Operating Manual

6877.5021 / 6877.5022
Converter for DMS full bridge sensors

Product features:

- 6877.5022: Connection for two independent DMS full bridge sensors
- 6877.5021: Connection for one independent DMS full bridge sensor
- 6877.5022: Two independent analog current/voltage outputs
- 6877.5021: One independent analog current/voltage output
- Four HTL inputs for triggering different states
- Four HTL outputs for displaying different states
- Transmission of sensor data by RS-485
- Programming by USB
- Supply 18 to 30 VDC

Version:	Description:
6877.502x_01a/AF/MBO/ May 2022	First version / edition
6877.5022_01b/mbo/Feb. 2023	Chapter 4/connection diagram updated

Table of content

1. Safety Instructions and Responsibility

1.1. General Safety Instructions

This operation manual is a significant component of the unit and includes important rules and hints about the installation, function and usage. Non-observance can result in damage and/or impairment of the functions to the unit or the machine or even in injury to persons using the equipment!

Please read the following instructions carefully before operating the unit and <u>observe all safety and warning instructions!</u> Keep the manual for later use.

A pertinent qualification of the respective staff is a fundamental requirement in order to use this manual. The unit must be installed, connected and put into operation by a qualified electrician.

Liability exclusion: The manufacturer is not liable for personal injury and/or damage to property and for consequential damage, due to incorrect handling, installation and operation. Further claims, due to errors in the operation manual as well as misinterpretations are excluded from liability.

In addition, the manufacturer reserves the right to modify the hardware, software or operation manual at any time and without prior notice. Therefore, there might be minor differences between the unit and the descriptions in operation manual.

The raiser respectively positioner is exclusively responsible for the safety of the system and equipment where the unit will be integrated.

During installation or maintenance all general and also all country- and application-specific safety rules and standards must be observed.

If the unit is used in processes, where a failure or faulty operation could damage the system or injure persons, appropriate precautions to avoid such consequences must be taken

1.2. Use according to the intended purpose

The unit is intended exclusively for use in industrial machines, constructions and systems. Non-conforming usage does not correspond to the provisions and lies within the sole responsibility of the user. The manufacturer is not liable for damages which has arisen through unsuitable and improper use.

Please note that unit may only be installed in proper form and used in a technically perfect condition (in accordance to the Technical Specifications, see chapter 14). The unit is not suitable for operation in explosion-proof areas or areas which are excluded by the EN 61010-1 standard..

1.3. Installation

The unit is only allowed to be installed and operated within the permissible temperature range. Please ensure an adequate ventilation and avoid all direct contact between the unit and hot or aggressive gases and liquids.

Before installation or maintenance, the unit must be disconnected from all voltage-sources. Further it must be ensured that no danger can arise by touching the disconnected voltage-sources.

Units which are supplied by AC-voltages, must be connected exclusively by switches, respectively circuit-breakers with the low voltage network. The switch or circuit-breaker must be placed as near as possible to the unit and further indicated as separator.

Incoming as well as outgoing wires and wires for extra low voltages (ELV) must be separated from dangerous electrical cables (SELV circuits) by using a double resp. increased isolation.

All selected wires and isolations must be conformed to the provided voltage- and temperature-ranges. Further all country- and application-specific standards, which are relevant for structure, form and quality of the wires, must be ensured. Indications about the permissible wire cross-sections for wiring are described in the Technical Specifications (see chapter 14).

Before first start-up it must be ensured that all connections and wires are firmly seated and secured in the screw terminals. All (inclusively unused) terminals must be fastened by turning the relevant screws clockwise up to the stop.

Overvoltages at the connections must be limited to values in accordance to the overvoltage
category II.

1.4. EMC Guidelines

All motrona units are designed to provide high protection against electromagnetic interference. Nevertheless, you must minimize the influence of electromagnetic noise to the unit and all connected cables.

Therefore, the following measures are mandatory for a successful installation and operation:
- **Use shielded cables for all signal and control input and output lines.**
- **Cables for digital controls (digital I/O, relay outputs) must not exceed a length of 30 m and are allowed for in building operation only**
- Use shield connection clamps to connect the cable shields properly to earth
- The wiring of the common ground lines must be star-shaped and common ground must be connected to earth at only one single point
- The unit should be mounted in a metal enclosure with sufficient distance to sources of electromagnetic noise.
- Run signal and control cables apart from power lines and other cables emitting electromagnetic noise.

Please also refer to motrona manual "General Rules for Cabling, Grounding, Cabinet Assembly". You can download that manual by the link
https://www.motrona.com/en/support/general-certificates.html

1.5. Cleaning, Maintenance and Service Notes

To clean the front of the unit please use only a slightly damp (not wet!), soft cloth. For the rear no cleaning is necessary. For an unscheduled, individual cleaning of the rear the maintenance staff or assembler is self-responsible.

During normal operation no maintenance is necessary. In case of unexpected problems, failures or malfunctions the unit must be shipped for back to the manufacturer for checking, adjustment and reparation (if necessary). Unauthorized opening and repairing can have negative effects or failures to the protection-measures of the unit.

2. Introduction

The 6877.5022 is a unit for connecting two DMS full bridge sensors, those converted measured values are available at two analog outputs (current/voltage) and at four HTL control outputs. Only one DMS full bridge sensor can be connected to the 6877.5021, and one analog output (current/voltage) is available.

There is a USB programming interface and a RS-485 communication interface with LECOM or MODBUS protocol. With the help of four HTL control inputs, a zero-setting of the DMS sensors can be forced.

The four HTL Control outputs transmit the rising above, the falling below of switching points, as well as movements outside of a range. A DMS error can also be detected.

The HTL Control inputs can be used to release the self-holding at the outputs. Furthermore, a set function of the analog output can be realized via the HTL Control inputs.

3. Block diagram for 6877.5022
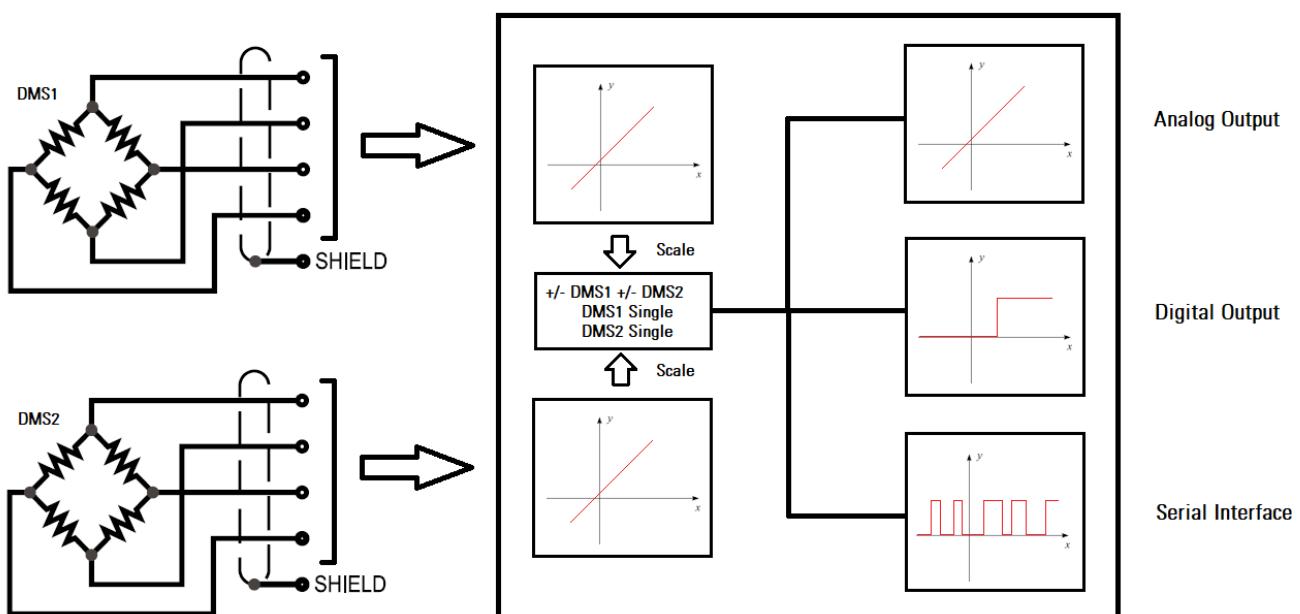
4. Electrical Connections 6877.5022

The terminals should be tightened with a slotted screwdriver (blade width 2mm).
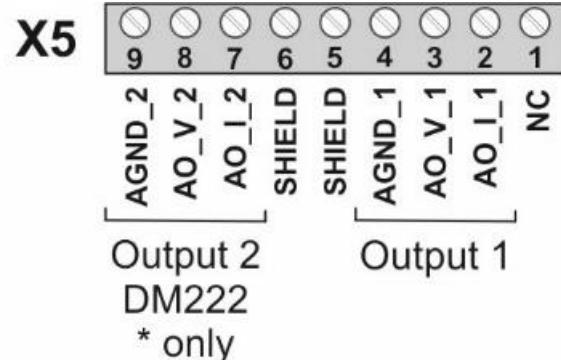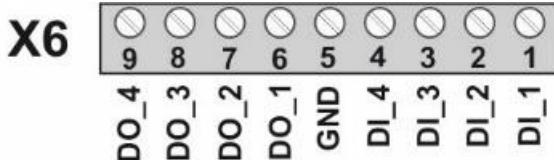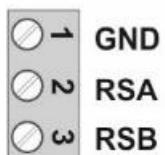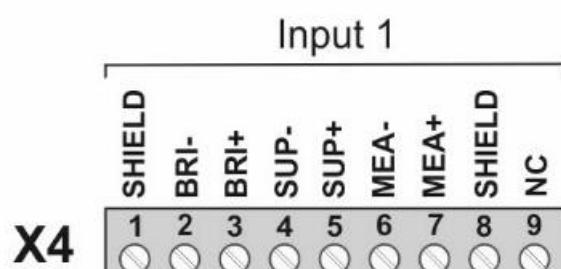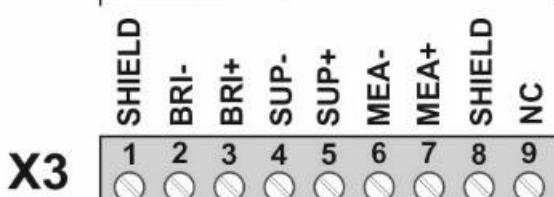
For the 6877.5021 the analog output 2 at X5, terminal 7,8,9 and the terminal X3 is without function. (NC = Not connect = terminal unassigned).

> **It should be noted that all inputs and outputs refer to the same ground potential GND (except USB), which is also the negative pole of the unit supply.**

4.1. DC Input Voltage Supply at X1

The unit is supplied with a DC voltage between 18 - 30 VDC via terminals 1 and 2 of X1. The current consumption depends among others on the level of the supply voltage and the settings and is approx. 50 mA at 24VDC without load from the DMS sensors and the analog and digital outputs. All GNDs are internally connected. Terminal 3 of X1 of the DM corresponds to the SHIELD connection.

4.2. DMS Full Bridge Supply at X3, X4

With the terminals SUP+, SUP- resp. 4, 5 of X3 and X4 the DMS sensor can be supplied by a programmable voltage of 3V - 10VDC with max. 50mA. The supply voltage can be read back in mV via Monitor (Page 0) by the codes <0 and <1.

4.3. DMS Full Bridge Readback at X3, X4

With the terminals MEA+, MEA- resp. 6,7 of X3 and X4 the DMS sensor supply voltage can be read back. These terminals must be connected in any case, ideally directly at the full bridge, in order to avoid voltage drops at the supply line.

4.4. DMS Full Bridge Voltage at X3, X4

With the terminals BRI+, BRI- resp. 2, 3 of X3 and X4 the DMS bridge voltage can be evaluated.
The bridge voltage in units can be read back via Monitor (Page 0) by the codes <4 and <5.

4.5. Example of Connection DMS Sensor

The picture below shows an example of the connection of a DMS sensor.
(SUP = Supply, MEA = Measurement Supply, BRI = Bridge Voltage)
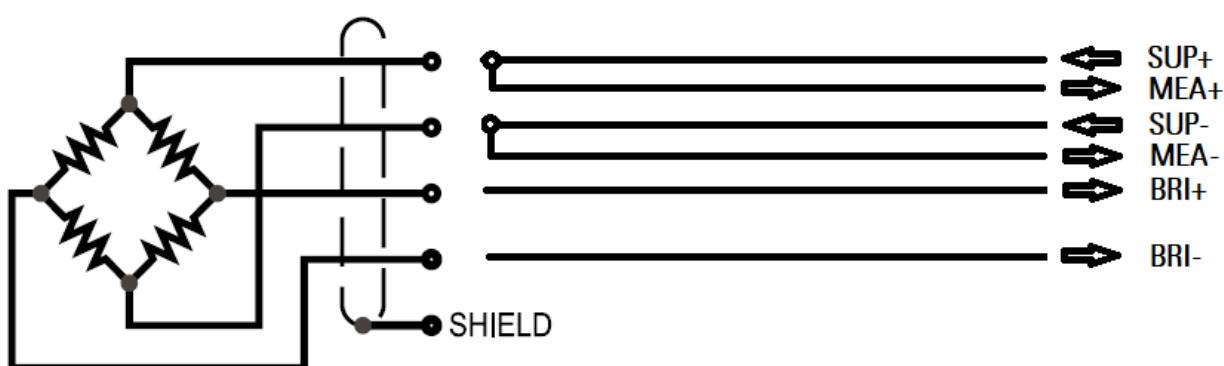
4.6. **Control Outputs OUTx at X6**

At the terminal 6 to 9 of X6 four HTL Control output signals are available. They can show different states by parameterization. These outputs are high side drivers. The status of the outputs are directly visible in the Outputs field of the OS.

4.7. **Control Inputs INx at X6**

At the terminal 1 – 4 of X6 four control inputs with HTL PNP characteristic (internal pull-down resistor) are available. The inputs can be used for HTL control signals. They can be programmed for different functions depending on the parameterization. The status of the inputs is directly visible in the Inputs field of the OS.
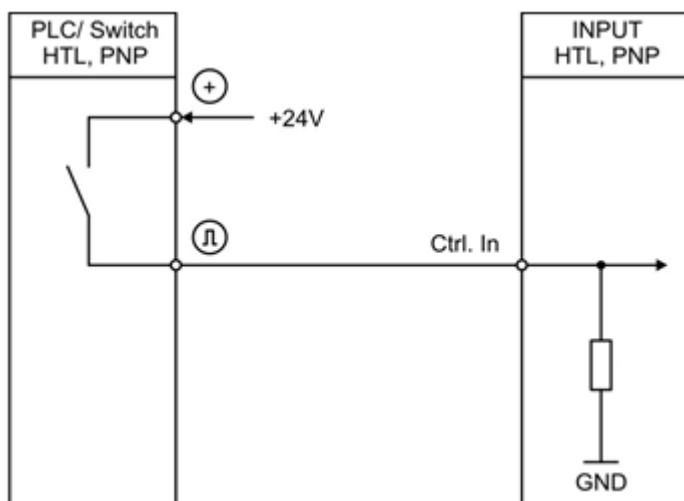
4.8. **Analog Outputs at X5**

At the outputs of the terminals two voltage outputs (+/-10V, 0-10V) and two current outputs
(0-20mA, 4-20mA) are available. The voltage output is located at the terminals 3 and 8, and the current output at terminals 2 and 7. The cable shield can be connected at terminal 5, 6.

Attention:
Only either the current or the voltage output of channel 1 resp. 2 may be used.
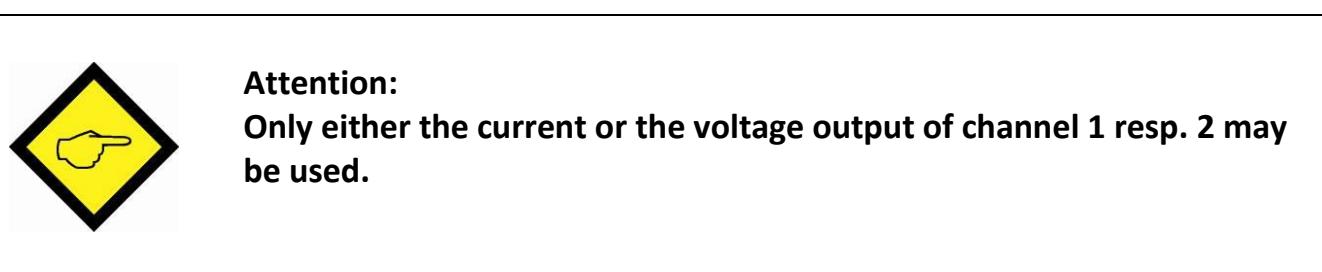
4.9. **LEDs**

The green LED shows that the unit is ready (power supply switched on).
The yellow LED indicates a DMS error in case of static control, otherwise it flashes.
A DMS error occurs when the current exceeds the value 50mA per DMS sensor or when the calculated resistance value deviates too far from the programmed resistance value. The error also occurs when a line break takes place. The resistance value in ohms can be read back via Monitor (page 0) by the codes <2 and <3.

4.10. **USB**

The USB port can be used to connect to a PC via a USB 2.0 mini type B socket. With the help of OS this interface can be used as a programming interface. The ground isolated USB interface is configured as a virtual port and operates in LECOM protocol with 115.2 kBaud, 8N1.
You can download the OS operator software free of charge from our homepage https://www.motrona.com/en/support/software.html, see also QR code on page 2.

4.11. **RS-485 at X2**

A RS-485 (2-wire) interface can be used at X2. At terminal 3 of X2 the non-inverted driver output resp. input (A/Y) and on the other terminal 2 the inverted driver output resp. input (B/Z) is available.
This interface works with LECOM protocol by default and can be changed to MODBUS by parameter setting using USB port and OS

4.12. **DIL**

The DIL switch contact 3 can be used to set the unit to factory settings. For this, the DIL switch contact 3 must be set to ON when the unit is switched on. The status of the DIL switch is visible in the Inputs field of the OS. (white = OFF, blue = ON).
The DIL switch contact 2 is used for the production test and must be set to ON. During production test the digital and analog outputs are switched over each second. (High/Low and -10V/+10V/0V
resp. -20mA/20mA/0mA).

5. Parameter

5.1. Sensor 1 Menu

No.	Parameter	Setting range	Default
000	**Supply 1:** This parameter sets the supply of sensor 1 in V. The setting 5 corresponds to a voltage of approx. 5V (Readback via Monitor Page 0 Code <0, calibration by parameter Vin Mea. Gain 1)	3 - 10	5
001	**Gain 1:** This parameter sets the amplification of bridge voltage 1. A setting of Gain = 0, 1, 2, 3, 4 results a gain of 1, 2, 4, 8, 16. Gain = 0 corresponds to a range of +/- 80mV Gain = 1 corresponds to a range of +/- 40mV Gain = 2 corresponds to a range of +/- 20mV Gain = 3 corresponds to a range of +/- 10mV Gain = 4 corresponds to a range of +/- 5mV	0 - 4	0
002	**Sampling Time 1:** This parameter sets the sampling time of bridge voltage 1. The sampling time doubles with each step. A higher sampling time results in a more accurate input value. The total time can be read out on page 0 by variable ;8 in ms. and is influenced by parameter Sampling Time 1,2 and the filter.	0 - 12	0
003	**Offset 1:** This parameter sets the offset of bridge voltage 1. This parameter is also used for the tare function of the inputs and thus overwritten but not permanently saved. Without using the inputs, the offset can be set permanently	-10000 - 10000	0
004	**Resistor 1:** This parameter is used to set the bridge resistance (input resistance) of sensor 1. This value can be monitored by the DM. For example, if 350 ohms is set, an error will be triggered at R < 175 ohms and R > 700 ohms. (/2 or *2) (Monitor Page 0 code <2) If the value is set to 0, no error can be detected.	0 - 10000	350
005	**Sensitivity 1:** This parameter sets the sensitivity (mV/V) of the sensor. This parameter is used only for certain types of calculation (see parameter Analog Source)	0.100 – 20.000	1.000
006	**Voltage 1:**	1 - 99999	1000

	This parameter is used to convert the bridge voltage together with the parameter Digit. This parameter is used only for certain types of calculation (see parameter Analog Source)		
007	**Digit 1:** This parameter is used to convert the bridge voltage together with the parameter Voltage. This parameter is used only for certain types of calculation (see parameter Analog Source)	1 - 99999	1000
008	**Correction 1:** With this parameter a correction can be made. This parameter is used only for certain types of calculation (see parameter Analog Source)	0.990 – 1.100	1.000
009	**Polarity 1:** With this parameter an inversion can be made. A positive measured bridge voltage can be changed into a negative one by the parameter. (Tension and compression with corresponding sign)	0 - 1	0
010	Reserved		

5.2. Sensor 2 Menu (only for 6877.5022)

No.	Parameter	Setting range	Default
011	**Supply 2:** See Supply 1. (Readback via monitor Page 0 Code <1, calibration by parameter Vin Mea. Gain 2)	3 - 10	5
012	**Gain 2:** See Gain 1.	0 - 4	0
013	**Sampling Time 2:** See Sampling Time 1	0 – 12	0
014	**Offset 2:** See Offset 1	-10000 - 10000	0
015	**Resistor 2:** See Resistor 1 (Monitor Page 0 Codestelle <3)	0 - 10000	350
016	**Sensitivity 2:** See Sensitivitiy 1	100 - 20000	1000
017	**Voltage 2:** See Voltage 1	1 - 99999	1000
018	**Digit 2:** See Digit 1	1 - 99999	1000
019	**Correction 2:** See Correction 1	990 - 1100	1000
020	**Polarity 2:** See Polarity 1	0 - 1	0
021	Reserved		

5.3. Combination Menu

No.	Parameter	Setting range	Default
022	**Multiplier 1:** With this parameter a multiplication with sensor value 1 can be performed. A setting of zero means that no multiplication or division occurs. This parameter is used only for certain types of calculation (see parameter Analog Source)	0 – 9999	0
023	**Divisor 1:**	1 – 9999	1000

No.	Parameter	Setting range	Default
	With this parameter a division with sensor value 1 can be performed. This parameter is used only for certain types of calculation (see parameter Analog Source)		
024	**Multiplier 2: (only for 6877.5022)** With this parameter a multiplication with sensor value 2 can be performed. A setting of zero means that no multiplication or division occurs. This parameter is used only for certain types of calculation (see parameter Analog Source)	0 - 9999	0
025	**Divisor 2: (only for 6877.5022)** With this parameter a division with sensor value 2 can be performed. This parameter is used only for certain types of calculation (see parameter Analog Source)	1 – 9999	1000
026	Reserved		
027	Reserved		

5.4. Digital Input Menu

No.	Parameter	Setting range	Default
028	**Input 1 Config:** Defines the behavior of the input. 0: Static Low, function triggering at a „low" state 1: Static High, function triggering at a „high" state	0 - 1	0
029	**Input 1 Function:** 0: No function 1: Tara for bridge voltage 1 (zero setting) 2: Tara for bridge voltage 2 (zero setting) 3: Tara für bridge voltage 1-2 (zero setting) 4: Reset of the self-holding for output 1 5: Reset of the self-holding for output 2 6: Reset of the self-holding for output 3 7: Reset of the self-holding for output 4 8: Reset of the self-holding for output 1-4 9: Set analog output 1 to set value 10: Set analog output 2 to set value 11: Set analog output 1-2 to set value	0 - 11	0
030	**Input 2 Config:** see Input 1 Config	0 - 1	0
031	**Input 2 Function:** see Input 1 Function	0 - 11	0
032	**Input 3 Config:** see Input 1 Config	0 - 1	0

No.	Parameter	Setting range	Default
033	**Input 3 Function:** see Input 1 Function	0 - 11	0
034	**Input 4 Config:** see Input 1 Config	0 - 1	0
035	**Input 4 Function:** see Input 1 Function	0 - 11	0
036	Reserved		
037	Reserved		

5.5. **Analog Output 1 Menu**

No.	Parameter	Setting range	Default

038	**Analog Source 1:**
	
	0: for the analog output 1 the direct converted bridge voltage of sensor 1 is used
	1: for the analog output 1 the converted bridge voltage of sensor 1 is
	  used
	2: for the analog output 1 the direct converted bridge voltage of sensor 2 is used
	3: for the analog output 1 the converted bridge voltage of sensor 2 is
	  used
	4: for the analog output 1 the factorized bridge voltage of sensor 1 + sensor 2 is used.
	5: for the analog output 1 the single converted bridge voltage of sensor 1 + sensor 2 is used.
		0 - 5	0

039	**Analog Mode 1:** Selection of analog output 1 0: 0V - 10V (Analog Start = 0V, Analog End = 10V) 1: -10V - +10V (Analog Start = -10V, Analog End = +10V) 2: 0mA – 20mA (Analog Start = 0mA, Analog End = 20mA) 3: 4mA – 20mA (Analog Start = 4mA, Analog End = 20mA)	0 - 3	1
040	**Analog Start 1:** Value at which the analog output is set to 0V or 0mA resp. 4mA (see Analog Mode)	-99999 - 99999	0
041	**Analog End 1:** Value at which the analog output is set to 10V or 20mA. (see Analog Mode)	-99999 - 99999	10000
042	**Analog Set 1:** Control value for the analog output, if the command "Set" appears at the control input or via interface.	-10000 - 10000	0
043	Reserved		

5.6. Analog Output 2 Menu (only 6877.5022)

No.	Parameter	Setting range	Default
044	**Analog Source 2:** See Analog Source 1.	0 - 5	0
045	**Analog Mode 2:** See Analog Mode 1.	0 - 3	1
046	**Analog Start 2:** See Analog Start 1.	-99999 - 99999	0
047	**Analog End 2:** See Analog End 1.	-99999 - 99999	10000
048	**Analog Set 2:** See Analog Set 1.	-10000 - 10000	0
049	Reserved		

5.7. Digital Output Menu

No.	Parameter	Setting range	Default
050	**Output Polarity:** Switching the output polarity (binary) 0: no inversion of the outputs Bit Value 1: OUT1 inverted Bit Value 2: OUT2 inverted Bit Value 4: OUT3 inverted Bit Value 8: OUT4 inverted Example 1+2+4+8 = 15: all outputs are inverted	0 - 15	0
051	**Output Lock:** Activation of the self-holding (binary) 0: no self-holding of the outputs Bit Value 1: for OUT1 the self-holding is activated Bit Value 2: für OUT2 the self-holding is activated Bit Value 4: für OUT3 the self-holding is activated Bit Value 8: für OUT4 the self-holding is activated Example 1+2+4+8 = 15: self-holding is activated for all outputs	0 - 15	0
052	**Output Source 1:** Selection of calculation for output 1. (see Analog Source) 0: Selection for channel 1 as set in Analog Source 1 1: Selection for channel 2 as set in Analog Source 2 2: Original value for channel 1 3: Original value for channel 2	0 - 3	0

053	**Output Function 1:** Output 1 function 0: no function (controlled on low) 1: Output becomes high when Output Source 1 > Output Preselec. 1 2: Output becomes high when |Output Source 1| > Output Preselec. 1 3: Output becomes high when Output Source 1 < Output Preselec. 1 4: Output becomes high when |Output Source 1| < Output Preselec. 1 5: Output becomes high when Output Source 1 outside the band 6: Output becomes high, when |Output Source 1| outside the band 7: Output becomes high, when a DMS sensor error is detected The band is defined as Output Preselec. 1 +/- (Output Preselec. 1 x Output Hysteresis 1 / 100) Example: Output Preselec. 1 = 2000 Output Hysteresis 1 = 15 As result the band reaches from 1700 to 2300 center 2000 +/- 300 (15% von 2000)	0 - 7	0
054	**Output Hysteresis 1:** Hysteresis (difference between switch-on and switch-off) for Output 1 in % refered to Output 1 Preselec. 1.	0 - 100	0
055	**Output Preselec. 1:** Switching point for Output 1 (If a band is selected, the Output Preselec. 1 corresponds to the center of the band)	-9999 - +9999	1000
056	**Output Source 2:** See Output Source 1	0 - 3	0
057	**Output Function 2:** See Output Source 1	0 - 7	0
058	**Output Hysteresis 2:** See Output Source 1	0 - 100	0
059	**Output Preselec. 2:** See Output Source 1	-9999 - +9999	1000
060	**Output Source 3:** See Output Source 1	0 - 3	0
061	**Output Function 3:** See Output Source 1	0 - 7	0
062	**Output Hysteresis 3:** See Output Source 1	0 - 100	0

063	**Output Preselec. 3:** See Output Source 1	-9999 - +9999	1000
064	**Output Source 4:** See Output Source 1	0 - 3	0
065	**Output Function 4:** See Output Source 1	0 - 7	0
066	**Output Hysteresis 4:** See Output Source 1	0 - 100	0
067	**Output Preselec. 4:** See Output Source 1	-9999 - +9999	1000
068	Reserved		
069	Reserved		

5.8. **Modbus Menu**

No.	Parameter	Setting range	Default
070	**Modbus Address:** Modbus address	1 - 247	1
071	**Modbus CRC Reset:** Modbus CRC calculator reset Additional tool, used to calculate the CRC value	0 - 1	0
072	**Modbus CRC Byte:** Modbus CRC calculator byte Additional tool, used to calculate the CRC value	0 - 255	0
073	Reserved		

5.9. **Serial Menu**

No.	Parameter	Setting range	Default
074	**USB Unit Nr.:** USB unit no for the virtual port is fixed to 11.	11	11
075	**USB Baud Rate:** USB baud rate for the virtual port is fixed to 115.2kBaud.	0	0
076	**USB Baud Rate:** USB format for the virtual port is fixed to 8N1.	0	0
077	**Serial Page:** Selection of a specific variable page for internal diagnostics	0 - 5	0
078	**Serial Mode:** Switching the RS-485 interface to different protocols, baud rates and formats 0 : Lecom protocol with RS unit no., baud rate and format 1 : Modbus protocol with RS baud rate and 8E1 2 : Modbus protocol with RS baud rate and 8O1 3 : Modbus protocol with RS baud rate and 8N2	0 - 3	0
079	**RS Unit Nr.:** Unit no. for the RS-485 interface (only for Lecom protocol)	11 - 99	11
080	**RS Baud Rate:** RS Baud Rate fot the RS-485 interface 0 : 9600 Baud 1: 4800 Baud 2: 2400 Baud 3: 1200 Baud 4: 600 Baud 5: 19200 Baud 6: 38400 Baud 7: 56000 Baud 8: 57600 Baud 9: 76800 Baud 10: 115200 Baud	0 - 10	10
081	**RS Format:** Format for the RS-485 interface 0 : 8N1 (8 Data Bit, Non Parity, 1 Stop Bit) 1 : 8E1 (8 Data Bit, Even Parity, 1 Stop Bit) 2 : 8O1 (8 Data Bit, Odd Parity, 1 Stop Bit)	0 - 2	0
082	Reserved		
083	Reserved		

5.10. General Menu

No.	Parameter	Setting range	Default
084	**Filter:** This parameter provides a better filtering of the DMS sensor supply readback. The filter time is doubled with each increase in value. The longer the filter time, the more accurate the read value. The total read-in time can be read out on page 3 by variable ;9 in ms. The total reading time is influenced by parameter Sampling Time 1,2 and filter.	$0-5$	0
085	**Min Max Channel:** Selection of the analog input for min/max value monitoring. With the Min/Max value monitoring the fluctuation range of the signal can be determined, an increase of the sampling time or the filter can reduce the fluctuations. 0 : Read back supply voltage sensor 1 1 : Read back supply voltage sensor 2 2 : Bridge voltage sensor 1 3 : Bridge voltage sensor 2 4 : Current measurement sensor 1 5 : Current measurement sensor 2	0 - 5	0
086	**Reset Min Max:** If this parameter is set to 1, the minimum and maximum values are reset. If the parameter is set to 0, continuous recording of the minimum and maximum values takes place.	$0-1$	0
087	**Monitor Switch:** If this parameter is set to 0, the analog output 1 is displayed in the Output Value field in the OS, otherwise the analog output 2 is displayed	$0-1$	0
088	Reserved		
089	Reserved		

5.11. Adjustment Menu

No.	Parameter	Setting range	Default
090	**Vout Offset 1:** Voltage offset setting for analog output 1. (see calibration of the analog output)	-30 - +30	0
091	**Vout Gain 1:** Voltage gain setting for analog output 1. (see calibration of the analog output)	0.9990 – 1.0010	1.0000
092	**Iout Offset 1:** Current offset setting for analog output 1 (see calibration of the analog output)	-30 - +30	0
093	**Iout Gain 1:** Current gain setting for analog output 1 (see calibration of the analog output)	0.9990 – 1.0010	1.0000
094	**Vout Offset 2:** Voltage offset setting for analog output 2. (see calibration of the analog output)	-30 - +30	0
095	**Vout Gain 2:** Voltage gain setting for analog output 2. (see calibration of the analog output)	0.9990 – 1.0010	1.0000
096	**Iout Offset 2:** Current offset setting for analog output 2. (see calibration of the analog output)	-30 - +30	0
097	**Iout Gain 2:** Current gain setting for analog output 2. (see calibration of the analog output)	0.9990 – 1.0010	1.0000
098	**Out Temp. C.:** Temperature compensation for the analog outputs. If the OUT TC parameter is set to 0, the outputs are corrected by an internal temperature measurement. This provides better accuracy. The temperature compensation refers only to the gain	0 – 1	0
099	**Vin T. Offset 1:** Voltage-temperature offset setting for analog input 1 (Fine adjustment of temperature compensation)	0.5000 – 1.5000	1.0000
100	**Vin T. Offset 2:** Voltage-temperature offset setting for analog input 2. (Fine adjustment of temperature compensation)	0.5000 – 1.5000	1.0000

101	**Vin T. Gain 1:** Voltage-temperature gain setting for analog input 1 (Fine adjustment of temperature compensation)	0.90000 – 1.10000	1.00000
102	**Vin T. Gain 2:** Voltage-temperature gain setting for analog input 2. (Fine adjustment of temperature compensation)	0.90000 – 1.10000	1.00000
103	**In Temp. C.:** Temperature compensation for the analog inputs. IN TC = 0: compensation of Offset and Gain IN TC = 1: only Offset compensation IN TC = 2: only Gain compensation IN TC = 3: no compensation	0 – 3	0
104	**Vin Mea. Gain 1:** Gain setting for the input MEA 1. (MEA)	0.8000 – 1.2000	1.0000
105	**Vin Mea. Gain 2:** Gain setting for the input MEA 2. (MEA)	0.8000 – 1.2000	1.0000
106	**Temp. Offset I1:** Inversion of the temperature compensation for the offset of input 1.	0 – 1	0
107	**Temp. Offset I2:** Inversion of the temperature compensation for the offset of input 2.	0 – 1	0
108	**Temp. Gain I1:** Inversion of the temperature compensation for the gain of input 1.	0 – 1	0
109	**Temp. Gain I2:** Inversion of the temperature compensation for the gain of input 2.	0 – 1	0
110	**Temp. Sim:** If parameter Temp. Sim = 0 is set, the internal temperature sensor is used. If the parameter is set to 1, parameter Temp. Sim. Value is used instead of the internal temperature sensor. This allows the temperature to be simulated and the calculation of the temperature compensation to be checked.	0 – 1	0
111	**Temp. Sim. Value:** Temperature simulation. The value 870 corresponds to +60°, the value 1140 corresponds to +20° and the value 1412 corresponds to -20°. The current temperature can be read out by the monitor value Page 0 code ;7.	870 – 1412	1140

112	Reserved		
113	Reserved		

6. Commissioning

6.1. Basic Setting of the DMS Sensor

For connecting or wiring see connection example for DMS sensor. After connection the parameter Supply, Gain, Sampling, Resistor and Filter can be set.

Parameter Supply corresponds to the supply voltage of the DMS sensor, this can be found in the operating manual of the sensor. Values from 3 (3V) to 10 (10V) can be set for parameter Supply. The Monitor Page 0 code >0,>1 is used to readback the supply voltage in mV, the measurement can be calibrated by parameter Vin Mea Gain. Also in the operating manual of the sensor you can find the value of the input resistance. This can be adopted for parameter Resistor. A check of the resistance value in ohms can be done by Monitor Page 0 with the code <2, <3. A miscalibration of Vin Mea Gain will result in a miscalculation.

The gain should be selected so that the input voltage range is not exceeded at maximum load.

At gain = 0 this is +/-80mV. This can be calculated approximately using a reference weight, for example.

Parameter Sampling Time should be selected in dependence of Gain, so that the input fluctuation is as small as possible and the input is still dynamic enough. This also applies to parameter Filter.

The resulting read-in cycle time can be displayed in the Page 0 monitor with the code ;8 in ms.

With the parameter Polarity a negative magnitude can be changed into a positive one. Thus, the user can provide tension and pressure with the corresponding sign.

Wiring faults, open connections and short circuits on the sensor can be detected by checking the monitor variables, by the Outputs field of the OS, or indicated by an output. (Read back supply voltage and calculated resistor value)

	Attention: **Check whether the sensor is designed for the programmed supply voltage.** **(Data sheet sensor: supply voltage)** **Check if the input voltage range is within the maximum load of the sensor** **(Data sheet sensor: nominal characteristic value [mV/V] x supply voltage)**

6.2. Simplest Setting

The simplest setting for the analog and digital outputs is to use the directly converted bridge voltage.

(Monitor Page 0 channel 1: <4, channel 2: <5)

For this, parameter Analog Source must be set to 0 or 2 for the analog outputs, for the digital outputs, parameter Output Source can also be set to 2 or 3.

The following parameters must be adjusted for the strain gauge sensor:

Parameter Supply: Data sheet sensor -> Permissible supply voltage of the DMS sensor

Parameter Gain: Data sheet sensor -> Sensor operating range

Parameter Sampling: fluctuation of measurement and dynamics of change

Parameter Resistor: Data sheet sensor -> input resistance

Setting with zeroing:

Zeroing is necessary when forces act in both directions and the transition of e.g. tension and pressure of the input variable is to be determined in the form of the sign.
Parameter Offset is decisive for zeroing. The unloaded DMS sensor can be zeroed using the tare function. The value displayed in the monitor can also be transferred directly to the offset register. Then the monitor value displays zero. With the tare function using an input, the value is only saved temporarily, after a new power-up, it must be zeroed again.
If the tare function is performed using the OS or serial communication, the value can also be saved by an OS Store Eeprom command.
Then the DMS sensor is loaded with a reference weight. A new monitor value is displayed, which corresponds to the reference weight. This value can now be converted into units for the analog and digital outputs. Based on the monitor value, you can determine the resolution in relation to the reference weight and then also optimize parameter Gain.
When parameter Gain is changed, parameter Offset must also be adjusted.

Example for channel 1:

Monitor value Page 0 <4: 25 at Offset = 0, DMS unloaded
Monitor value Page 0 <4: 0 at Offset = 25, DMS unloaded and zeroed
Monitor value Page 0 <4: 1000 at 5kg reference weight
It follows that at 50kg the value must be 10000. If the digital output is to switch at more than 40kg, the Output Preselec. must be set to 8000. If the analog output is to output at 0kg -> 0V, and at 50kg -> 10V, Analog Start = 0 and Analog End = 10000 must be set.

Setting without zeroing:

Zeroing is not necessary if the input variable is not required as a reference for the forces, that means the acting forces are not directly readable from the input variable. (e.g. value 531 -> 400g)
After that, the DMS sensor is loaded with a reference weight, a new monitor value is displayed, that corresponds to the reference weight. This value can now be converted into units for the analog and digital outputs. Based on the monitor value, you can determine the resolution in relation to the reference weight and then also optimize parameter Gain.

Example for channel 1:

Monitor value Page 0 <4: 25 at Offset = 0, DMS unloaded
Monitor value Page 0 <4: 1025 at 5kg reference weight
It follows that at 50kg the value must be 10025. (1025 – 25 = 1000 corresponds
5kg -> 50kg = 10000, -> monitor value at 50kg = 10025)
If the digital output is to switch at more than 40kg, the Output Preselec. must be set to 8025.
If the analog output is to output at 0kg -> 0V, and at 50kg -> 10V, Analog Start = 25 and Analog End = 10025 must be set.

6.3. Conversion to Sensor Units

A conversion to sensor units is necessary if these quantities are to be transmitted by the interface and an external conversion is to be dispensed with. Furthermore, this type of conversion is necessary if a reference load or reference weight is not used for setting.
By using parameters Sensitivity, Voltage, Digits, and Correction, the read-in sensor value can be converted into units such as N or kg. For parameter Correction, you need a reference load or a reference weight with which the displayed value can be corrected. Parameter Analog Source must be set to 1 or 3 for the analog outputs and parameter Output Source must be set to 0 or 1 for the digital outputs.
Parameter Offset is important for zeroing. The unloaded DMS sensor can be zeroed using the tare function. The value displayed in the monitor can also be transferred directly to the offset register. Then the monitor value displays zero. When using the tare function with the help of an input, the value is only saved temporarily; after a new power-up, it must be zeroed again.
If the tare function is operated by using the OS or serial communication, the value can also be saved by using a Store Eeprom.
Parameter Sensitivity corresponds to the sensitivity (mV/V) of the DMS sensor, this can be found in the operating manual of the sensor. The standard load or standard force can also be found here. (e.g. 2mV/V @ 100N or 10.194kg)

Parameter Sensitivity = 2,000 see data sheet
Parameter Analog Source = 1 calculation type
Parameter Voltage = 1000   Gain = 1
Parameter Digits = 10194 conversion to kg, number of digits in g
Parameter Correction = 1000   no correction
Parameter Offset = 133 -> 0
With a reference weight of 200g -> input variable 54
Conversion -> 197..201

Attention: Here a multiplication by a factor of 4 takes place, it would be better to raise the gain to 4 if you want an accuracy to 1g.
To adjust the conversion to a small extent, parameter Correction can be used. A 1% adjustment is made by 990 or 1010.
Checking of the calculation can be done by Monitor Page 0 with the code position <8, <9. Based on the monitor value, you can determine the resolution in relation to the reference weight and then also optimize parameter Gain. With changing of parameter Gain, parameter Offset must also be adjusted.

6.4. Combined Sensors

The combined setting for the analog and digital outputs is to use the factorized or the single converted bridge voltages. (Monitor Page 0 channel 1: <8, channel 2: <9)
For this purpose, parameter Analog Source must be set to 4 or 5 for the analog outputs, and parameter Output Source can also be set to 2 or 3 for the digital outputs.
Parameter Offset is important for zeroing. The unloaded DMS sensor can be zeroed using the tare function. The value displayed in the monitor can also be transferred directly to the offset register. Then the monitor value displays zero. When using the tare function with

the help of an input, the value is only saved temporarily; after a new power-up, it must be zeroed again.

If the tare function is operated by using the OS or serial communication, the value can also be saved by using a Store Eeprom.

After that the DMS sensor is loaded with a reference weight, a new monitor value is displayed which corresponds to the reference weight. This value can now be converted into units for the analog and digital outputs. Based on the monitor value, you can determine the resolution in relation to the reference weight and then also optimize parameter Gain. With changing of parameter Gain, parameter Offset must also be adjusted.

When combining the two channels with a factorized calculation (Analog Source = 4), the single bridge voltage can be multiplied by parameter Multiplier and divided by parameter Divisor. If different DMS sensors are used, they can be adjusted to each other by factorization.

Example for channel 1 and 2:

Monitor value Page 0 <4: 25 at Offset = 0, DMS 1 unloaded

Monitor value Page 0 <4: 0 at Offset = 25, DMS 1 unloaded and zeroed

Monitor value Page 0 <5: 70 at Offset = 0, DMS 2 unloaded

Monitor value Page 0 <5: 0 at Offset = 70, DMS 2 unloaded and zeroed

Monitor value Page 0 <4: 55 at Offset = 25, DMS 1 loaded with reference weight and zeroed

Monitor value Page 0 <5: 110 at Offset = 70, DMS 2 loaded with reference weight and zeroed

DMS sensor 2 has twice the sensitivity of DMS sensor 1. Both are operated with the same voltage. Parameter Multiplier 2 and Divisor 2 could now be set to halve the sensor value 2. Checking of the calculation can be done by Monitor Page 0 with the code position <8, <9. Here an addition of both values takes place, by changing parameter Polarity also a subtraction can take place.

When combining the two channels with a single conversion (Analog Source = 5), the single bridge voltages can first be converted to sensor units and then added together. Parameter Multiplier and parameter Divisor are not used. If different DMS sensors are used, they can be adjusted to each other by individual conversion.

6.5. Digital Input

The digital inputs are used to trigger functions. Here the zeroing can be done by an input. A reset of the self-holding of an output, as well as the activation of the analog output with a set value is also possible.

6.6. Analog Output

In the analog output menu, the source is set by parameter Analog Source. Parameter Analog Mode can be used to differentiate between different voltage ranges and current ranges. (+/-10V, 0V-10V, 0mA-20mA or also 4mA-20mA)

Parameter Analog Start defines the source value at 0V or 0mA or also 4mA. Parameter Analog End defines the source value at 10V or 20mA.

Parameter Analog Set defines a source value within the range from start to end that can be controlled by a digital input. Thus the analog output can also be controlled directly by the interface.

6.7. Digital Output

The digital outputs are used for the detection of states. For example, if the force exceeds a certain value, the output is set. Shortfall can also be detected. The functions can be used for forces in one direction, or in both directions.

A hysteresis can also be programmed, as well as a self-holding whose reset is only triggered again by an input.

6.8. Additional Optional Settings

6.8.1. Examination of the Read Analog Values

By using parameter Min Max Channel, different read-in values can be examined for their scatter. Setting the parameter Reset Min Max = 1 resets minimum and maximum values. Then parameter Reset Min Max must be set to 0 again. The deviations can be made visible by Monitor Page 0 with the code <6 and <7. If the values fluctuate too much, the sampling time or the filter must be increased.

6.8.2. Setting of the RS-485 Serial Interface

By using parameter Serial Mode, the protocol of the RS-485 interface can be used to set. With the setting Serial Mode = 0 the interface works with the Lecom protocol and with the parameter setting options RS Unit No., RS Baud rate and RS Format. If the Serial Mode parameter is set to 1, 2 or 3, the Modbus protocol is used, the baud rate remains adjustable by parameter RS Baud Rate, where the format is set to 8 data bits, Parity Even (=1), Parity Odd (=2) or Parity None (=3) with 1 stop bit.

Different functions can be sent by Modbus or Lecom. The Modbus address can be set by parameter Modbus address. Furthermore a modbus CRC calculator is available. (parameter CRC Reset and Byte)

6.9. Calibration of Analog Output

Both analog outputs can be calibrated individually. The set function is used for this purpose. An unconnected input can control the set values at the analog outputs by setting the parameters Input Config = 0 and Input Function = 11. The set values is set to 0V (analog set = analog start). By using parameter Vout Offset 1 you can now fine-tune the offset of analog output 1. After that, the gain of analog output 1 can be fine-tuned. For this purpose, the set value is set to 10V, and then the value can be corrected by parameter Vout Gain 1, so that exactly 10000mV are measured. (analog set = analog end)

6.10. Calibration of MEA Readback

Both analog readbacks of the bridge voltage can be calibrated. For this, an external multimeter must be connected and then compared in relation to the readback via monitor. A calibration is possible by using parameter Vin Mea. Gain. An adjustment is necessary to increase the accuracy of the calculated resistance value and when using the

conversion in sensor units. The setting must be done after the parameter Supply was selected.

6.11. Calibration of Analog Input BRI / DMS

Both analog inputs can only be calibrated in relation to the temperature.
These settings linearly correct the offset and gain depending on the temperature.

6.11.1. Calibration of Input Stage

Using different parameters, the input stage can be optimized in relation to the temperature. Using parameter Temp. Sim., the temperature for the unit can be simulated. This makes it easy to determine the influences of individual variables. First the offset correction must take place and after that the gain correction.

Example Offset correction:

Voltage at Input 1	0 mV
Parameter In Temp. C. = 1	Temperature compensation of Offset
Parameter Temp. Sim. = 1	Simulation active
Parameter Temp. Sim. Value = 1412	Simulation with -20°
Monitor Page 5 code <0	-20 (read back temperature)
Parameter Gain 1 = 0	Gain = 0 selected
Parameter Vin T. Offset 1 = 1.0000	Standard
Parameter Temp. Offset I1 = 0	Inversion
Monitor Page 5 code ;8	-8 (read back correction at 40K)
Monitor Page 5 code <1	Offset changes e.g.from 21 to 29 at In Temp.C = 1/3

By looking at the monitor page 5 code <1 you can directly see the influence with and without temperature offset compensation by switching. The correction is zero at 20° and is the reference point. The offset is reduced by 8 increments at -20°. At 40K the offset is corrected by 8 increments. By changing the parameter Temp. Offset I1 = 1, the code ;8 does not change, but at >1. Here the offset is then increased by 8 increments. The Gain parameter also affects the calculation, with Gain = 4, -132 increments are compensated for instead of -8. By parameter Vin T. Offset 1 the 8 increments can be increased or decreased.
The following relationship applies:
Correction = (Temperature -20) x (Gain + 1) x (Gain + 1) x 2063 / Vin T. Offset
Correction (Temperature = -20°, Gain = 0, Vin T. Offset = 1.0000) = -40 x 2063 / 10000= -8
With the standard settings, there is sufficient optimization for the input stage.

Example Gain correction:

Voltage at Input 1   5 mV

Parameter In Temp. C. = 0   Temperature compensation of Offset and Gain

Parameter Temp. Sim. = 1   Simulation active

Parameter Temp. Sim. Value = 1412   Simulation with -20°

Monitor Page 5 code <0   -20 (Read back temperature)

Parameter Gain 1 = 0   Gain = 0 selected

Parameter Vin T. Gain 1 = 1.00000   Standard

Parameter Temp. Gain I1 = 0   Inversion

Monitor Page 5 code <3   (Read back correction at 40K)

Monitor Page 5 code <5   Gain changes by factor at In Temp.C = 0/3

The following relationship applies:

Correction factor = ((Temperature -20) x (Gain + 1) + 100000) / Vin T. Gain

Correction (Temperature = -20° , Gain = 0, Vin T. Gain = 1.00000) = -40 + 100000 / 100000 = 0,9996

With the standard settings, there is sufficient optimization for the input stage.

6.11.2.   Calibration of Input Stage and of DMS Sensor

Using different parameters, the input stage and the DMS can be optimized in relation to the temperature. Condition is that the DMS and the unit are exposed to approximately the same temperatures. Here, for example, the temperature-dependent offset of the DMS can be taken into account in addition to the input stage. First the offset correction must take place and after that the gain correction.

6.11.3.   Monitor Codes for Calibration

Calibration can be simplified by using of different monitor codes.

Monitor Page 5 code ;8   Read back offset correction input 1

Monitor Page 5 code ;9   Read back offset correction input 2

Monitor Page 5 code <0   Read back temperature

Monitor Page 5 code <1   Input 1 with offset compensation

Monitor Page 5 code <2   Input 2 with offset compensation

Monitor Page 5 code <3   Factor of gain compensation of input 1

Monitor Page 5 code <4   Factor of gain compensation of input 2

Monitor Page 5 code <1   Input 1 with offset, offset and gain compensation

Monitor Page 5 code <2   Input 2 with offset, offset and gain compensation

7. Input Functions

7.1. Tara 1

The Tara 1 function zeroes the bridge voltage of DMS sensor 1. The current measured value is transferred to parameter Offset 1.

Tiggering	Parameter	Comment	Addition
Input	Input X Config = 0/1 Input X Function = 1	If Input X Config = 0 is set, the command is triggered on a "low" state at input X	The status of the input can be read in the OS Input field
Lecom	Code 66 (dec)	Release : 04 31 31 02 36 36 30 03 33 Set : 04 31 31 02 36 36 31 03 32 (Unit no. 11, command in hex)	If 1 is written at code 66, the command is set.
Modbus	Cell FF00 (hex)	Release : 07 06 FF 00 00 00 B9 B8 Set : 07 06 FF 00 00 01 78 78 (Modbus address = 7, command in hex)	If 1 is written to cell FF00, the command is set.

7.2. Tara 2

The Tara 2 function zeroes the bridge voltage of DMS sensor 2. The current measured value is transferred to parameter Offset 2.

Tiggering	Parameter	Comment	Addition
Input	Input X Config = 0/1 Input X Function = 2	If Input X Config = 0 is set, the command is triggered on a "low" state at input X	The status of the input can be read in the OS Input field
Lecom	Code 65 (dec)	Release : 04 31 31 02 36 35 30 03 30 Set : 04 31 31 02 36 35 31 03 31 (Unit no. 11, command in hex)	If 1 is written at code 65, the command is set.
Modbus	Cell FF02 (hex)	Release : 07 06 FF 02 00 00 18 78 Set : 07 06 FF 02 00 01 D9 B8 (Modbus address = 7, command in hex)	If 1 is written to cell FF02, the command is set.

7.3. Tara 12

The Tara 12 function zeroes the bridge voltage of DMS sensor 1 and 2. The current measured value is transferred to parameter Offset 1 and 2.

Tiggering	Parameter	Comment	Addition
Input	Input X Config = 0/1 Input X Function = 3	If Input X Config = 0 is set, the command is triggered on a "low" state at input X	The status of the input can be read in the OS Input field
Lecom	Code 64 (dec)	Release : 04 31 31 02 36 34 30 03 31 Set : 04 31 31 02 36 34 31 03 30 (Unit no. 11, command in hex)	If 1 is written at code 64, the command is set.
Modbus	Cell FF04 (hex)	Release : 07 06 FF 04 00 00 F8 79 Set : 07 06 FF 04 00 01 39 B9 (Modbus address = 7, command in hex)	If 1 is written to cell FF04, the command is set.

7.4. Lock 1

The Lock 1 function releases the digital output 1 again when the self-holding has been activated. For this purpose, parameter Output Lock of the respective output must be switched active.

Tiggering	Parameter	Comment	Addition
Input	Input X Config = 0/1 Input X Function = 4	If Input X Config = 0 is set, the command is triggered on a "low" state at input X	The status of the input can be read in the OS Input field
Lecom	Code 63 (dec)	Release : 04 31 31 02 36 33 30 03 36 Set : 04 31 31 02 36 33 31 03 37 (Unit no. 11, command in hex)	If 1 is written at code 63, the command is set.
Modbus	Cell FF06 (hex)	Release : 07 06 FF 06 00 00 59 B9 Set : 07 06 FF 06 00 01 98 79 (Modbus address = 7, command in hex)	If 1 is written to cell FF06, the command is set.

7.5. Lock 2

The Lock 2 function releases the digital output 2 again when the self-holding has been activated. For this purpose, parameter Output Lock of the respective output must be switched active.

Tiggering	Parameter	Comment	Addition
Input	Input X Config = 0/1 Input X Function = 5	If Input X Config = 0 is set, the command is triggered on a "low" state at input X	The status of the input can be read in the OS Input field
Lecom	Code 62 (dec)	Release : 04 31 31 02 36 32 30 03 37 Set : 04 31 31 02 36 33 31 03 36 (Unit no. 11, command in hex)	If 1 is written at code 62, the command is set.
Modbus	Cell FF08 (hex)	Release : 07 06 FF 08 00 00 38 7A Set : 07 06 FF 08 00 01 F9 BA (Modbus address = 7, command in hex)	If 1 is written to cell FF08, the command is set.

7.6. Lock 3

The Lock 3 function releases the digital output 3 again when the self-holding has been activated. For this purpose, parameter Output Lock of the respective output must be switched active.

Tiggering	Parameter	Comment	Addition
Input	Input X Config = 0/1 Input X Function = 6	If Input X Config = 0 is set, the command is triggered on a "low" state at input X	The status of the input can be read in the OS Input field
Lecom	Code 61 (dec)	Release : 04 31 31 02 36 31 30 03 34 Set : 04 31 31 02 36 31 31 03 35 (Unit no. 11, command in hex)	If 1 is written at code 61, the command is set.
Modbus	Cell FF0A (hex)	Release : 07 06 FF 0A 00 00 99 BA Set : 07 06 FF 0A 00 01 58 7A (Modbus address = 7, command in hex)	If 1 is written to cell FF0A, the command is set.

7.7. Lock 4

The Lock 4 function releases the digital output 4 again when the self-holding has been activated. For this purpose, parameter Output Lock of the respective output must be switched active.

Tiggering	Parameter	Comment	Addition
Input	Input X Config = 0/1 Input X Function = 7	If Input X Config = 0 is set, the command is triggered on a "low" state at input X	The status of the input can be read in the OS Input field
Lecom	Code 60 (dec)	Release : 04 31 31 02 36 30 30 03 35 Set : 04 31 31 02 36 30 31 03 34 (Unit no. 11, command in hex)	If 1 is written at code 60, the command is set.
Modbus	Cell FF0C (hex)	Release : 07 06 FF 0C 00 00 79 BB Set : 07 06 FF 0C 00 01 B8 7B (Modbus address = 7, command in hex)	If 1 is written to cell FF0C, the command is set.

7.8. Lock 1-4

The Lock 1-4 function releases the digital output 1-4 again when the self-holding has been activated. For this purpose, parameter Output Lock of all outputs (or less) must be switched active.

Tiggering	Parameter	Comment	Addition
Input	Input X Config = 0/1 Input X Function = 8	If Input X Config = 0 is set, the command is triggered on a "low" state at input X	The status of the input can be read in the OS Input field
Lecom	Code 59 (dec)	Release : 04 31 31 02 35 39 30 03 3F Set : 04 31 31 02 35 39 31 03 3E (Unit no. 11, command in hex)	If 1 is written at code 59, the command is set.
Modbus	Cell FF0E (hex)	Release : 07 06 FF 0E 00 00 D8 7B Set : 07 06 FF 0E 00 01 19 BB (Modbus address = 7, command in hex)	If 1 is written to cell FF0E, the command is set.

7.9. Set 1

The Set 1 function sets the analog output 1 to the value of the parameter Analog Set 1.

Tiggering	Parameter	Comment	Addition
Input	Input X Config = 0/1 Input X Function = 9	If Input X Config = 0 is set, the command is triggered on a "low" state at input X.	The status of the input can be read in the OS Input field
Lecom	Code 58 (dec)	Release : 04 31 31 02 35 38 30 03 3E Set : 04 31 31 02 35 38 31 03 3F (Unit no. 11, command in hex)	If 1 is written at code 58, the command is set.
Modbus	Cell FF10 (hex)	Release : 07 06 FF 10 00 00 B8 7D Set : 07 06 FF 10 00 01 79 BD (Modbus address = 7, command in hex)	If 1 is written to cell FF10, the command is set.

7.10. Set 2

The Set 2 function sets the analog output 2 to the value of the parameter Analog Set 2.

Tiggering	Parameter	Comment	Addition
Input	Input X Config = 0/1 Input X Function = 10	If Input X Config = 0 is set, the command is triggered on a "low" state at input X.	The status of the input can be read in the OS Input field
Lecom	Code 57 (dec)	Release : 04 31 31 02 35 37 30 03 31 Set : 04 31 31 02 35 37 31 03 30 (Unit no. 11, command in hex)	If 1 is written at code 57, the command is set.
Modbus	Cell FF12 (hex)	Release : 07 06 FF 12 00 00 19 BD Set : 07 06 FF 12 00 01 D8 7D (Modbus address = 7, command in hex)	If 1 is written to cell FF12, the command is set.

7.11. Set 12

The Set 12 function sets the analog output 1 and 2 to the value of the parameter Analog Set 1 and 2.

Tiggering	Parameter	Comment	Addition
Input	Input X Config = 0/1 Input X Function = 11	If Input X Config = 0 is set, the command is triggered on a "low" state at input X.	The status of the input can be read in the OS Input field
Lecom	Code 56 (dec)	Release : 04 31 31 02 35 36 30 03 30 Set : 04 31 31 02 35 36 31 03 31 (Unit no. 11, command in hex)	If 1 is written at code 56, the command is set.
Modbus	Cell FF14 (hex)	Release : 07 06 FF 14 00 00 F9 BC Set : 07 06 FF 14 00 01 38 7C (Modbus address = 7, command in hex)	If 1 is written to cell FF14, the command is set.

8. Output Functions

All output functions can be inverted by parameter Output Polarity. A self-holding can be activated by parameter Output Lock. The status of the outputs is directly visible in the Outputs field of the OS. (white = low, blue = high)

8.1. Output Function = 1

If Output Source > Output Preselec, the output is set high. A programmable hysteresis in % prevents signal changes in case of movements around the switching point. The output is set to low when the value is decreased by the hysteresis.

8.2. Output Function = 2

If the amount of Output Source > Output Preselec, the output is set high. A programmable hysteresis in % prevents signal changes in case of movements around the switching point. The output is set to low when the value is decreased by the hysteresis.

8.3. **Output Function = 3**

If Output Source < Output Preselec, the output is set high. A programmable hysteresis in % prevents signal changes in case of movements around the switching point. The output is set to low when the value is increased by the hysteresis.

8.4. **Output Function = 4**

If the amount of Output Source < Output Preselec, the output is set high. A programmable hysteresis in % prevents signal changes in case of movements around the switching point. The output is set to low when the value is increased by the hysteresis.

8.5. **Output Function = 5**

If Output Source is outside the range of Output Preselec +/- hysteresis, the output is set high.

8.6. **Output Function = 6**

If the amount of Output Source is outside the range of Output Preselec +/- hysteresis, the output is set high.

8.7. **Output Function = 7**

If a DMS error is detected, the output is set. A DMS error is output in case of overcurrent at the DMS supply and in case of an incorrect DMS resistance.

Example:

Output Function = 1
Output Presel.   = 2000,
Output Hysteresis = 10
It results with 2000 x 10/100 = 200
The output is set to high when greater than 2000, and is set to low when less than 1800.

Output Function = 5
Output Presel.   = 2000,
Output Hysteresis = 10
It results with 2000 x 10/100 = 200
The output is set to high in the range 1800 to 2200, outside it is set to low.

9. Lecom Protocol

If you communicate with the unit by the Lecom protocol, you have full read and write access to all internal parameters, states and actual values. The counter uses the Lecom protocol according to DIN ISO 1745. The serial access codes for all parameters of the unit are specified in the parameter list.

9.1. Lecom Read

To request data from the unit, the following request string must be sent:

EOT		AD1	AD2	C1	C2	ENQ

EOT = control character (Hex 04)
AD1 = unit address, High Byte
AD2 = unit address, Low Byte
C1 = code to be read, High Byte
C2 = code to be read, Low Byte
ENQ = control character (Hex 05)

If the current differential counter, for example, should be read (code position: 1) with the unit
address 11 (parameter RS Unit No.), then the detailed request string is:

ASCII-Code:	EOT	1	1	:	1	ENQ
Hexadecimal:	04	31	31	3A	31	05
Binary:	0000 0100	0011 0001	0011 0001	0011 1010	0011 0001	0000 0101

If the request is correct the answer of the unit is:

STX	C1	C2	x x x x x x x	ETX	BCC

STX = control character (Hex 02)
C1 = code to be read, High Byte
C2 = code to be read, Low Byte
xxxxx = data to be read
ETX = control character (Hex 03)
BCC = block check character

Leading zeros are <u>not</u> transferred. The Block Check Character (BCC) is formed by an EXCLUSIVE-OR function of all characters from C1 to ETX (each inclusive).

9.2. **Lecom Write**

To describe a parameter, the following string must be sent:

EOT	AD1	AD2	STX	C1	C2	x x x x x x x	ETX	BCC

EOT = control character (Hex 04)
AD1 = unit address, High Byte
AD2 = unit address, Low Byte
STX = control character (Hex 02)
C1 = code to be described, High Byte
C2 = code to be described, Low Byte
xxxxx = sent parameter value
ETX = control character (Hex 03)
BCC = block check character

The Block Check Character (BCC) is formed by an EXCLUSIVE-OR function of all characters from C1 to ETX (each inclusive). If the reception is correct, the unit responds with the control character ACK, otherwise with NAK or no message. A newly sent parameter is first stored temporarily in the unit without influencing the function. Thus, it is possible to prepare several new parameters in the background while the unit is running.

If the transferred parameters are to be activated, the value "1" must be sent to the "Activate Data" register. This will activate all changed parameters simultaneously.
If the new parameters are to remain permanently stored even after the power supply has been switched off, additionally the value "1" must be sent to the "Store EEProm" register. Thus, all new data are also stored in the unit. Otherwise, the unit will return to the original parameter set after power up.

Function	Code
Command Activate Data	67
Command Store EEProm	68

Both commands react dynamically, i.e. it is sufficient to send the value "1" to the corresponding code. After execution, the command is automatically reset.

Activate Data on unit 11:

ASCII	EOT	1	1	STX	6	7	1	ETX	BCC
Hex	04	31	31	02	36	37	31	03	33

Store EEProm on unit 11:

ASCII	EOT	1	1	STX	6	7	1	ETX	BCC
Hex	04	31	31	02	36	38	31	03	3C

10. Modbus Protokoll

If you communicate with the unit by the Modbus protocol, you have full read and write access to all internal parameters, states and actual values. The DM uses the Modbus RTU protocol. The serial access codes for all parameters of the unit are listed in the parameter list. With the help of USB access the parameter Serial Mode can be changed from Lecom to Modbus. The parameter Serial Baud Rate refers to both protocols. With the parameter Modbus Address the Modbus unit address can be set. Allowed here are the settings 1… 247.

Attention: The Modbus checksum sequence L/H is just reversed to the data.

The DM supports the function Reading Holding Register (R, FCT = 03), the function Report Slave ID (R, FCT = 11) and the function Preset Single Register (W, FCT = 06).

10.1. Modbus Read

To request data from the unit, the following request string must be sent:

ADR	FCT	STH	STL	CRH	CRL	CRCL	CRCH
ADR = MB address (parameter)							
FCT = function (Hex 03)							
STH = start address, High Byte							
STL = start address, Low Byte							
CRH = number of registers High Byte							
CRL = number of registers, Low Byte							
CRCL = checksum CRC16, Low Byte							
CRCH = checksum CRC16, High Byte							

For example, if a parameter (Modbus ST = 00 0C (hex), 32 Bit = 2 Word -> Modbus CRC = 00 02) is to be read from the unit with address 07, the detailed request string is:

Designation:	ADR	FCT	STH	STL	CRH	CRL	CRCL	CRCH
Hexadecimal:	07	03	00	0C	00	02	04	6E
Binary:	0000 0111	0000 0011	0000 0000	0000 1100	0000 0000	0000 0010	0000 0100	0110 1110

The unit will answer if the request is correct, for example:

ADR	FCT	CB	DATA	CRCL	CRCH
ADR = MB address (parameter)					
FCT = function (Hex 03)					
CB = number of bytes, here 4 bytes					
DATA = data, 4 bytes (32 Bit)					
CRCx = check sum CRC16					

Designation:	ADR	FCT	CB	DATA	CRCL	CRCH
Hexadecimal:	07	03	04	00 00 0F A0	99	BB
Binary:	0000 0111	0000 0011	0000 0100		1001 1001	1011 1011

The data above corresponds to a read out of the parameter of 4000.
-The function Reading Holding Registers supports 2 Word (32-bit) accesses to the direct parameter addresses (0x0, 0x4, 0x8, 0xC ..)
- The function Reading Holding Register also supports more than 2 Word accesses to the direct parameter addresses (0x0, 0x4, 0x8, 0xC ..) for area readout.

10.2. Modbus Write

To describe a parameter, the following request string must be sent:

ADR	FCT	REH	REL	DAH	DAL	CRCL	CRCH
	ADR = MB address (parameter)						
	FCT = Function (Hex 06)						
	REH = register address, High Byte						
	REL = register address, Low Byte						
	DAH = data High Byte						
	DAL = data Low Byte						
	CRCL = check sum CRC16, Low Byte						
	CRCH = check sum CRC16, High Byte						

If for example the unit shall be written with the parameter (Modbus ST = 00 0E, 000C (hex), Modbus DA = 00 01, 00 01), then the detailed request string for the High Word Register is:

Designation:	ADR	FCT	REH	REL	DAH	DAL	CRCL	CRCH
Hexadecimal:	07	06	00	0E	00	01	29	AF
Binary:	0000 0111	0000 0011	0000 0000	0000 1110	0000 0000	0000 0001	0010 1001	1010 1111

The unit will answer if the request is correct:

ADR	FCT	REG	DATA	CRCL	CRCH

ADR = MB address (parameter)
FCT = function (Hex 06)
REG = register address
DATA = data
CRCx = check sum CRC16

Designation:	ADR	FCT	REG	DATA	CRCL	CRCH
Hexadecimal:	07	06	00 0E	00 01	29	AF
Binary:	0000 0111	0000 0110			0010 1001	1010 1111

String for writing the Low Word Register:

Designation:	ADR	FCT	REH	REL	DAH	DAL	CRCL	CRCH
Hexadecimal:	07	06	00	0C	00	01	88	6F
Binary:	0000 0111	0000 0011	0000 0000	0000 0110	0000 0000	0000 0001	1000 1000	0110 1111

The data corresponds to a written value of the parameter of 65537.
(00 04 00 02 hex). The newly sent parameter is first stored temporarily in the unit, without influencing the function. Thus, it is possible to prepare several new parameters in the background while the unit is running.

If the transferred parameters are to be activated, an "Activate Data" must be sent to the unit.
This will activate all changed parameters simultaneously.

To execute an "Activate Data", the following string must be sent:

Designation:	ADR	FCT	REH	REL	DAH	DAL	CRCL	CRCH
Hexadecimal:	07	06	FF	FE	00	01	19	88
Binary:	0000 0111	0000 0011	1111 1111	1111 1110	0000 0000	0000 0001	0001 1001	1000 1000

It must be ensured that a range violation of the parameter does not cause it to be transferred to the buffer. The permissible parameter ranges can be taken from the parameter description.

If the new parameters are to remain permanently stored even after the power supply is switched off, an additional "Store EEProm" must be sent to the unit. This means that all new data is also stored in the unit. Otherwise, the unit will return to the original parameter set after power up.

To execute a "Store EEProm" the following string must be sent:

Designation:	ADR	FCT	REH	REL	DAH	DAL	CRCL	CRCH
Hexadecimal:	07	06	FF	FE	00	02	34	49
Binary:	0000 0111	0000 0011	1111 1111	1111 1110	0000 0000	0000 0010	0011 0100	0100 1001

With negative parameter values such as -10000, the value must be divided into two 16-bit values and transmitted with two write accesses. (-10000 dec = FFFF D8F0 hex)

An ID can be requested to identify the unit:

To request an ID, the following string must be sent:

Designation:	ADR	FCT	CRCL	CRCH
Hexadecimal:	07	11	C3	8C
Binary:	0000 0111	0001 0001	1100 0011	1000 1100

The answer of the unit is if the request is correct:

Designation:	ADR	FCT	BYTE	ID	RUN	DATA	CRCL	CRCH
Hexadecimal:	07	11	12	01	FF	44 4D 32 32 32 20 20 20 44 4D 32 32 32 30 31 41	30	05
Binary:	0000 0111	0001 0000	0001 0020	0000 0001	1111 1111		0011 0000	0000 0101

44 4D 32 32 32 30 31 41 corresponds in ASCII format : 6877.502201A
Here the unit header, which is also visible in the OS, is displayed. It identifies the unit (6877.5022) with software version (01A) and, if available, the special number.

Splitting of the memory area

Memory address (dec)	MODBUS-FCT	R-access	Read / Write	Note
0…459 0…456 (32 Bit)	03 (R) 06 (W)	2-228 Words 1 Word	R/W	Parameter area
1000..1127 1000..1124 (32 Bit)	03 (R)	2-64 Words	Read only	Variable area
FF00 – FF14 FFFE (hex, 16 Bit)	06 (W) 06 (W)	1 Word 1 Word	Write only Write only	Command area

11. Modbus CRC Calculation

Parameter Modbus CRC Reset is used to reset the CRC Calulator. If Modbus CRC Reset = 0, the CRC Calculator is set to FFFF in the monitor field (Page 1; code <4). If Modbus CRC Reset = 1, the CRC value can be calculated with every Modbus byte.
Parameter Modbus CRC Byte is used to enter the bytes for the CRC calculation.
Into this memory address the Modbus bytes can be transferred one after the other and then the CRC checksum can be read out in the monitor field (Page 1, code <4).

Using the OS:

For the Modbus command 0x07 0x11 the checksum shall be determined. First the Serial Page parameter should be set to 1 to select Page 1.
- Modbus CRC Reset = 0,   Modbus Byte = 7dec   (Press OS Transmit change)
-> Monitor Page 1 Code <4 = 0x0000 FFFF (reset)
- Modbus CRC Reset = 1,   Modbus Byte = 7dec   (Press OS Transmit change)
-> Monitor Page 1 Code <4 = 0x0000 82FE
- Modbus CRC Reset = 1,   Modbus Byte = 17dec   (Press OS Transmit change)
-> Monitor Page 1 Code <4 = 0x0000 8CC3

Now the command can be set together
-> 07 11 C3 8C
Note that with Modbus the CRC sends first the LByte and then the HByte, therefore byte swapping is necessary.

12. Parameter-List

No.	Parameter	Min – value	Max – value	Default	Places	Decimal places	Lecom Code	Modbus Code
	Sensor 1 Menu							
000	Supply 1	3	10	5	2	0	00	**L**000/**H**002
001	Gain 1	0	4	0	1	0	01	**L**004/**H**006
002	Sampling 1	0	12	0	2	0	02	**L**008/**H**00A
003	Offset 1	-10000	+10000	0	85	0	03	**L**00C/**H**00E
004	Resistor 1	0	10000	350	5	0	04	**L**010/**H**012
005	Sensitivity 1	0.100	20.000	1.000	5	3	05	**L**014/**H**016
006	Voltage 1	1	99999	1000	5	0	06	**L**018/**H**01A
007	Digits 1	1	99999	1000	5	0	07	**L**01C/**H**01E
008	Correction 1	0.900	1.100	1.000	4	3	08	**L**020/**H**022
009	Polarity 1	0	1	0	1	0	09	**L**024/**H**026
010	Reserved	0	10000	1000	5	0	A0	**L**028/**H**02A
	Sensor 2 Menu							
011	Supply 2	3	10	5	2	0	A1	**L**02C/**H**02E
012	Gain 2	0	4	0	1	0	A2	**L**030/**H**032
013	Sampling 2	0	12	0	2	0	A3	**L**034/**H**036
014	Offset 2	-10000	+10000	0	85	0	A4	**L**038/**H**03A
015	Resistor 2	0	10000	350	5	0	A5	**L**03C/**H**03E
016	Sensitivity 2	0.100	20.000	1.000	5	3	A6	**L**040/**H**042
017	Voltage 2	1	99999	1000	5	0	A7	**L**044/**H**046
018	Digits 2	1	99999	1000	5	0	A8	**L**048/**H**04A
019	Correction 2	0.900	1.100	1.000	4	3	A9	**L**04C/**H**04E
020	Polarity 2	0	1	0	1	0	B0	**L**050/**H**052
021	Reserved	0	10000	1000	5	0	B1	**L**054/**H**056

	Combination Menu							
022	Multiplier 1	0	9.999	0.000	4	3	B2	**L**058/**H**05A
023	Divisor 1	1	9.999	1.000	4	3	B3	**L**05C/**H**05E
024	Multiplier 2	0	9.999	0.000	4	3	B4	**L**060/**H**062
025	Divisor 2	1	9.999	1.000	4	3	B5	**L**064/**H**066
026	Reserved	0	10000	1000	5	0	B6	**L**068/**H**06A
027	Reserved	0	10000	1000	5	0	B7	**L**06C/**H**06E
	Digital Input Menu							
028	Input 1 Config	0	1	0	1	0	B8	**L**070/**H**072
029	Input 1 Function	0	11	0	2	0	B9	**L**074/**H**076
030	Input 2 Config	0	1	0	1	0	C0	**L**078/**H**07A
031	Input 2 Function	0	11	0	2	0	C1	**L**07C/**H**07E
032	Input 3 Config	0	1	0	1	0	C2	**L**080/**H**082
033	Input 3 Function	0	11	0	2	0	C3	**L**084/**H**086
034	Input 4 Config	0	1	0	1	0	C4	**L**088/**H**08A
035	Input 4 Function	0	11	0	2	0	C5	**L**08C/**H**08E
036	Reserved	0	10000	1000	5	0	C6	**L**090/**H**092
037	Reserved	0	10000	1000	5	0	C7	**L**094/**H**096

No.	Parameter	Min – value	Max – value	Default	Places	Decimal places	Lecom Code	Modbus Code
	Analog Output 1 Menu							
038	Analog Source 1	0	5	0	1	0	C8	**L**098/**H**09A
039	Analog Mode 1	0	3	1	1	0	C9	**L**09C/**H**09E
040	Analog Start 1	-99999	99999	0	85	0	D0	**L**0A0/**H**0A2
041	Analog End 1	-99999	99999	10000	85	0	D1	**L**0A4/**H**0A6
042	Analog Set 1	-10000	10000	0	85	0	D2	**L**0A8/**H**0AA
043	Reserved	0	10000	1000	5	0	D3	**L**0AC/**H**0AE
	Analog Output 2 Menu							
044	Analog Source 2	0	5	0	1	0	D4	**L**0B0/**H**0B2
045	Analog Mode 2	0	3	1	1	0	D5	**L**0B4/**H**0B6
046	Analog Start 2	-99999	99999	0	85	0	D6	**L**0B8/**H**0BA
047	Analog End 2	-99999	99999	10000	85	0	D7	**L**0BC/**H**0BE
048	Analog Set 2	-10000	10000	0	85	0	D8	**L**0C0/**H**0C2
049	Reserved	0	10000	1000	5	0	D9	**L**0C4/**H**0C6
	Digital Output Menu							
050	Output Polarity	0	15	0	2	0	E0	**L**0C8/**H**0CA
051	Output Lock	0	15	0	2	0	E1	**L**0CC/**H**0CE
052	Output Source 1	0	3	0	1	0	E2	**L**0D0/**H**0D2
053	Output Function 1	0	7	0	1	0	E3	**L**0D4/**H**0D6
054	Output Hysteresis 1	0	100	0	3	0	E4	**L**0D8/**H**0DA
055	Output Preselec. 1	-9999	9999	1000	84	0	E5	**L**0DC/**H**0DE
056	Output Source 2	0	3	0	1	0	E6	**L**0E0/**H**0E2
057	Output Function 2	0	7	0	1	0	E7	**L**0E4/**H**0E6
058	Output Hysteresis 2	0	100	0	3	0	E8	**L**0E8/**H**0EA

059	Output Preselec. 2	-9999	9999	1000	84	0	E9	**L**0EC/**H**0EE
060	Output Source 3	0	3	0	1	0	F0	**L**0F0/**H**0F2
061	Output Function 3	0	7	0	1	0	F1	**L**0F4/**H**0F6
062	Output Hysteresis 3	0	100	0	3	0	F2	**L**0F8/**H**0FA
063	Output Preselec. 3	-9999	9999	1000	84	0	F3	**L**0FC/**H**0FE
064	Output Source 4	0	3	0	1	0	F4	**L**100/**H**102
065	Output Function 4	0	7	0	1	0	F5	**L**104/**H**106
066	Output Hysteresis 4	0	100	0	3	0	F6	**L**108/**H**10A
067	Output Preselec. 4	-9999	9999	1000	84	0	F7	**L**10C/**H**10E
068	Reserved	0	10000	1000	5	0	F8	**L**110/**H**112
069	Reserved	0	10000	1000	5	0	F9	**L**114/**H**116
	Modbus Menu							
070	Modbus Address	1	247	1	3	0	G0	**L**118/**H**11A
071	Modbus CRC Reset	0	1	0	1	0	G1	**L**11C/**H**11E
072	Modbus CRC Byte	0	255	0	3	0	G2	**L**120/**H**122
073	Reserved	0	10000	1000	5	0	G3	**L**124/**H**126

No.	Parameter	Min – value	Max – value	Default	Places	Decimal places	Lecom Code	Modbus Code
	Serial Menu							
074	USB Unit Nr.	11	11	11	2	0	90	**L**128/**H**12A
075	USB Baud Rate	0	0	0	1	0	91	**L**12C/**H**12E
076	USB Format	0	0	0	1	0	92	**L**130/**H**132
077	Serial Page	0	5	0	1	0	~0	**L**134/**H**136
078	Serial Mode	0	3	0	1	0	G4	**L**138/**H**13A
079	RS Unit Nr.	11	99	11	2	0	G5	**L**13C/**H**13E
080	RS Baud Rate	0	10	10	2	0	G6	**L**140/**H**142
081	RS Format	0	2	0	1	0	G7	**L**144/**H**146
082	Reserved	0	10000	1000	5	0	G8	**L**148/**H**14A
083	Reserved	0	10000	1000	5	0	G9	**L**14C/**H**14E
	General Menu							
084	Filter	0	9	0	1	0	H0	**L**150/**H**152
085	Min Max Channel	0	5	0	1	0	H1	**L**154/**H**156
086	Reset Min Max	0	1	0	1	0	H2	**L**158/**H**15A
087	Monitor Switch	0	1	0	1	0	H3	**L**15C/**H**15E
088	Reserved	0	10000	1000	5	0	H4	**L**160/**H**162
089	Reserved	0	10000	1000	5	0	H5	**L**164/**H**166
	Adjustment Menu							
090	Vout Offset 1	-30	30	0	82	0	H6	**L**168/**H**16A
091	Vout Gain 1	0.9990	1.0010	1.0000	5	4	H7	**L**16C/**H**16E
092	Iout Offset 1	-30	30	0	82	0	H8	**L**170/**H**172
093	Iout Gain 1	0.9990	1.0010	1.0000	5	4	H9	**L**174/**H**176
094	Vout Offset 2	-30	30	0	82	0	I0	**L**178/**H**17A
095	Vout Gain 2	0.9990	1.0010	1.0000	5	4	I1	**L**17C/**H**17E

096	Iout Offset 2	-30	30	0	82	0	I2	**L**180/**H**182
097	Iout Gain 2	0.9990	1.0010	1.0000	5	4	I3	**L**184/**H**186
098	Out Temp. C.	0	1	0	1	0	I4	**L**188/**H**18A
099	Vin T. Offset 1	0.5000	1.5000	1.0000	5	4	I5	**L**18C/**H**18E
100	Vin T. Offset 2	0.5000	1.5000	1.0000	5	4	I6	**L**190/**H**192
101	Vin T. Gain 1	0.90000	1.10000	1.00000	6	5	I7	**L**194/**H**196
102	Vin T. Gain 2	0.90000	1.10000	1.00000	6	5	I8	**L**198/**H**19A
103	In Temp. C.	0	3	0	1	0	I9	**L**19C/**H**19E
104	Vin Mea. Gain 1	0.8000	1.2000	1.0000	5	4	J0	**L**1A0/**H**1A2
105	Vin Mea. Gain 2	0.8000	1.2000	1.0000	5	4	J1	**L**1A4/**H**1A6
106	Temp. Offset I1	0	1	0	1	0	J2	**L**1A8/**H**1AA
107	Temp. Offset I2	0	1	0	1	0	J3	**L**1AC/**H**1AE
108	Temp. Gain I1	0	1	0	1	0	J4	**L**1B0/**H**1B2
109	Temp. Gain I2	0	1	0	1	0	J5	**L**1B4/**H**1B6
110	Temp. Sim.	0	1	0	1	0	J6	**L**1B8/**H**1BA
111	Temp. Sim. Value	870	1412	1140	4	0	J7	**L**1BC/**H**1BE
112	Reserved	0	10000	1000	5	0	J8	**L**1C0/**H**1C2
113	Reserved	0	10000	1000	5	0	J9	**L**1C4/**H**1C6

13. Dimensions
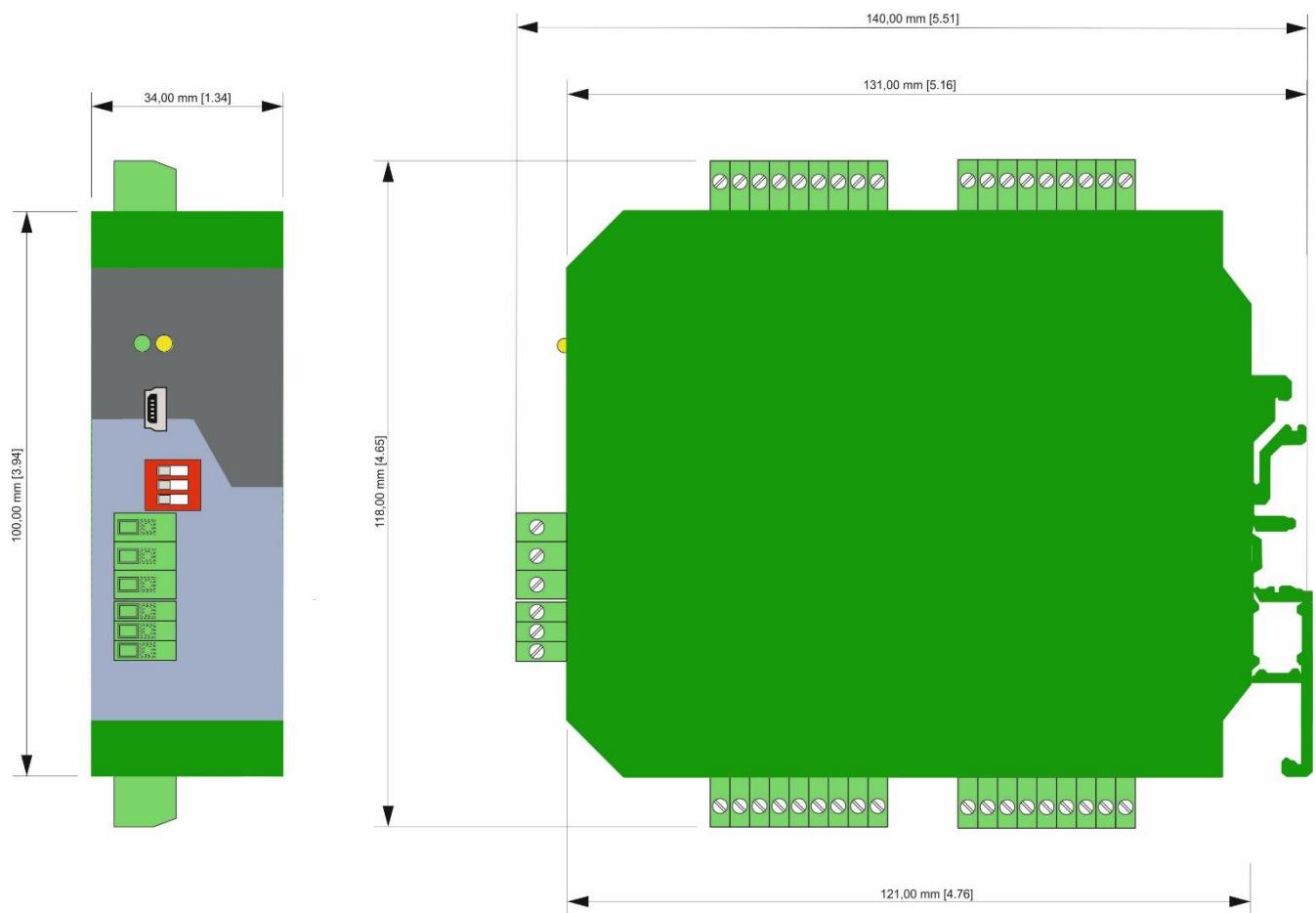
14. Technical Specifications

Technical specifications:		
Connections:	Connection type:	Screw terminal, 1,5 mm² / AWG 16
Power supply:	Input voltage:	18 … 30 VDC
	Protection circuit:	Reverse polarity protection
	Ripple:	$\leq$ 10 %
	Consumption:	approx. 50 mA (bei 24 V, unloaded)
DMS supply:	Output voltage:	3-10 VDC
	Output current:	max. 50 mA
DMS inputs:	Number of inputs:	2 with readback (6877.5022)
		1 with readback (6877.5021)
	Configuration:	voltage
	Sensitivity:	+/- 5mV, +/-10mV, +/-20mV, +/-40mV, +/-80mV
	Resolution:	16 Bit
	Accuracy:	+/- 0.01% / 10K
Analog outputs:	Number of outputs:	2 (6877.5022)
		1 (6877.5021)
	Voltage:	+/- 10V (external load max. 5kOhm)
	Current:	0/4mA…20mA (burden max. 270 Ohm)
	Resolution:	16 Bit
	Accuracy:	+/- 0.01% / 10K
	Reaction time:	Depending on Sampling Time und Filter
Control inputs:	Number of inputs:	4
	Format:	HTL, PNP (Low 0 … 4 V, High 10 … 30 V)
	Frequency:	max. 1 kHz
	Reaction Time:	1 ms
	Load:	max. 3mA bei 24VDC
Control outputs:	Number of outputs:	4
	Format / level:	HTL: 17 … 29 V (depending on supply voltage)
	Output current:	max. 30 mA, High Side Driver
USB:	Version:	USB 2.0 Mini Type B
RS-422:	Version:	2-wire RS-422
	Protocol:	LECOM, MODBUS
Housing:	Material:	Plastic
	Mounting:	35 mm top hat rail (according to EN 60715)
	Dimensions:	34 x 140 x 118 mm
	(B x H x T)	
	Protection class:	IP20
	Weight:	approx. 100 g
Ambient temperature:	Operation:	0 °C … +60 °C (not condensing)
	Storage:	-25 °C … +70 °C (not condensing)
Failure rate:	MTBF in years:	59,9 (6877.5022)
		66.5 (6877.5021)
		(continuous operation at 60 °C / 140°C)
Conformity & standards:	EMC 2014/30/EU:	EN 61326-1: 2013 for industrial location
		EN 55011: 2016 + A1: 2017 + A11: 2020 Class A
	RoHS (II)	
	2011/65/EU	EN IEC 63000: 2018

	RoHS (ⅠⅠⅠ) 2015/863: