MS-ADTE1

Technical Manual

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1. Purpose

The MS-ADTE1 instrument's reduced dimensions and high flexibility make it possible to use in a wide industrial range. It can be equipped with an external display unit as well.

The set-point outputs are isolated via opto-couplers and by this way they can be connected to the control organs of the technology. The isolated analogue current output produces signal proportional to the measured mass in form of 0..20 mA or 4..20 mA. Through the both communication interfaces all the functions of the instrument will be available.

Attention: it is **not allowed** (must not) to feed the analogue current output with external power! The analogue input of the PLC has to be used in that mode which doesn't provide voltage.

2. Technical parameters

Type number:	MS-ADTE1
Program version:	ADTE v2.2
Supply voltage:	12..24V DC
Power consumption:	2,5VA
Weighing cells:	4*350Ω
Signal range to be used:	0..2mV/V
Zero point setting:	0..2mV/V
Outputs:	5 set-point outputs isolated via opto-couplers
Inputs:	4 inputs isolated via opto-couplers
Analogue output:	Isolated 0..20mA or 4..20 mA proportional to the measured mass
Max. load:	470Ω
Linearity:	±0.05%
Temperature error:	±0.1%/30
Communication:	RS232, RS422/485

If the load cell is equipped with **4-wire** cable, then scale instrument's **Sense- , Excitation-** connections and **Sense+ , Excitation+** connections have to be short-circuited!

3. Definition of the parameters

3.1. Metrological parameters

3.1.1. Resolution (number of divisions)

It defines the resolution (number of divisions) of the scale.
Values: It can be adjusted from 100 up to 60,000 divisions by 100 steps.

3.1.2. One division

It defines the value of one scale division.
Values: 1,2,5,10,20,50,100

3.1.3. Number of decimals

It defines the number of decimals of the measured mass.
Values: 0,1,2,3,4

3.1.4. Operation mode

OMH (Hungarian Metrological Bureau): in this operation mode – according to the regulation in force – during the calibration process the scale can set to zero within ± 2% range; furthermore under the zero point by 9 divisions an „Underloaded", over the span value by 9 divisions „Overloaded" signal will be given out.
The following parameters can have only specified values:

- Range for zero setting: **-1+3 , +-2**
- Still-stand needed for taring: **Igen**
- Zero-point compensation mode:
  Lassu (if weighing frequency > 12Hz), **Kozepes** (if weighing frequency <= 12Hz)
- One division: max. **5** (if number of decimals < 3)
- Resolution: max. **6000**
- Conditions of the still-stand position: **0.3*20, 0.3*10, 0.3*5, 0.4*5, 0.5*5**

Ipari (Technological mode): in this operation mode the scale can be put into zero position within ± 20% and there are no „Underloaded" and „Overloaded" signals.

3.1.5. Filter table resolution

The scale – according to the selected filter table – will use the averaging. As higher number of the averaging shall be set as slower the weighing operation will be, but at the same time the indication shall be more stable.
Values: It can be adjusted from 1 to 8.

3.1.6. Hysteresis of the indication

With this value we can define a range. If the high resolution mass value shall be moving within this range, the indication will not be changed. Of course under this terminology we understand the refreshing cycle of the normal mass value.
Values: 0, 0.1d, 0.2d, 0.3d (in division)

3.1.7. Conditions of the still-stand position

Value	Definition
0.2*20	During 20 weighing cycles the changes of mass will be within 0.2 scale division
0.2*10	During 10 weighing cycles the changes of mass will be within 0.2 scale division
0.2*5	During 5 weighing cycles the changes of mass will be within 0.2 scale division
0.2*1	During 1 weighing cycle the changes of mass will be within 0.2 scale division
0.3*20	During 20 weighing cycles the changes of mass will be within 0.3 scale division
0.3*10	During 10 weighing cycles the changes of mass will be within 0.3 scale division
0.3*5	During 5 weighing cycles the changes of mass will be within 0.3 scale division
0.3*1	During 1 weighing cycle the changes of mass will be within 0.3 scale division
0.4*5	During 5 weighing cycles the changes of mass will be within 0.4 scale division
0.4*1	During 1 weighing cycle the changes of mass will be within 0.4 scale division
0.5*5	During 5 weighing cycles the changes of mass will be within 0.5 scale division
0.5*1	During 1 weighing cycle the changes of mass will be within 0.5 scale division
0.7*1	During 1 weighing cycle the changes of mass will be within 0.7 scale division
1.0*1	During 1 weighing cycle the changes of mass will be within 1.0 scale division
1.5*1	During 1 weighing cycle the changes of mass will be within 1.5 scale division
2.0*1	During 1 weighing cycle the changes of mass will be within 2.0 scale division

Table 1: Parameters of the still-stand conditions

3.1.8. Zero-point compensation mode

It is used to compensate the slow movement of zero-point of the unloaded scale.
Values: Nincs (None) , Lassu (Slow), Kozepes (Middle-speed), Gyors (Fast)

3.1.9. Weighing frequency (sampling rate)

It is defined by the sampling rate of the A/D converter of the instrument.

Value
6 Hz
12 Hz
25 Hz
50 Hz

Table 2: Parameters of the weighing frequencies

3.1.10. Zero setting at switching-on

After switching-on, the instrument will set the zero-point if the conditions are appropriate (see the case of section **3.1.12.**)
Values: Nincs (None), Probal (Try)

3.1.11. Still-stand needed for taring

The taring of the scale only can be carried out if no weight movement.
Values: Nem (No), Igen (Yes)

3.1.12. Range for zero setting

Zero setting can be carried out within the given percentage of the weighing range.
Value: -1+3, +-2, +-10, +-30 (in percentage)

3.2. Communication parameters

By means of these parameters we can define the characteristics and the protocols of the communication interfaces, their identification addresses. The COM1 is the RS232 interface (dSub9) and the COM2 is the RS485 interface (teminal block).

3.2.1. Name

The range of the names can be used for one of the communication channels (COM1, COM2) depends on the adjusted protocol.
In case of „Metrisoft" and „Onadas" protocol: ASCII characters between '@' and 'Z'.
In case of „Modbus" protocol: numbers (decimal) between 0 and 255.

3.2.2. Name of the display device

It determines the address where the scale will continuously send the gross weight value to, if the protocol has been set to „Onadas" on one of the communication channels.
Values: ASCII characters between '@' and 'Z'

3.2.3. Transmission speed (Baud rate)

Here the transmission speed of the communication channel can be set.

Value (baud)
600
1200
2400
4800
9600
19200
38400
56700
115200
230400

Table 3: Parameters of the communication speed (data transfer)

3.2.4. Parity

Here the parity of the communication channel can be set.

Value
Nincs (None)
Paros (Even)
Paratlan (Odd)

Table 4: Parameters of the parity

3.2.5. Number of data bits

On both communication channels 7 or 8-bit communication form can be set on.

3.2.6. Number of stop bits

The number of stop bits is set to 1 on both communication channels and it can't be adjusted.

3.2.7. Protocol

In the MS-ADT1 unit two protocols are realized. One of them is the Metrisoft Kft's own protocol, the description of which can be found in the section of the **Communication protocol** (see the case of section **6.1.**). The second protocol is the MODBUS protocol. The address distribution is also can be read in this same section (see the case of section **6.2.**).
In this menu the „Onadas" and the „Nyomtatas" function can be set on as well. By using „Onadas" the scale continuously sends the gross weight value to the previously set display address (see the case of section **3.2.2.**). The „Nyomtatas" function has to be used if a printer device is connected to the COM1 port and we would like to print.
<u>Values:</u> Metrisoft, Modbus, Onadas (Independent transmission), Nyomtatas (Printing)

3.2.8. COM1 DTR listening

<u>Values :</u> Nincs (None) , Van (Yes)
In case of using „Nyomtatas" protocol on COM1 port and the DTR output is attached as well, this value must be set to „Van" (Yes). In other case it must be set to „Nincs" (None).

3.3. I/O parameters

By means of these parameters we can settle the functions of the set-point outputs and the functions of the inputs as well.

3.3.1. Operation of the set-points

By means of this parameter we can enable or disable the operation of the set-points.
<u>Values:</u> Nincs (None) , Van (Yes)

3.3.2. Extending panel

The MS-ADT1 unit in basic version has 2 set-point outputs, and this can an be extended using an additional panel having 3 set-point outputs and 4 inputs. In turn, the MS-ADTE1 unit already has 5 set-point outputs and 4 inputs by default. This parameter can be found here by the relation of the MS-ADT1 instrument, and it used to indicate the „virtual" presence of this extending panel toward

the instrument. So by disabling this parameter, only 2 set-point outputs will be usable.
Values: Nincs (None) , Van (Yes)

3.3.3. Set-point operation modes

The operation mode of the set-point outputs is composed from two parts. In the first part we can define the relation of an output with an appropriate mass value combined with other conditions. In the second part we have a possibility to set on other characteristics as well.

	Parameter value	Definition
0.	Nincs (None)	The set-point output is passive
1.	B>SP & OUT3=0	The output is active if the gross mass is higher than the settled value and the output 3 is inactive
2.	B>SP	The output is active if the gross mass is higher than the settled value
3.	N>SP	The output is active if the net mass is higher than the settled value
4.	B<SP	The output is active if the gross mass is lower than the settled value
5.	N<SP	The output is active if the net mass is lower than the settled value
6.	SP1<B<SP2	The output is active if the gross mass is between the value settled on the Output1 and the value settled on the Output2
7.	SP1<N<SP2	The output is active if the net mass is between the value settled on the Output1 and the value settled on the Output2
8.	B<SP & FLAG=1	The output is active if the gross mass is higher than the settled value and the corresponding FLAG to the output is set on
9.	N<SP & FLAG=1	The output is active if the net mass is higher than the settled value and the corresponding FLAG to the output is set on

Table 5: Set-point modes

	Parameter value	Definition
0.	Nincs (None)	No modification
1.	Nyug (Still-stand)	The output is inactive, if the mass is out of still-stand
2.	3Hz	A 3 Hz signal will appear on the output
3.	Nyug, 3Hz	The two conditions are fulfilled
4.	Neg (Negation)	The output is negated
5.	Nyug, Neg	The two conditions are fulfilled
6.	3Hz, Neg.	The two conditions are fulfilled
7.	Nyug, 3Hz, Neg.	The two conditions are fulfilled
8.	ABS	The absolute mass value is considered

Table 6: modification of the set-poit modes

There are **90** kinds of set-point operation modes (0..89) can be adjusted by using the upper two tables. The required operation mode can be adjusted as follows: at first, take a value from the Table 6 and after that take a value from the Table 5 (Example: 12 = the scale is in still-stand condition and the gross mass is higher than the settled value).

3.3.4. INPUT operation modes

The MS-ADTE1 unit is supplied by 4 inputs, the functions of them can be settled into the following operation modes.

Parameter value	Definition
Nincs (None)	The input is passive
Nullaz (Zero setting)	The scale is zeroed in gross mode
Taraz (Taring)	In net mode the scale will be taring
Nullaz/Taraz (Zero setting/Taring)	Performs a zero setting or a taring, depending on the current operation mode (gross or net). So the two functions can be achieved by using only one input.
Uzemmod valt. (Switch operation mode)	Switches between gross and net operation modes
Nyomtat (Print)	Starts to print values defined on the printing form.
Tarol (Validate)	Stores the current measuring result into the data storing buffer. After switching off the unit, the stored data will be lost.
Tarol+Nyomtat (Validate+Print)	If the data store is succeeded, it performs the print.

Table 7: INPUT operation modes

3.3.5. INPUT printing form

It can be set separately for the 4 inputs if which printing form will be printed out when the given input is active. The printing forms can be sent (uploaded) to the instrument by using the program called „MS_SETUP" and also this program is used to query (download) them from the instrument. In the instrument, 2 different printing forms can be stored.
Values: Elso forma (First form), Masodik forma (Second form)

3.4. Data storing parameters

3.4.1. Store mode

Parameter value	Definition
Nincs (None)	No data storing
Ido (Periodic)	The data store will be carried out by the given interval if the scale is in still-stand condition.
Hiba (Error)	Only the wrong weight values will be stored
Hatarertek (Set-point)	The data store will be carried out on any of the active outputs
Bemenet (Input)	The data store will be carried out if the operation mode of one of the inputs is set to „Tarol" and the given input is active.

Table 8: Data store modes

3.4.2. Store location

Values: Belso memoria (RAM memory), Flash memoria (Flash memory), Belso+Flash m. (RAM+Flash)
Attention: after switching off the unit, all the data stored in the internal (RAM) memory will be lost!

3.4.3. Set-point output stores

It can be set separately for the 5 inputs if data store will be performed when the given output is active. It only takes effect if the **Store mode** is set to „Hatarertek" (see the case of section **3.4.1.**)
Values: Nincs (None), Van (Yes)

3.4.4. Storage period

The value given here and the **Time unit of storage** parameter (see the case of section **3.4.1.**) together specify the time interval of the periodic data storage.
It only takes effect if the **Store mode** is set to „Ido" (see the case of section **3.4.1.**)

3.4.5. Time unit of storage

Values: mp, perc, ora (sec, min, hour)

3.4.6. Structure of the data record

serial number	date	time	code	operation mode	gross mass	net mass

The **date** field means the storage date, the **time** field means the storage time.
The value of the **code** field is always 0.
The **operation mode** field is displayed by 2 characters (xy), that can be interpreted as follows:
Examples: Bi = data store operation performed in Gross mode, by an input signal
Nb = data store operation performed in Net mode, by active set-point Output2

Character	Value	Definition
x	B, N	data store performed in Gross or Net operation mode
y (what caused the data store)	a	data store performed by active set-point Output1 (HAT1)
	b	data store performed by active set-point Output2 (HAT2)
	c	data store performed by active set-point Output3 (HAT3)
	d	data store performed by active set-point Output4 (HAT4)
	e	data store performed by active set-point Output5 (HAT5)
	h	erroneous data store performed
	i	data store performed by an active input
	t	data store performed by time interval

Table 9: Structure of the data record

In the scale instrument's internal memory **20** records, in the flash memory **10000** records can be stored. If during the data store process it reaches this record amount, then content of the first record will be lost and the new record will get the serial number of the first record.
The value of the **serial number** field can be between 0 and 19, and between 0 and 9999 (the counting starts not from 1).

3.4.7. Power outage detection

The value given here specify the level of supply voltage under which the instrument will be switched off and over which it will be switched on.
Values: decimal numbers between 25 and 104 which mean a practical relation ratio.
25 = ~ 20V, 104 = ~ 11V.

3.5. Parameter list of the instrument

Parameter name	Parameter value
01. Felbontas	see the case of section **3.1.1.**
02. Lepesnagysag	see the case of section **3.1.2.**
03. Tizedesjegyek szama	see the case of section **3.1.3.**
04. Nyugalom feltetel	see the case of section **3.1.7.**
05. Tarazashoz nyug. kell	see the case of section **3.1.11.**
06. Uzemmod	see the case of section **3.1.4.**
07. Nullazasi tartomany	see the case of section **3.1.12.**
08. Nullkovetesi mod	see the case of section **3.1.8.**
09. Cella szurohossz	see the case of section **3.1.5.**
10. Kijelzesi hiszterezis	see the case of section **3.1.6.**
11. Meresi frekvencia	see the case of section **3.1.9.**
12. Bekapcsolasi nullazas	see the case of section **3.1.10.**

Parameter name	Parameter value
13. COM1 neve	see the case of section **3.2.1.**
14. COM1 baud rate	see the case of section **3.2.3.**
15. COM1 paritas	see the case of section **3.2.4.**
16. COM1 adatbitszam	see the case of section **3.2.5.**
17. COM1 stopbitszam	see the case of section **3.2.6.**
18. COM1 protokoll	see the case of section **3.2.7.**
19. COM1 DTR figyeles	see the case of section **3.2.8.**
20. COM2 neve	see the case of section COM1 neve
21. COM2 baud rate	see the case of section COM1 baud rate
22. COM2 paritas	see the case of section COM1 paritas
23. COM2 adatbitszam	see the case of section COM1 adatbit szam
24. COM2 stopbitszam	see the case of section COM1 stopbit szam
25. COM2 protokoll	see the case of section COM1 protokoll
26. Kijelzo neve (onadas)	see the case of section **3.2.2.**
27. Hatarertek kezeles	see the case of section **3.3.1.**
28. Bovitoport kezeles	see the case of section **3.3.2.**
29. OUT1 uzemmod	see the case of section **3.3.3.**
30. OUT2 uzemmod	see the case of section OUT1 uzemmod
31. OUT3 uzemmod	see the case of section OUT1 uzemmod
32. OUT4 uzemmod	see the case of section OUT1 uzemmod
33. OUT5 uzemmod	see the case of section OUT1 uzemmod
34. INPUT1 uzemmod	see the case of section **3.3.4.**
35. INPUT2 uzemmod	see the case of section INPUT1 uzemmod
36. INPUT3 uzemmod	see the case of section INPUT1 uzemmod
37. INPUT4 uzemmod	see the case of section INPUT1 uzemmod
38. INPUT1 nyomtat. forma	see the case of section **3.3.5.**
39. INPUT2 nyomtat. forma	see the case of section INPUT1 nyomtat. forma
40. INPUT3 nyomtat. forma	see the case of section INPUT1 nyomtat. forma
41. INPUT4 nyomtat. forma	see the case of section INPUT1 nyomtat. forma
42. Tarolasi mod	see the case of section **3.4.1.**
43. Tarolas helye	see the case of section **3.4.2.**
44. Ido mertekegyseg	see the case of section **3.4.5.**
45. Tarolasi ido	see the case of section **3.4.4.**

Parameter name	Parameter value
46. HAT1 tarol	see the case of section **3.4.3.**
47. HAT2 tarol	see the case of section HAT1 tarol
48. HAT3 tarol	see the case of section HAT1 tarol
49. HAT4 tarol	see the case of section HAT1 tarol
50. HAT5 tarol	see the case of section HAT1 tarol
51. Halozatkimaradas erz.	see the case of section **3.4.7.**

Table 10: Parameter list of the instrument

4. Configuration

The configuration of the instrument is performed via the COM1 or the COM2 communication channel.

4.1. Configuration at switching-on

The **„Üzemkész”** LED is blinking for about 3-4 seconds when you switch on the instrument.
If you enter the configuration during this time, the **„Üzemkész”** LED will remain in blinking state until exiting. The configuration at switching-on is used in case of corruption of serial communication parameters when therefore it is impossible to make a connection to the instrument.
During the configuration at switching-on the following default serial parameter values can be used to communicate with the instrument:

Baud rate	Parity	Data bits	Stop bits
9600 baud	None (nincs)	8	1

Table 11: Configuration at switching-on

4.2. Configuration during operation

After the configuration at switching-on is being ended (the **„Üzemkész”** LED is continuously lighting) the scale instrument will work in „normal” operation mode.
At this time just the previously stored serial parameter values can be used to communicate with the instrument and to enter the configuration.

4.3. Means of configuration

The configuration of the instrument can be done in different ways.

4.3.1. „ADTKIJ” external display device

About its usage can be read in its own user manual.

4.3.2. Computer that runs a serial testing application

It can be done by using a Windows application called „STW”, which can be downloaded from the website of Metrisoft Kft.
The tables below section **6.1.** contain the list of the queries and the commands can be used by this application.
By the following you can read about the basic usage of this program.

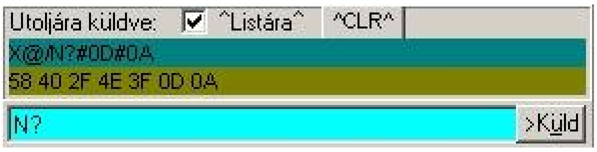
4.3.2.a. Communication with the instrument

After starting the program, the edit fields of those parameters can be found on the topside of the screen that are used to establish a connection with the scale.
These values must be adjusted the same as the scale instrument's same parameters' value for establishing the connection:

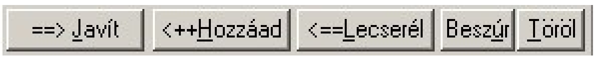
But there's an exception, and that is the **„MS-Kinek”** parameter which one's value can be different from the scale address (name) and it can be the '@' address as well. It means that a connection can be established with a scale that has any of addresses (name) and has the same serial parameter values.

4.3.2.b. Managing the instrument

On the lower right side of the screen, an edit field can be seen that is used to input the queries and the commands for managing the instrument via serial communication channel.
The query or the command can be sent to the instrument by using the **„Küld”** button:

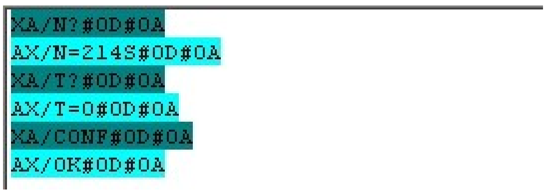


It is possible to send more than one query at the same time by using a semicolon separator after inputting each of the queries.
On the lower left side of the screen, a listbox can be found that contains preloaded queries and commands.
By double-clicking on the currently selected item – without clicking on **„Küld”** button –
that will be sent to the scale instrument immediately. In addition the content of the listbox can be modified at will by using these buttons on the right:



(= =>Fix, <+ +Add,<= = Change, Insert, Delete)

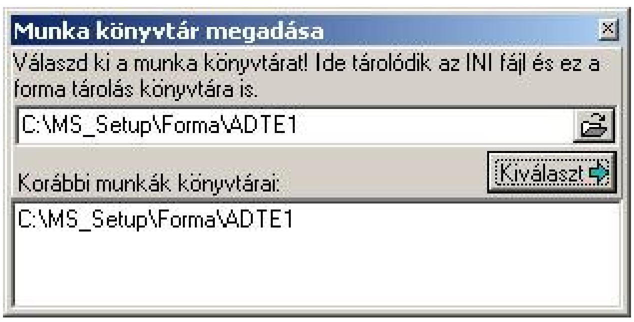
Below the part of the screen for serial communication setup, a listbox can be found that contains all the queries and commands sent and also the response messages received:



The interpretation of these messages can be found in the tables below section **6.1.** as well.

4.3.3. Computer that runs „MS_SETUP” configuration program

This is the most complete and the most easily usable configurating tool, and also used to edit the printing forms, send them to the instrument or get from the instrument.



After starting the program, a window appears that can be seen here on the left.
The printing forms will be stored in the form directory and also the yet existing ones will be loaded from there. Besides the configuration files will be stored there too.
After specifying the needed path, the program's main screen will appear by clicking on the

button.

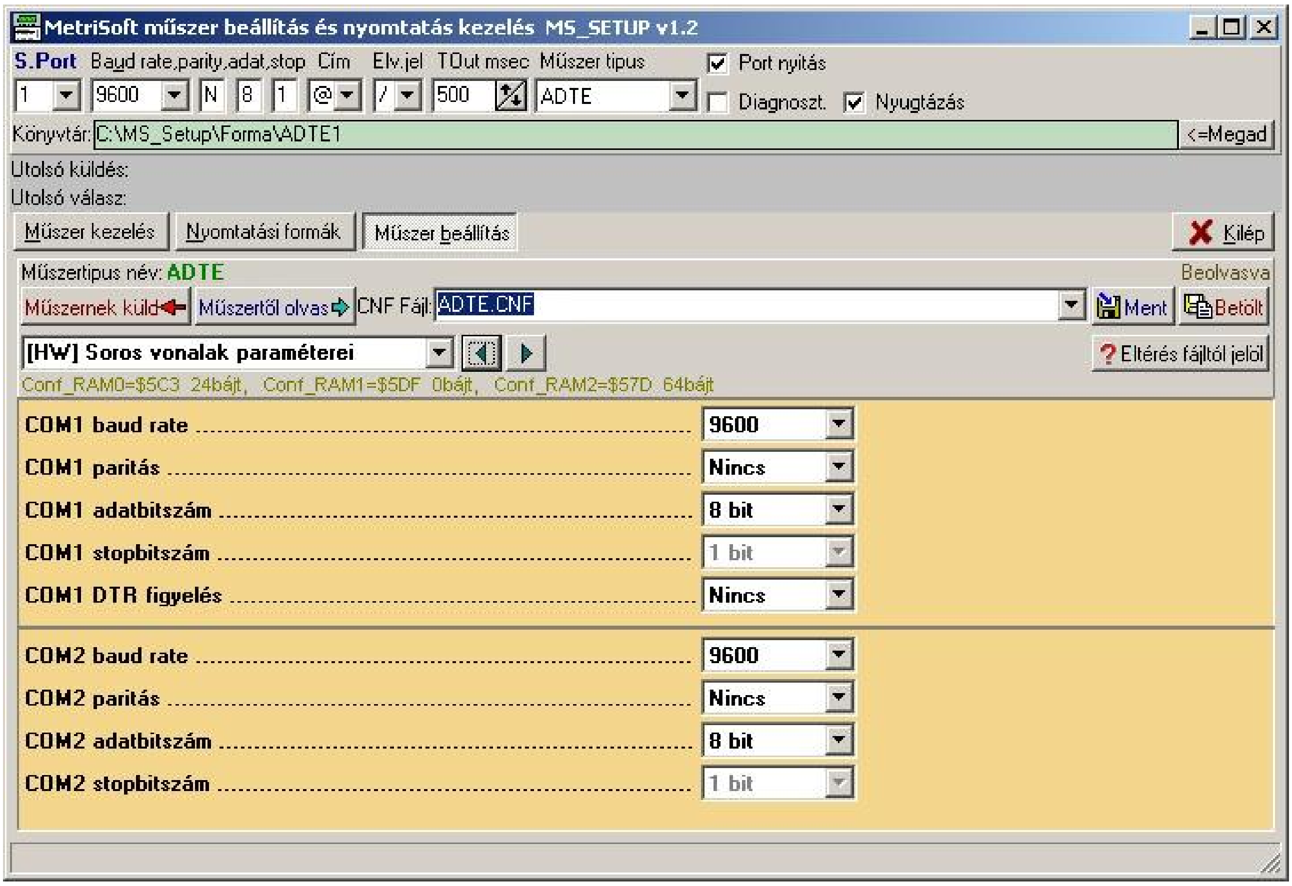
The edit fields of those parameters can be found on the topside of the screen that are used to establish a connection with the scale.
These values must be adjusted the same as the scale instrument's same parameters' value for establishing the connection:

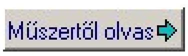
But there's an exception, and that is the **„Cím”** parameter which one's value can be different from the scale address (name) and it can be the '@' address as well. It means that a connection can be established with a scale that has any of addresses (name) and has the same serial parameter values.
After setting the proper values, the **„Port nyitás”** checkbox must be checked for establishing the connection. In case of a problem during access to the scale, a warning message will appear.

4.3.3.a. Setting the instrument

The managing of the instrument's parameters can be done on the following screen by clicking on the 

button:



The 

button is used to enter the configuration and read the parameters from the instrument.
The parameters of the instrument are sorted into different groups. You can switch between these groups by using this tool here on the right:

After setting the values of the needed parameters, the 

button is used to upload them to the instrument and also exit from both configurating modes.
Besides there's a possibility for saving the adjusted parameters into a configuration file by clicking on the 

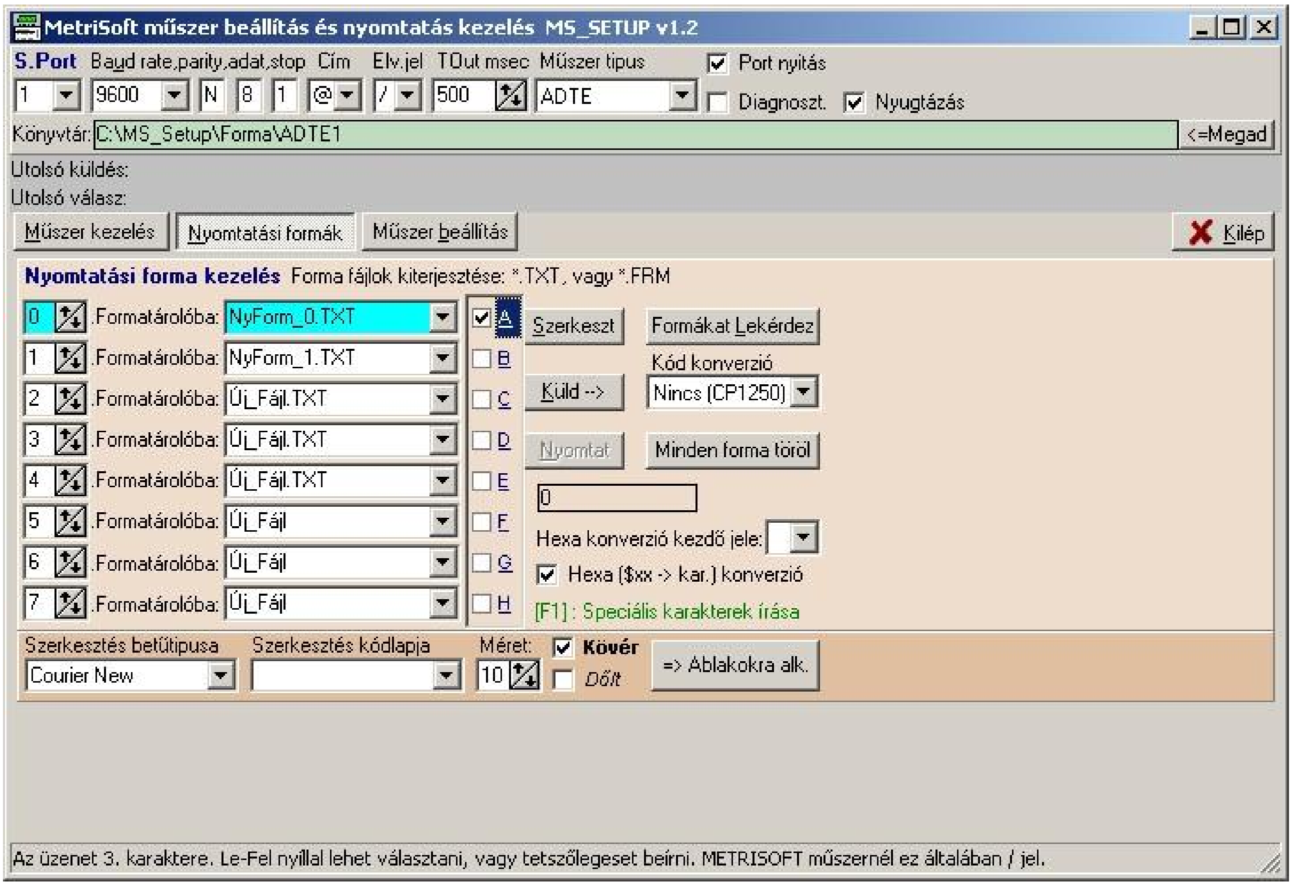
button and also loading them from the configuration file by clicking on the 

button. This procedure can be useful if the settings get corrupted in the instrument for some reason, but of course it can be used in other cases.
The new configuration file can be named in the combobox that can be seen below and also this is used to select the yet existing and loadable configuration file:

4.3.3.b. Printing forms

The managing of the printing forms can be done on the following screen by clicking on the 

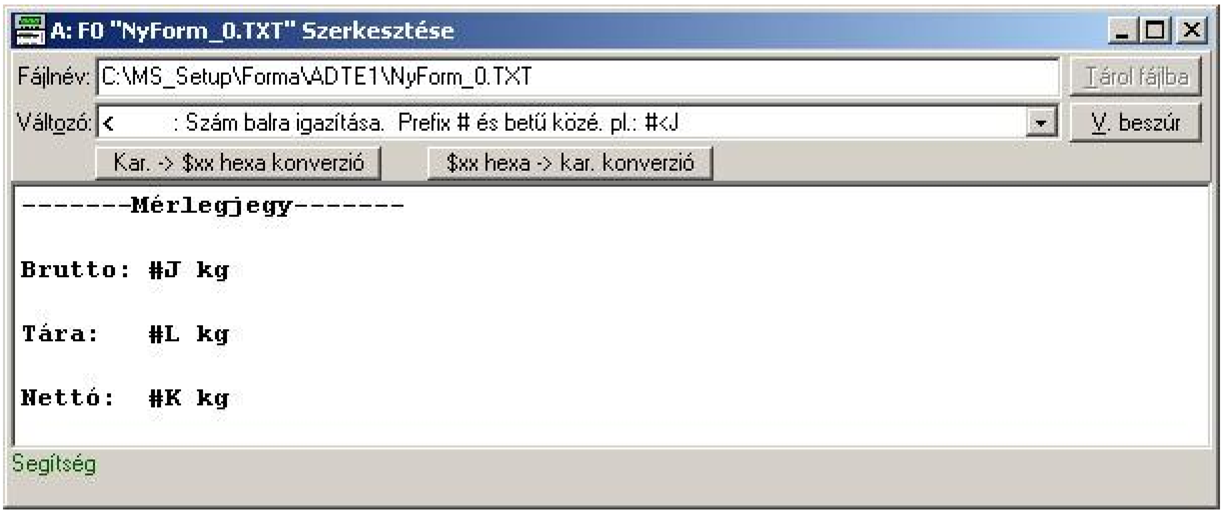
button:



In MS-ADT1 instrument, 2 different printing forms can be stored. These forms can be placed in the 0. and 1. form containers. A printing form can be assigned to a container on the following part of the screen: 

In case of a non-existing printing form, the name of the new file can be input in this combobox and also this is used to specify the file name which the form will be stored to, at quering (downloading) the form from the instrument.

The window below will appear by clicking on the Szerkeszt button. This window is used to edit and store that printing form on the computer which has the checkbox in checked state (A or B):



The window above has an edit box that is used to specify the appearance of the printig form.
By giving any constant text content, it is possible to insert variable fields too, which have changing values during operation of the program (Examples: serial number, mass values, date).
The variables are marked with a „#" sign and can be selected from this checkbox here below:

Thereafter the cursor has to be positioned to the printing location in the edit box, and the variable can be inserted there by clicking on the V. beszúr gomb.

After editing, the Tárol fájlba button is used to save the completed printing form to a text file which name can be specified in the **„Fájlnév"** field. An alert message will appear if the given file name already exists or the window gets closed without saving.

After that, the main screen will appear again where the saved printing forms can be uploaded to the instrument's form containers by clicking on the Küld --> button.

The Formákat Lekérdez button is used to download the printing forms – if there are any – from the instrument and store them on the computer in the specified files.

4.3.3.c. Managing the instrument

The screen below is used to input the queries and the commands by using the combo boxes for managing the instrument via serial communication channel.

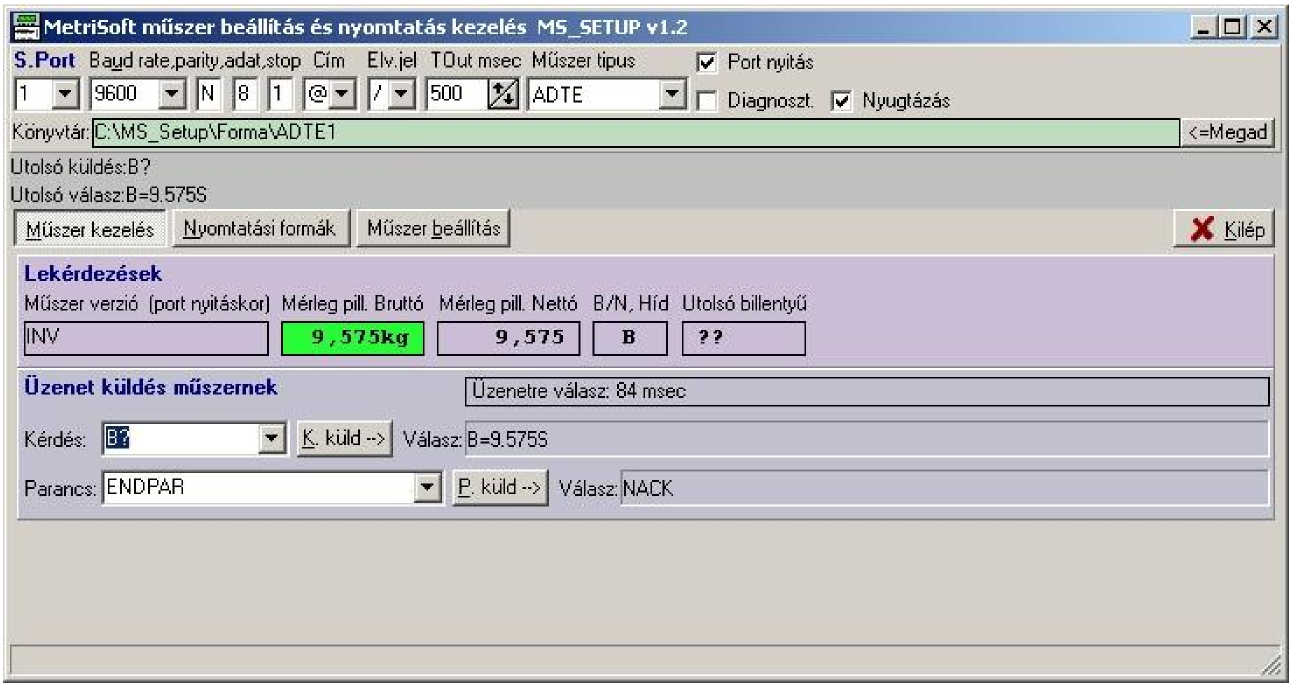
The Műszer kezelés button is used to appear the screen below.
These combo boxes contain preloaded values, but it is possible to modify the contents of the input

fields which are needed by using some queries and commands.
The tables below section **6.1.** contain the list of the queries and the commands can be used.

The content of **„Parancs”** combox can be sent to the instrument by using the P. küld --> button.

The content of **„Kérdés”** combobox can be sent to the instrument by using the K. küld --> button.

The response messages received from the queries and the commands will be displayed in the **„Válasz”** fields, next to the two buttons. The interpretation of these messages can be found in the tables below section **6.1.** as well.
Here's a possibility for exiting the configuration without loading the parameter values into the instrument.
This can be done by sending the ENDPAR command to the instrument.



5. Calibration

The calibration of the instrument can be made by two different ways. Before the calibration it is necessary to configure the instrument's metrological parameters! (see the case of section **4.**)

5.1. „Two-knob” calibration

This procedure can be done by using the knobs (see the case of section **7.**) which are used to set the current output.

5.1.1. Entering the calibration

At switching on the instrument the **„Fel”** and **„Le”** knobs must be pressed and held for about 3 seconds. After this, the **„Nulla”** LED and the **„Végérték”** LED starts blinking alternately.

5.1.2. Storing the zero value

Be sure that load receiving mechanism is empty and the scale is in the still-stand condition.
After that, the **„Fel”** knob must be pressed which causes that the **„Nulla”** LED will start lighting continuously, the **„Végérték”** LED will remain in blinking state and the zero value will be stored.

5.1.3. Storing the span value

After storing the zero value, be sure that scale is in still-stand condition and put on the load of calibration mass - that corresponds to the nominal span value - on the load receiving mechanism.
After that, the **„Le”** knob must be pressed which causes that the **„Végérték”** LED will start lighting continuously as well and the span value will be stored.

5.1.4. Exiting the calibration

Before storing: the **„Start”** knob must be pressed, directly after entering the calibration. At this time zero value and span value will not be stored in the instrument.
After storing: the **„Start”** knob must be pressed after storing the span value.

After exiting the „two-knob” calibration, the instrument's program will automatically start working.

5.2. Calibration by the „STW” serial testing application

5.2.1. Entering the calibration

This can be done by the way described at the **Managing the instrument** section (see the case of section **4.3.2.b.**) of the manual. The „CONF” command must be sent so to the instrument.

5.2.2. Storing the zero value

Be sure that load receiving mechanism is empty and the scale is in the still-stand condition.
After that, the „ZERO” command must be sent to the instrument by the way described at the **Managing the instrument** section (see the case of section **4.3.2.b.**) which causes that the zero value will be stored in the instrument.
It is necessary to store the zero value at least once. At later time if its value is the same, it is enough to re-calibrate the span value only.

5.2.3. Storing the span value

This procedure must be done after storing the zero value!

If we have at our disposal the calibration mass that corresponds to the nominal span value, then this load must be put on the load receiving mechanism and must be waited until the scale gets into still-stand condition.
After that, the „VEG” command must be sent to the instrument by the way described at the **Managing the instrument** section (see the case of section **4.3.2.b.**) which causes that the span value will be stored in the instrument.

If we don't have the requested calibration mass that corresponds to the nominal span value, then it is possible to calibrate by partial mass (the available calibration mass).
At this time the program automatically calculates the cell signal value that belongs to the nominal span value.
The available calibration mass load must be put on the load receiving mechanism and must be waited until the scale gets into still-stand condition.
After that, the „RVEG=” command must be sent to the instrument by the way described at the **Managing the instrument** section (see the case of section **4.3.2.b.**). Before sending, the available mass value must be input after the equal sign („=”) (Example: RVEG=100) This causes that the span value will be stored in the instrument.

5.2.4. Exiting the calibration

The „ENDPAR” command must be sent to the instrument by the way described at the **Managing the instrument** section (see the case of section **4.3.2.b.**).

5.3. Calibration by the „MS_SETUP” configuration program

5.3.1. Entering the calibration

The Műszertől olvas button is used to read the parameters from the instrument and also enter the calibration.
The other option to enter the calibration is the following:

the CONF command must be sent to the instrument by the way described at the **Managing the instrument** section (see the case of section **4.3.3.c.**).

5.3.2. Storing the zero value

Be sure that load receiving mechanism is empty and the scale is in the still-stand condition.

After that, the ZERO command must be sent to the instrument by the way described at the **Managing the instrument** section (see the case of section **4.3.3.c.**) which causes that the zero value will be stored in the instrument.
It is necessary to store the zero value at least once. At later time if its value is the same, it is enough to re-calibrate the span value only.

5.3.3. Storing the span value

This must be done after storing the zero value!

If we have at our disposal the calibration mass that corresponds to the nominal span value, then this load must be put on the load receiving mechanism and must be waited until the scale gets into still-stand condition.

After that, the VEG command must be sent to the instrument by the way described at the **Managing the instrument** section (see the case of section **4.3.3.c.**) which causes that the span value will be stored in the instrument.

If we don't have the requested calibration mass that corresponds to the nominal span value, then it is possible to calibrate by partial mass (the available calibration mass).
At this time the program automatically calculates the cell signal value that belongs to the nominal span value.
The available calibration mass load must be put on the load receiving mechanism and must be waited until the scale gets into still-stand condition.

After that, the RVEG= command must be sent to the instrument by the way described at the **Managing the instrument** section (see the case of section **4.3.3.c.**). Before sending, the available mass value must be input after the equal sign („=”) (Example: RVEG=100) This causes that the span value will be stored in the instrument.

5.3.4. Exiting the calibration

The ENDPAR command must be sent to the instrument by the way described at the **Managing the instrument** section (see the case of section **4.3.3.c.**).

6. Communication protocol

All the inquiries and commands will be started by the marker of the inquirer, the next character will be the name of the instrument followed by the „/” separating character. After these characters the actual inquiry or command will appear. All the messages should be closed by the „0Dh0Ah” characters.

The first character of the response is the name of the instrument followed by the mark of the inquirer and the separating character and finally the actual answer will appear. All the messages should be closed by the „0Dh0Ah” characters.

6.1. Metrisoft protocol

6.1.1. General inquiries

Inquiry	Definition	Response	Definition
XA/VER?	Inquiring the firmware version	**AX/VER=x**	x=version number
XA/M?	Inquiring the operation mode of the instrument	**AX/M=x**	x=B, Gross mode x=N, Net mode
XA/MV?	Inquiring the weighing cell signal	**AX/MV=x**	x=cell signal (mV)
XA/FB?	Inquiring the high resolution mass value	**AX/FB=x**	x=high resolution mass value

Table 12: General inquiries

6.1.2. General commands

<table>
<tr><th>Command</th><th>Definition</th><th>Response</th><th>Definition</th></tr>
<tr><td>XA/TA</td><td>Taring in Net operation mode</td><td rowspan="4">AX/OK

AX/NACK</td><td>The taring was performed
The taring can not be performed</td></tr>
<tr><td>XA/NU</td><td>Zero setting in Gross operation mode</td><td>The zero setting was performed
The zero setting can not be performed</td></tr>
<tr><td>XA/NT</td><td>Switching to Net operation mode</td><td>Performed
The command can not be performed</td></tr>
<tr><td>XA/BR</td><td>Switching to Gross operation mode</td><td>Performed
The command can not be performed</td></tr>
</table>

Table 13: General commands

6.1.3. Inquiry commands of the mass

Inquiry	Definition	Response	Definition
XA/B?	Inquiring the gross mass	**AX/B=1000** **AX/B=1000S** **AX/B=0SF**	The gross mass: 1000Kg S=still-stand F=fine zero
XA/N?	Inquiring the net mass	**AX/N=1000**	The net mass: 1000Kg
XA/T?	Inquiring the tare value	**AX/T=100**	The tare value: 100Kg

Table 14: Inquiry commands of the mass

6.1.4. Data storing inquiries and commands

<table>
<tr><th>Inquiry, comm.</th><th>Definition</th><th>Response</th><th>Definition</th></tr>
<tr><td>XA/DEF</td><td>Emptying the storing buffer in the RAM memory, the stored data records will be lost. It has to be performed once before the start of data storing!</td><td rowspan="2">AX/OK</td><td rowspan="2">Performed</td></tr>
<tr><td>XA/FDEF</td><td>Emptying the storing buffer in the flash memory, the stored data records will be lost. It has to be performed once before the start of data storing!</td></tr>
<tr><td>XA/ELS?</td><td>Stepping to the first data record of the storing buffer in the RAM memory</td><td rowspan="3">AX/BUF:
a,b,c,d,e,f,g</td><td rowspan="3">a=serial number
b=date (not interpreted)
c=time (not interpreted)
d=code (always 0)
e=operation mode (B,N)
f=gross mass
g=net mass
empty buffer</td></tr>
<tr><td>XA/AKT?</td><td>Inquiring the current data record of the storing buffer in the RAM memory</td></tr>
<tr><td>XA/KOV?</td><td>Stepping to the next data record of the storing buffer in the RAM memory</td></tr>
<tr><td>XA/FELS?</td><td>Stepping to the first data record of the storing buffer in the flash memory</td><td rowspan="3">AX/BUF:---</td><td rowspan="3">a=serial number
b=storage date
c=storage time
d=code (always 0)
e=operation mode (B,N)
f=gross mass
g=net mass
empty buffer</td></tr>
<tr><td>XA/FAKT?</td><td>Inquiring the current data record of the storing buffer in the flash memory</td></tr>
<tr><td>XA/FKOV?</td><td>Stepping to the next data record of the storing buffer in the flash memory</td></tr>
</table>

Inquiry, comm.	Definition	Response	Definition
XA/RPOI?	Inquiring the current record number of the read pointer	**AX/RPOI=x**	x=record number to read from
XA/RPOI=x	Setting the read pointer to the record number to read from. x=record number to read from	**AX/OK**	Performed
XA/WPOI?	Inquiring the current record number of the write pointer	**AX/WPOI=x**	x=record number to write to
XA/SMOD?	Inquiring the setting of the data store mode	**AX/PAR:x=y**	x=”42. Tarolasi mod”, y=value of store mode (Example: „00. Nincs”)
XA/SMOD=x	Setting the data store mode, x=value of the store mode (0..3)	**AX/NACK**	The command can not be performed
XA/STIME?	Inquiring the value of the data store timer	**AX/STIME=x,y**	x=time interval of the periodic data storage, y= time unit (s, m, h)
XA/STIME=x,y	Setting the value of the data store timer. x=time interval of the periodic data storage, y=time unit (s, m, h) (Example: XA/STIME=5,s)	**AX/OK** **AX/INV**	Performed Invalid parameter value
XA/SHTx?	Data storing in case of active set-point output. Inquiring the state. x=serial number of the set-point output (1..5)	**AX/SHTx=y**	x=serial number of the set-point output (1..5), y=value of the storing state (0..1)
XA/SHTx=y	Data storing in case of active set-point output. Setting the state. x=serial number of the set-point output (1..5), y=value of the storing state (0..1)	**AX/OK** **AX/INVPAR** **AX/INV**	Performed Invalid parameter value Invalid set-point output serial number

Table 15: Data storing inquiries and commands

6.1.5. I/O inquiries and commands

Inquiry, command	Definition	Response	Definition
XA/SP?	Inquiring the I/O state	**AX/SP=xxxxxyyyy**	x=status of the outputs H=active, L=inactive y=status of the inputs, 0,2,4,6,8: inactive 1,3,5,7,9: active
XA/HTxy?	x=set-point output serial number y=1, inquiring the set-point operation mode (section **3.3.3.**) y=2, inquiring the mass value y=3, inquiring the FLAG	**AX/HTxy=value**	x=serial number of the set-point output (1..5) y=1, set-point oper. mode y=2, mass value y=3, FLAG status
XA/HTxy= érték	x=set-point output serial number y=1, setting the set-point mode (section **3.3.3.**) y=2, setting the mass value y=3, setting the FLAG	**AX/OK**	Performed **Note:** if the given set-point value is higher than the nominal final value, set-point will be adjusted to final value

Table 16: I/O inquiries, commands

6.1.6. Configuration inquiries and commands

Inquiry, comm.	Definition	Response	Definition
XA/MANPAR	Entering the manual parameter setup. The parameter values can be queried only.	**AX/OK** **AX/NACK**	Performed The command can not be performed
XA/CONF	Entering the configuration. The parameter values can be queried and modified as well.		
XA/AKTPAR?	Inquiring the current parameter	**AX/PAR:x=y** **AX/NACK**	x=parameter name, y=parameter value The command can not be performed
XA/KOVPAR	Stepping to the next parameter		
XA/ELOPAR	Stepping to the previous parameter		
XA/FELPAR	Increasing the value of the current parameter		
XA/LEPAR	Decreasing the value of the current parameter		
XA/ELSOPAR	Jumping to the first parameter		

Inquiry, comm.	Definition	Response	Definition
XA/DEFAULT	Setting the parameter values to default („factory” setup). It's usually used at startup-configuration in case of parameter corruption.	**AX/OK** **AX/NACK**	Performed The command can not be performed
XA/ALLPAR?	Listing all of the parameters	**AX/PAR:x=y** **AX/NACK**	x=parameter name, y=parameter value The command can not be performed
XA/PARSZ=x	Stepping to the given parameter number. x=parameter number		
XA/PAR=x	Setting the parameter's value directly. For certain parameters only (resolution) x=value of parameter		
XA/ZERO	Storing the zero value for calibration	**AX/OK** **AX/NACK**	Performed The command can not be performed
XA/VEG	Storing the span value for calibration		
XA/RVEG=x	Calibrating on the given partial span value. x=the calibration mass (kg)		
XA/FELB?	Inquiring the value of the resolution directly.	**AX/PAR:x=y** **AX/NACK**	x=”01. Felbontas”, y=value of the resolution The command can not be performed
XA/FELB=x	Setting the value of the resolution directly. x=value of the resolution		
XA/NEV1? **XA/NEV2?**	Inquiring the name of COM1 or COM2 directly	**AX/PAR:x=y** **AX/NACK**	x=”13. COM1 neve”, x=”20. COM2 neve”, y=name ('@'..'Z' or 0..255) The command can not be performed
XA/NEV1=x **XA/NEV2=x**	Setting the name of COM1 or COM2 directly. x=name of COM1 or COM2 (Example: XA/NEV1=A)		
XA/KNEV?	Inquiring the name of the display device directly	**AX/PAR:x=y** **AX/NACK**	x=”26. Kijelzo neve (onadas)”, y=name ('@'..'Z') The command can not be performed
XA/KNEV=x	Setting the name of the display device directly x=name of the display device		

Inquiry, comm.	Definition	Response	Definition
XA/IDO?	Inquiring the current date and time. It is recommended to check these values before data store.	**AX/IDO=x,y**	x=year.month.day y=hour:minute:second
XA/IDO=x,y	Setting the current date and time. It is recommended to perform this operation before data store. x=year.month.day (year contains 2 digits!) y=hour:minute:second (Example: XA/IDO=11.01.01,08:00:00)	**AX/OK** **AX/INV**	Performed Invalid parameter value
XA/HALKI?	Inquiring the value of the power outage detection directly	**AX/PAR:x=y**	x=”51. Halozatkimaradas erz.”, y=value
XA/HALKI=x	Setting the value of the power outage detection directly. x=value (section **3.4.7.**)	**AX/OK** **AX/NACK**	Performed The command can not be performed
XA/ENDPAR	Exiting the manual parameter setup or configuration		
XA/SAVEPAR	Saving the modified parameters in configuration		

Table 17: Configuration inquiries, commands

6.1.7. Cell under- and overload errors

If the value of the **Operation mode** parameter (see the case of section **3.1.4.**) is set to „OMH”, the scale can indicate the following error messages depending on the scale's load.

Value	Definition
ERROR2	Scale (cell) is extremly underloaded (over zero point - 9 divisons)
ERROR3	Scale (cell) is extremly overloaded (over span value + 9 divisions)
ERROR4	Scale (cell) is underloaded (until zero point - 9 divisions)
ERROR5	Scale (cell) is overloaded (until span value + 9 divisions)

Table 18: Cell under- and overload errors

6.2. Modbus protocol

6.2.1. Modbus inquiries

Memory address (0x)	Denomination	Size
01	Set-point Output1 switching value Example: 01 03 00 01 00 02	2 words
03	Set-point Output2 switching value	2 words
05	Set-point Output3 switching value	2 words
07	Set-point Output4 switching value	2 words
09	Set-point Output5 switching value	2 words
0B	Status bits: bit 0: unused (always 0) bit 1: Still-stand bit 2: Cell overload bit 3: Cell underload bit 4: Output1 status bit 5: Output2 status bit 6: Output3 status bit 7: Output4 status bit 8: Output5 status bit 9: Input1 status bit 10: Input2 status bit 11: Input3 status bit 12: Input4 status bit 13: Operation mode (0 = Gross, 1 = Net)	1 word
0C	Number of decimals	1 word
0D	Gross mass value	2 words
0F	Net mass value	2 words
11	Tare value	2 words

Table 19: Modbus inquiries

Note: the number of decimals specify the interpretation of mass values.
<u>Example:</u> The gross mass value by querying = 1390kg, the number of decimals = 2
The real gross mass value = 1390 / (10^2) = 1390 / 100 = 13.90kg

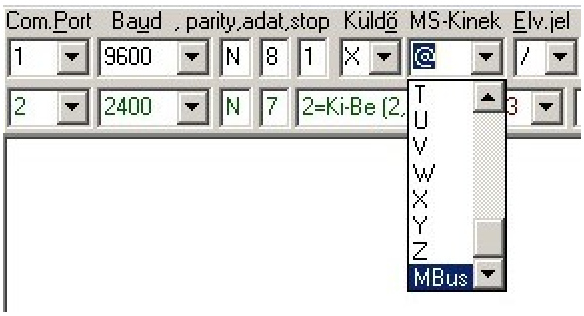
6.2.2. Modbus commands

Memory address (0x)	Denomination	Size
01, 03, 05, 07, 09	Setting the switching values of the set-point outputs Example: set-point Output1: 01 10 00 01 00 02 04 00 01 38 80	2 words
0B	Switching between gross and net operation modes Allowed values: 0 (Gross), 1 (Net) Example: switching to Net mode: 01 06 00 0B 00 01	1 word
13	Zero setting in Gross mode or taring in Net mode Allowed values: 0 (Zero setting), 1 (Taring) Example: taring in Net operation mode: 01 10 00 13 00 01 02 00 01	1 word

Table 20: Modbus commands

6.2.3. Testing the Modbus communication with computer

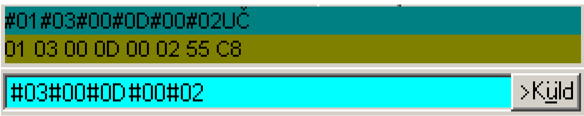
For testing, the previously described „STW" serial testing application (see the case of section **4.3.2.**) can be used as well. Of course, it can be done if the protocol has been set to MODBUS on one of the communication channels.
Similarly to „Metrisoft" protocol, the parameters of serial communication have to be set first.
After that, on the picture can be seen on the lower left, the lowermost **„Mbus"** element has to be selected from the combobox named **„MS-Kinek"**, which contains the scale addresses.
By doing so, the **„MS-Kinek"** label's name changes to **„MB-Kinek"**, and the combobox will contain MODBUS addresses (decimal values). Here the address has to be selected that is specified at the **Configuration** section (see the case of section **4.**).
The comboboxes named **„Küldő"**, **„Elv.jel"**, **„Adás záró"** and **„Vétel záró"** will be disabled, theirs set values will be ignored by the program. This case can be seen down on the middle picture.
After that, on the picture can be seen on the lower right, the value of the **„Kijelzés"** checkbox has to be set to **„Hexa"** in order that sent and the received values be readable.



6.2.3.a. Sending a Modbus inquiry

Similarly to „Metrisoft" protocol, on the lower right side of the screen, an edit field can be seen that is used to input the MODBUS queries and commands. The query or the command can be sent to the instrument by using the **„Küld"** button.

The next picture is showing an example of sending a MODBUS query, that is used to query the gross mass value from the scale instrument:



Structure of the query:

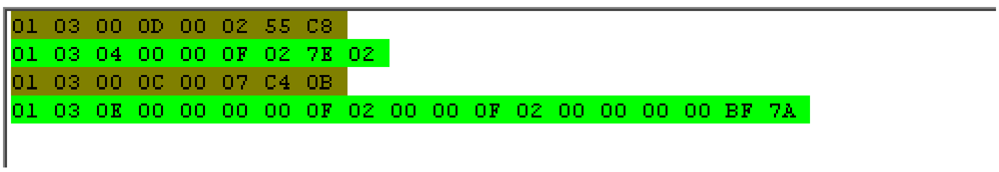
The query has a size of 8 bytes. Each byte has to be separated by a „#” sign in the input field.

byte nr.	Definition
byte 1	The address of the scale instrument, but it doesn't have to be specified in the input field because it can be selected from the above-mentioned **MB-Kinek** combobox. In the example above, its value is 0x01.
byte 2	The MODBUS read function code (read holding registers). Its value is 0x03.
byte 3	The address of the first register requested (upper byte). Its value is always 0x00 by using this version of the instrument program.
byte 4	The address of the first register requested (lower byte). Its values can be the memory addresses found in the table below section **6.2.1.** In the example above, its value is 0x0D (gross mass).
byte 5	The total number of registers requested (upper byte). Its value is always 0x00 by using this version of the instrument program.
byte 6	The total number of registers requested (lower byte). If you want to get the value of the first requested register only then its value is always 0x01. The maximum number of the registers can be requested is dependent on the register number (memory address) where the query begins. By using this version of the instrument program and the table below section **6.2.1.**, this value can be 0x12 if the query begins from the 0x01 memory address. In the example above, its value is 0x02.
byte 7 & 8	The cyclic redundancy check (CRC) for error checking. It's automatically generated by the program, so it doesn't have to be specified.

Table 21: Structure of the Modbus query

Stucture of the answer:

Similarly to „Metrisoft” protocol, below the part of the screen for serial communication setup, a listbox can be found that contains the queries sent (with brown background) and also the response messages received (with green background):

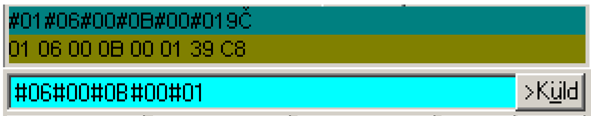


Denomination	Size	Value
Device address	1 byte	It's the same as the device address sent in the query. In the example above, its value is 0x01.
Function code	1 byte	0x03
Byte number	1 byte	2*n (n=the number of registers requested) In the example above, its value is 0x04.
Register value	n*2 bytes	The value(s) found on the requested memory address(es). In the example above the gross mass = 0x00000F02 (3842 kg), if the number of decimals = 0.
Cyclic redundancy check (CRC)	2 bytes	It's automatically generated by the program.

Table 22: Structure of the answer given to the Modbus query

6.2.3.b. Sending a Modbus command

The next picture is showing an example of sending a MODBUS command, that is used to switch the instrument to net operation mode:



Structure of the command:

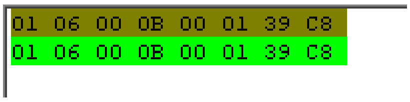
The command has a size of 8 bytes. Each byte has to be separated by a „#” sign in the input field.

byte nr.	Definition
byte 1	The address of the scale instrument, but it doesn't have to be specified in the input field because it can be selected from the above-mentioned **MB-Kinek** combobox. In the example above, its value is 0x01.
byte 2	The MODBUS write function code (preset single register). Értéke 0x06.
byte 3	The address of the register written (upper byte). Its value is always 0x00 by using this version of the instrument program.
byte 4	The address of the register written (lower byte). Its values can be those memory addresses found in the table below section **6.2.2.**, which values don't have to be assigned on 2 words (4 bytes). In the example above, its value is 0x0B (switch operation mode).
byte 5	The value to write to the register (upper byte). In the example above, its value is 0x00.
byte 6	The value to write to the register (lower byte). In the example above, its value is 0x01.
byte 7 & 8	The cyclic redundancy check (CRC) for error checking. It's automatically generated by the program, so it doesn't have to be specified.

Table 23: Structure of the Modbus command

Note: it is possible to write more than one registers at the same time by using the 0x10 MODBUS function code (preset multiple registers). Of course, in this case the structure of the command differs from the description that can be found in the previous table.

Stucture of the answer:



Similarly to „Metrisoft" protocol, below the part of the screen for serial communication setup, a listbox can be found that contains the queries sent (with brown background) and also the response messages received (with green background).

By default, the structure of the respone message is the same as the structure of the command, so we get back what we send to the instrument.

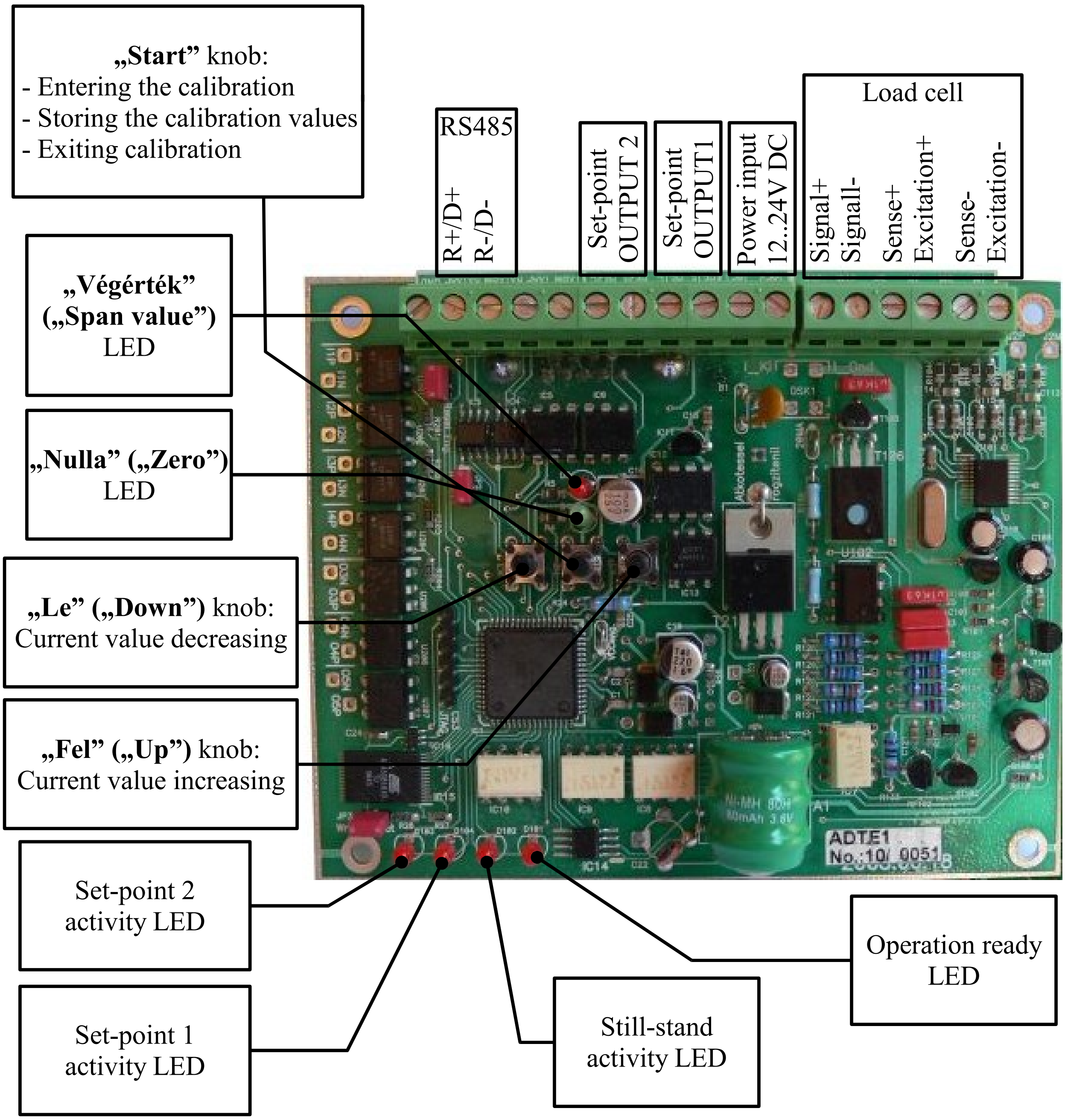
7. Setting the analogue current output

Before setting the current output it is **necessary** to calibrate the instrument as scale (see the case of section **5.**). After doing so, the needed current value can be assigned to the cell signal values that correspond to the zero value and the span value.

7.1. Entering the calibration of the current output

Entering the calibration of the current output is not allowed if the instrument is in the configuration!

- Press and hold the **„Start”** knob for about 4-5 seconds.
- When the **„Nulla” („Zero”)** LED will be illuminated, then release the **„Start”** knob.
  By these operations you can enter the zero position setting of the calibration function.



7.2. Setting the zero position

- By using the **„Fel" („Up")** and the **„Le" („Down")** knobs you can set the current value (0mA or 4mA) corresponding to the mass zero value.
- To store this value, press and hold the **„Start"** knob while the **„Nulla" („Zero")** LED will be switched-off and the **„Végérték" („Span value")** LED will be illuminated.
  By doing so, you enter the span value setting.

> **!**
> If the **„Up"** or the **„Down"** knobs will not be depressed and we shall follow to press the **„Start"** knob to set the span value, then the zero point value in the instrument shall not be changed!

7.3. Setting the span value

- By using the **„Fel" („Up")** and the **„Le" („Down")** knobs you can set the current value (20mA) corresponding to the mass span value.
- Press and hold the **„Start"** knob while the **„Végérték" („Span value")** LED will be switched-off. By doing so, you exit the calibration function.

> **!**
> If the **„Up"** and the **„Down"** knobs will not be depressed, then the span value in the instrument shall not be changed!