel X parameters show the average values of the respective channels. The number of samples that are added together and averaged from them is determined by the Average Number parameter for each channel. These parameters are in the averaging parameters table.
- Parameters Present value Channel X shows the most recent converted value of each channel.

6.4 Averaging parameter

Title	Variable type	length	Read/Write	Address	Description	Default
Average Number Channel1	Unsigned int	1	W	33 40034	Min=1 Max=40	10
Average Number Channel2	Unsigned int	1	W	34 40035	Min=1 Max=40	10
Average Number Channel3	Unsigned int	1	W	35 40036	Min=1 Max=40	10

- Average Number Channel X parameters determine the number of samples that are added and averaged from them. The average values of each channel are in the Average Value Channel parameters.

6.5 Channel activation parameter

Title	Variable type	length	Read/Write	Address	Description	Default
Channel1 Activation	Unsigned int	1	W	39 40040	1=Active 0=Enactive	1
Channel2 Activation	Unsigned int	1	W	40 40041	1=Active 0=Enactive	1
Channel3 Activation	Unsigned int	1	W	41 40042	1=Active 0=Enactive	1

- Channel X Activation parameters are used to activate and deactivate the conversion science for the respective channels. By setting the value of these parameters to zero, the corresponding channel is deactivated, and by setting this parameter to one, the channel conversion operation is activated.

6.6 Return to factory settings

Title	Variable type	length	Read Write	Address	Description	Default
Communication Reset to Factory Setting	Unsigned int	1	W	71 40072	1=Reset	0
Device Reset to Factory Settings	Unsigned int	1	W	72 40073	1 = Reset	0
Reset	Unsigned int	1	W	73 40074	1=Reset	0

- Activating the Communication Reset to Factory Setting parameter causes only the communication parameter settings to be returned to the default state of home work.
- By setting this parameter to one, all the parameters in the device will be returned to the factory default state.
- **Note:** If each of the **Communication Reset to Factory Setting** and **Device Reset to Factory Setting** parameters are combined, the device will be **reset** once to apply the changes to the communication parameter.

6.7 Sampling frequency setting parameter

Title	Variable type	length	/Read Write	Address	Description	Default
Sampling Frequency	Unsigned int	1	W	77 40078	0=242Hz 1=39Hz 2=4.17Hz	0

- The Sampling Frequency parameter determines the sampling frequency or the sampling speed of the input analog signal.

6.8 Input signal type selection parameter

Title	Variable type	length	Ability to write	Address	Description	Default
Input Mode Channel1	Unsigned int	1	RW	84 40085	0=0~10V 1=-10~+10V 2=0~20mA 3=-20~+20	0
Input Mode Channel2	Unsigned int	1	RW	85 40086	0=0~10V 1=-10~+10V 2=0~20mA 3=-20~+20	0
Input Mode Channel3	Unsigned int	1	RW	86 40087	0=0~10V 1=-10~+10V 2=0~20mA 3=-20~+20	0
Input Signal CH1	Float	2	R	51 40052	--	--
Input SignalCH2	Float	2	R	53 40054	--	--
Input SignalCH3	Float	2	R	55 40056	--	--

Input Signal CH X parameters show the value of the input signal for each channel according to the variables Input Mode Channel X. For example, if the Input Mode CH1 parameter is equal to one, the Input Signal CH1 parameter will display the value of the input voltage, and if it is equal to two, the value of the input current will be displayed.

6.9 The maximum scaled value parameter

Title	length	Variable type	Ability to write	Address	Description	Default
Max Scale Channel1	2	Float	RW	91 40092	1~ 8388607	1000
Max Scale Channel2	2	Float	RW	93 40094	1~ 8388607	1000
Max Scale Channel3	2	Float	RW	95 40096	1~ 8388607	1000
Scaled Value Channel1	2	Float	R	100 40101	--	--
Scaled Value Channel2	2	Float	R	102 40103	--	--
Scaled Value Channel3	2	Float	R	104 40105	--	--

In the Max Scale Channel X parameters, the maximum scale value is determined, and in the Scaled Value Channel X parameters, the scaled value for each channel is displayed.

Example: if Max Scale Channel 1 = 1000. Parameter value Scaled Value Channel 1

It varies between the minimum value of 0 and the maximum value of 1000.

The amount of changes in the Scaled Value Channel 1 parameter is from the minimum to the maximum according to the changes in the Average Value Channel 1 parameter from the minimum to the maximum value.

In fact, the value of the Scaled Value Channel 1 parameter is the scaled Average Value Channel 1 parameter.

6.10 16-bit digital values of channels parameter

Title	Variable type	length	Read/ write	Address	Description	Default
16Bit Average Value Channel 1	signed long	2	R	112 40113	Average value bit channel -16 one	-
16Bit Present Value Channel 1	signed long	2	R	114 40115	current amount bit channel 16 one	-
16Bit Average Value Channel 2	signed long	2	R	116 40117	Average value bit channel 16 two	-
16Bit Present Value Channel 2	signed long	2	R	118 40119	current amount bit channel 16 two	-
16Bit Average Value Channel 3	signed long	2	R	120 40121	Average value bit channel 16 three	-
16Bit Present Value Channel 3	signed long	2	R	122 40123	current amount bit channel 16 three	-

In the parameters of 16Bit Average Value Channel X, the average value of the corresponding channel is displayed. The type of these parameters is 32 bits, but their maximum value does not exceed 16 bits.

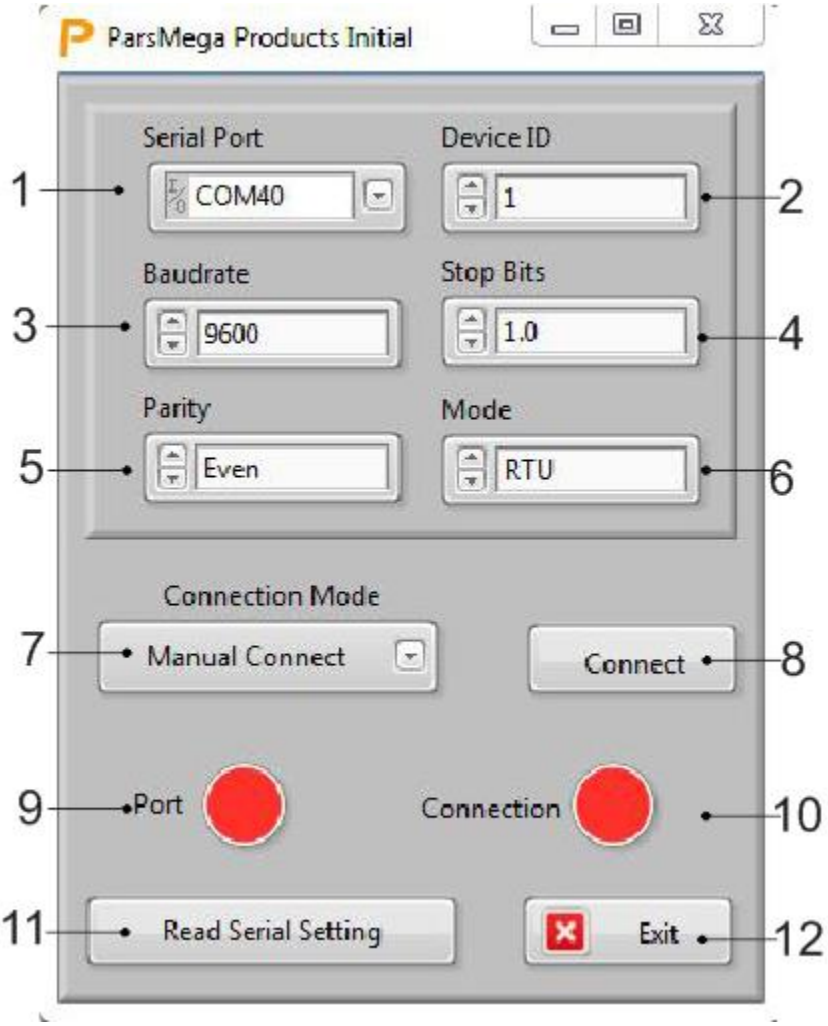
In the 16Bit Present Value Channel X parameters, the current value of the corresponding channel is displayed. The type of these parameters is 32 bits, but their maximum value does not exceed 16 bits.

7 Analog to digital converter settings software

In order to set up and monitor the transmitter, a computer program has been prepared by Pars Mega Company, which includes all the features of the transmitter.

7.1 Introduction

By running the program, the following page will open at first



Number 1: The number of the serial port to which the transmitter is connected.

When the correct port is selected, the indicator number 7 will turn green.

Number 2: is the ID of the transmitter, which is 1 by default in the transmitter.

Number 3: The serial communication baud rate is 9600 by default.

Number 4: The Stop bit specifier is in serial communication and is 1 bit by default.

Number 5: It specifies the parity of serial communication and it is even by default.

Number 6: Specifies the serial communication mode, which is RTU by default.

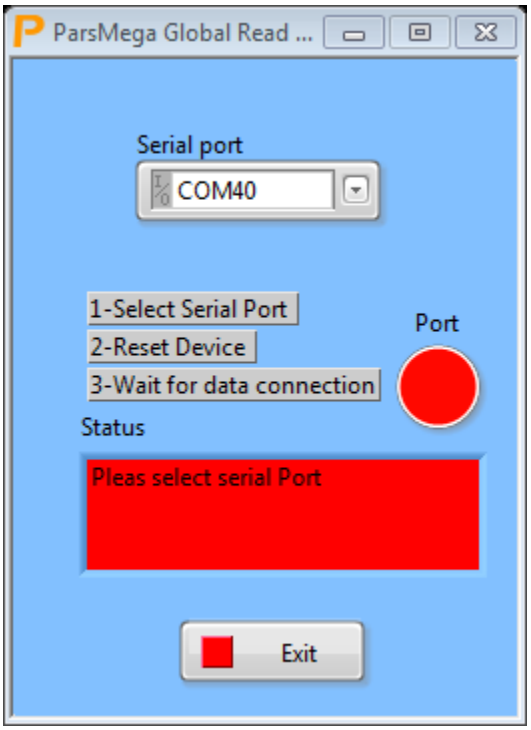
Number 7: Specifying the type of communication that is manual and automatic. This option is used only when using the software.

Number 8: Connection key.

Number 9: indicates the status of the selected port: red color for error and green color for no error

Number 10: When the connection is established, this indicator will turn green and this page will be closed automatically and the main page of the program will be opened.

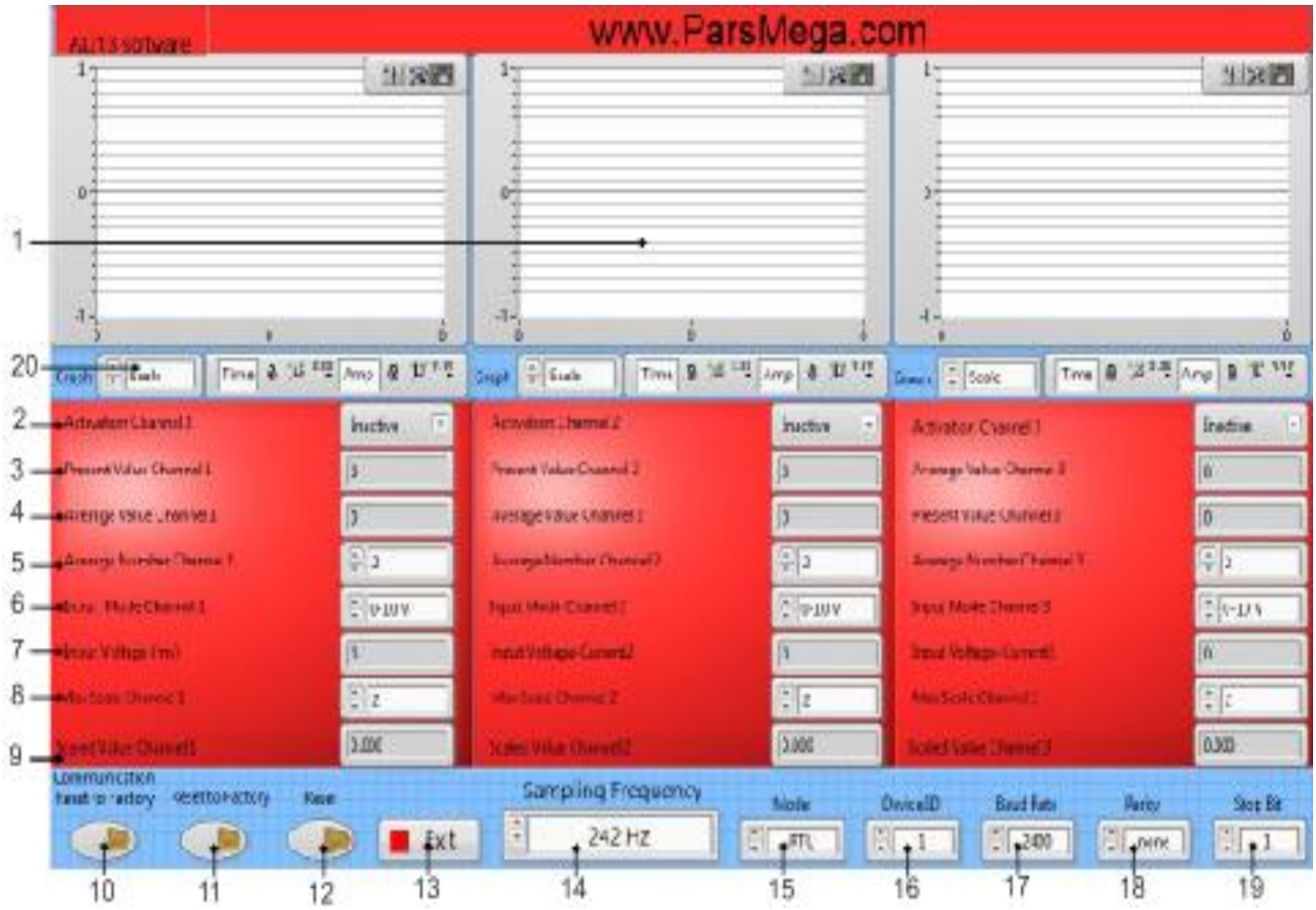
Number 11: If you don't know what settings are on the device and communication is not established, press this button to go to another page where it is possible to read these parameters.



If you have pressed the "Read Serial Setting" button on the previous page, the above page will open, after opening this page, first select the port (if selected

correctly, the port will turn green) and then turn the device off and on once. After reading these values, this page will be closed and the main page will be opened.

7.2 The main page of the program



1 - Graph showing the averaged value or the scaled value of each channel.

2 - Activation Channel X: key to select channel activity status. It has two states: Active and Inactive.

3 - Present Value Channel X: Displays the value of the raw number of the channel. Without averaging.

4 - Average Value Channel X: It displays the averaged value of the channel. The number of samples is selected in the Average Number channel X option.

5 - Edit Box: Average Number Channel X to select the number of channel interpolation samples. The acceptable range is 1 to 40. The number of samples that are added together and averaged from them is determined.

Entering a number close to 40 causes a steep increase in the average value.

6 - Input Mode Channel X: Specifies the type of channel input signal. Which has four modes:

0-10V 10+V 0-20mA +20mA

7 - Input Voltage or Input Current: If one of the voltage options is selected in the Input Mode Channel X option, the value of the input voltage in millivolts is displayed here, or if one of the current options is selected in this the location of the input current value is displayed in milliamps.

8 - Edit box: Max Scale Channel X Setting the parameter of the maximum scale value of the channel.

9 - Scaled Value Channel X: Displays the scaled value of the channel.

10 - Communication Reset to Factory: The key is to restore the default settings of the communication network. In this case, after pressing the key, the communication settings will be as follows. Device Id = 1 and Baud Rate = 9600 and parity = Even and Stop Bit = 1

11 - Reset to Factory: The key is to restore all device settings to default. By pressing this key, all device settings will be returned to factory defaults.

12 - Reset: It is the restart key. Pressing this key will restart the device. Such as when connected to a power source.

13 - Exit: The key to exit the program environment.

14 - Edit Box: Sampling Frequency is to select the sampling frequency. Which is used jointly for both channels. Which includes three frequencies: 4.17 Hz - 39 Hz - 242 Hz. The highest conversion accuracy is found at the sampling frequency of 4.17 Hz, and the lowest conversion accuracy is obtained at the sampling frequency of 242 Hz.

15 - Edit Box: Mode determines the communication mode, which can be one of three options.

RTU ASCII 8Bit ASCII 7Bit

16 - Edit Box: Device Id is the identification number of the device in the communication network. The allowed limit for this parameter is 1 to 247.

17 - Edit Box: Baud Rate is determining the rate of sending information in the communication network.

18 - Edit Box: Parity is the determination of the balance bit in the communication network.

19 - Edit Box: Stop Bit is to determine the stop bit in the communication network.

20 - By using this option, you can choose one of the parameters of the average value or the scaled value to display in the graph.