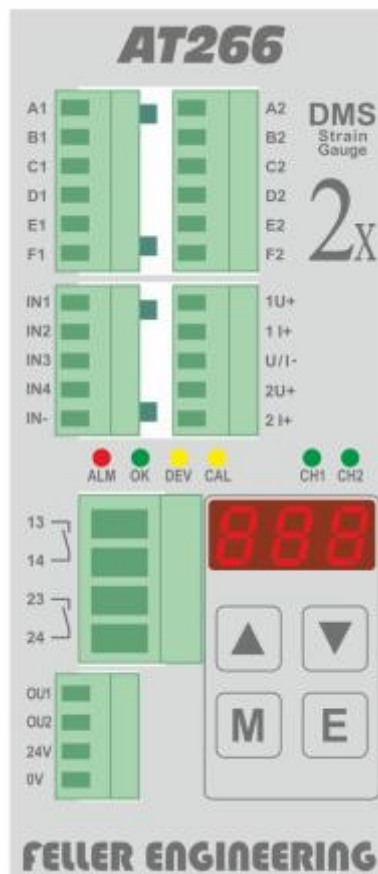


AT266

2-channel DMS-amplifier module with digital display

User Manual
for firmware V1.06



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1 Short description

The module is used to capture the measurement signals of two strain gauge bridges and the current values and status information for further processing at automation level. For this purpose, there are two analog outputs (as current and voltage output each), two 24V digital outputs, as well as two potential-free relay contacts available.

The pressure values of the two measured values are delivered on the analog outputs of the AT266 module as voltage and/or current signals. Among other things, an alarm is triggered when one of the measured values exceeds or undershoots a limit value. As standard an alarm is triggered in case a sensor is defective (broken line, short-circuit).

The device has a three-digit, 7-segment display for the presentation of the measured and pre-set values. Important status information is additionally displayed by 6 LEDs of different colours on the front of the device. Operation is possible on-site via a membrane keyboard with 4 keys. These keys also serve for the parameterization of the device, displaying of values and calibration. Calibrations can be carried out via the 24V inputs and alarm statuses can be acknowledged.

The module is designed for the installation on a mounting rail type TS35 in a switch cabinet and is operated by a supply voltage of 24 VDC (5W).

All connections are led out at the front via coded connecting plugs.

The device was developed in accordance with the following directives:

EMC Directive 2014/30/EU

Low Voltage Directive 2014/35/EU

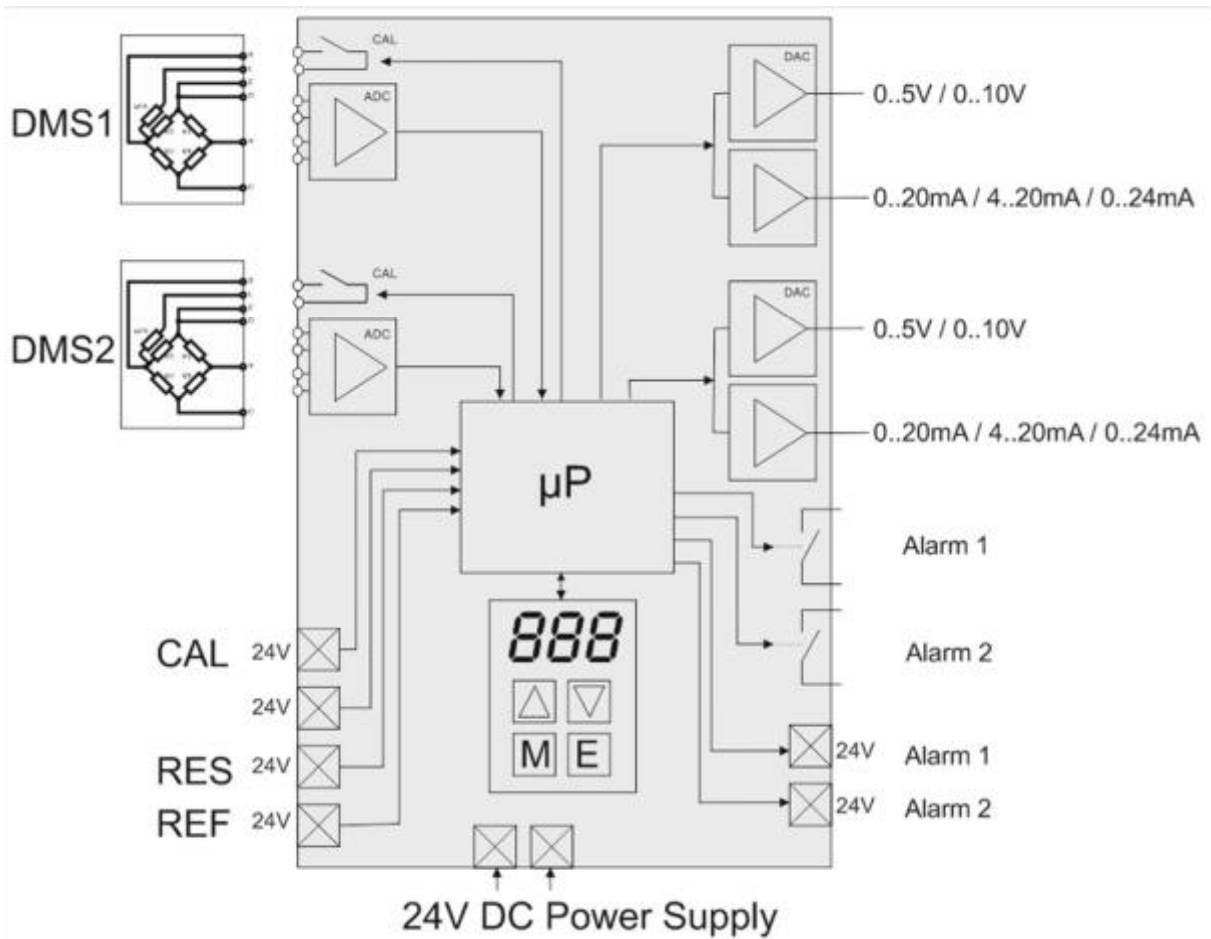
1.1 Symbols used:



Caution: If these warning symbols are not observed, failures and malfunctions can be the consequence.

Warning: If this warning symbol is not observed, personal injuries and/or damage to the machine can be the consequence.

1.2 Block diagram



1.3 Quick start

After executing the steps listed below, the module can be put in operation fast and successfully within a short time:

1.3.1 Electrical connection of the module

Connect the two sensors to the terminal X1 and X2 (chapter 5.2.2.1 and 5.2.2.2)

Connect the current output 4 – 20mA for the acquisition of the measured data (chapter 5.2.2.4 or

– if this is not needed – switch off via parameter *low* = 0 (chapter 6.5).

Connect the power supply 24VDC with terminal X6 (chapter 5.2.2.7)

1.3.2 Adaptation of the module to the used sensor

Reading out of the relevant characteristics on the sensor



In the example, the sensor has a measuring range of 350bar as well as an integrated calibration unit at 80%.

Therefore, the value 350 is to be entered in parameter *RbS*
Input 80 in parameter *rEF*. (Find both in chapter 6.5)

1.3.3 Calibration of the module under depressurized condition

Carry out calibration as per chapter 8.2.

Now, the module indicates the pressure values measured by the sensors.

1.3.4 Adaptation to specific requirements

The module can be adapted to the respective requirements by setting of specific alarm limits, connecting the digital inputs and outputs as well as the analog outputs. Please find the details in the following chapters.

2 Important instructions

2.1 General safety instructions

This device has been developed for industrial applications and for the installation in a switch cabinet.



**The electrical connections are to be installed by an electrician!
Only authorized specialist personnel are allowed to put the device into operation and to operate it during operation!**

Further safety-related instructions are specifically marked in the respective sections of this documentation.

The device was carefully checked before delivery and passed the tests specified in the test plan as per applicable quality guideline issued by the manufacturer.

To ensure a reliable and safe operation, each user is obliged to observe the instructions and warnings. If it is part of subcontracting, this documentation must be attached and the compliance with these safety instructions must be pointed out.

Manufacturer and distributor of this device cannot be held liable for direct and indirect damages caused by improper handling or treatment.

2.2 Electrical connection

The electrical lines are to be laid in accordance with the applicable national regulations and the work's standards of the operating company. Make sure that the measuring lines are laid separately from the signal and power supply lines.

The device is intended to be used on a power supply unit with fuses.



The device must be able to be completely disconnected from the power supply!

**The device is to be used far from disturbing sources if possible.
All signal lines must be equipped with screening and connected to the on one side to earth potential on one side.**

3 Commissioning

Before the device is switched on for the first time, make sure that the following items have been observed:



The power supply voltage of the device, the switching voltages of the potential-free contacts, as well as the control voltage of the digital inputs and outputs must comply with the specifications on the device or in this documentation!

**The device may only be used when it is properly installed!
The ventilation openings may not be covered and the environmental conditions specified for the use of the device must be met before and during the operation!**

3.1 Putting out of service

Because the potential-free alarm contacts are open under deenergized conditions and the 24VDC outputs are at 0V, the "alarm" status is reported to the automation level if the device is switched off.



Therefore, before switching off of the device, make sure that the downstream evaluation of the alarms does not cause any unintended effects.

4 Care and maintenance

No special measures for maintenance or care are required. Replaceable wearing parts or parts that have to be calibrated mechanically are not included. No intervention in the module is required for calibration of the strain gauge bridges.

4.1 Spare parts

Each device comes with a set of appropriate screw terminals. They are coded in a way that they only match to the correct connection and cannot be confused during assembly. This is especially advantageous when a device is replaced.

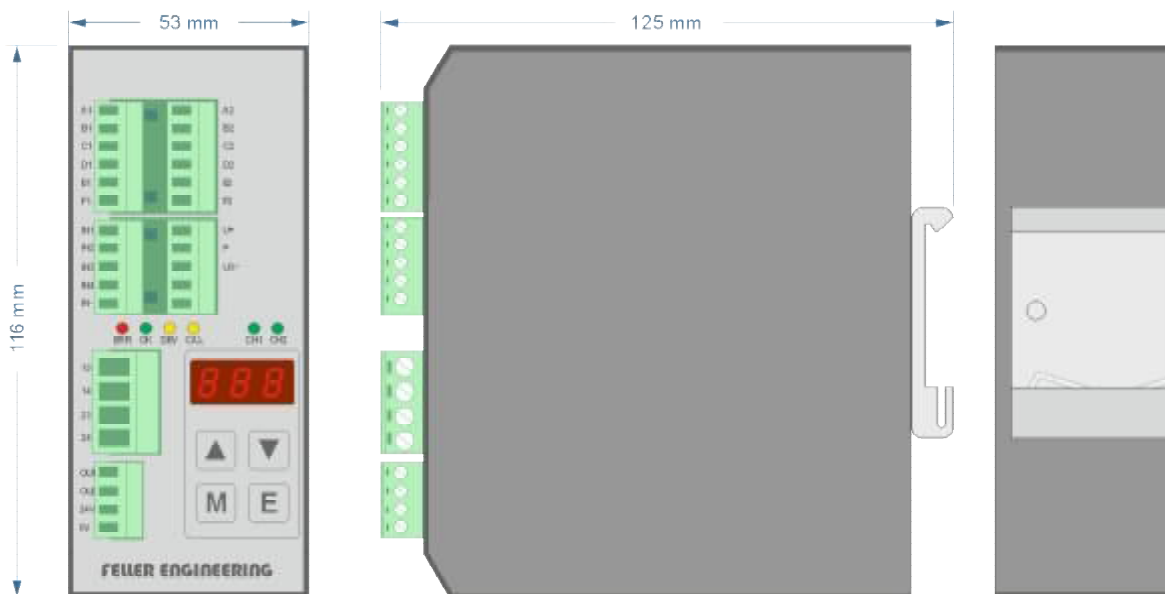
If one or more connectors get lost, they can be ordered as spare part from the manufacturer.



It is not allowed to use neutral connectors without coding because they can damage the female connectors in the device.

To order spare parts or for further information, please contact the Service address given in this documentation.

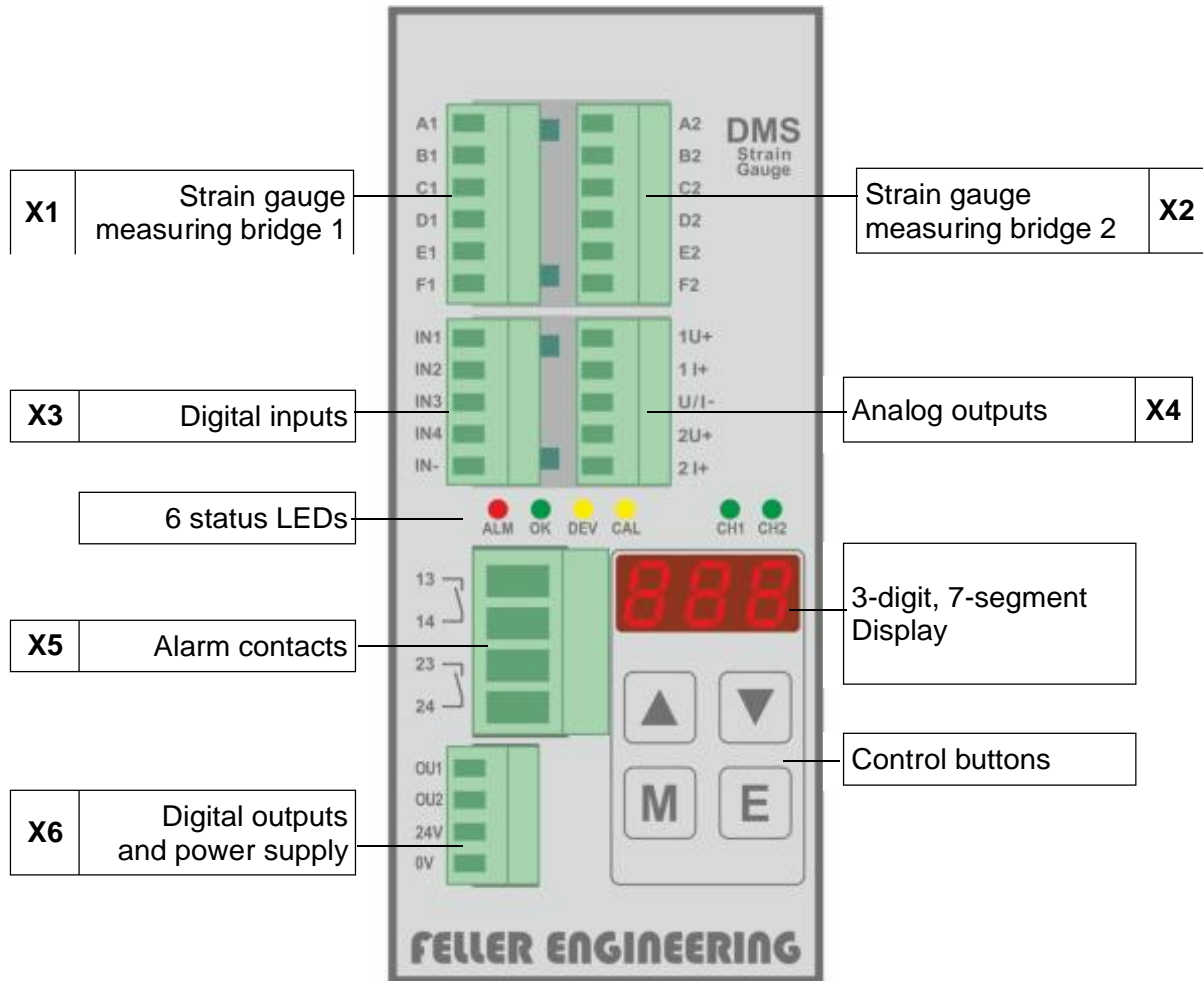
4.2 Dimensions of the device and instructions for assembly



5 Terminal assignment, display and controls

The module provides several connection facilities, 6 status LEDs, a 7-degment display and a keyboard with 4 keys.

They are arranged on the front of the device as shown in the next figure.



The screwed terminals are designed for wiring with splice ferrules.

5.1 Use of terminal strips

Terminal strip	Use	Assignment	Wire size
X1	Strain gauge measuring bridge 1	10 VDC	1.5 mm ²
X2	Strain gauge measuring bridge 2	10 VDC	1.5 mm ²
X3	Digital inputs	24 VDC	1.5 mm ²
X4	Analog outputs	10 VDC / 20 mA	1.5 mm ²
X5	Alarm contacts (potential-free)	250 VAC / 2 A	2.5 mm ²
X6	Digital outputs & power supply	24 VDC	1.5 mm ²

5.2 Design of connections

5.2.1 General instructions for polarizing key

Each of the connection terminals X1..X6 described here is designed as male connector and coded in a way that it can only be used for one connection in this device.

Devices of the same design have also the same coding. Therefore, the device can be replaced without new wiring. Only the already wired male connectors must be plugged into the new device.

5.2.2 Wiring diagram

For the installation, the connectors are pulled off and wired accordingly. This work does not require any special tools; a typical screwdriver 0.4 x 2.5 x 80 mm can be used.

If the connectors are plugged in again, they snap in and are self-retaining.

5.2.2.1 X1: Strain gauge measuring bridge 1

The terminal clamp X1 is designed as 6-pole connector and planned for connecting a commercial strain gauge measuring bridge (DMS).

X1.A1	+ Bridge measurement signal
X1.B1	+ Bridge measurement signal
X1.C1	+ Power supply of bridge
X1.D1	+ Power supply of bridge
X1.E1	Contact 80 % bridge balance
X1.F1	Contact 80 % bridge balance

5.2.2.2 X2: Strain gauge measuring bridge 2

Referred to functioning, terminal clamp X2 has the same design as X1.

X2.A2	+ Bridge measurement signal
X2.B2	+ Bridge measurement signal
X2.C2	+ Power supply of bridge
X2.D2	+ Power supply of bridge
X2.E2	Contact 80 % bridge balance
X2.F2	Contact 80 % bridge balance



Only the same types of strain gauge measurement bridges are allowed to be connected to X1 and X2!

5.2.2.3 X3: Digital inputs

The digital inputs are planned for controlling the device from the automation level and are connected to 24 VDC.

X3.IN1	Activate calibration process
X3.IN2	No function
X3.IN3	Acknowledge alarms
X3.IN4	Switching over of the analog signal to the output of the calibration value
X3.IN-	Common reference potential for all inputs.

The external wiring of this terminal is stringently required.

5.2.2.4 X4: Analog outputs

- X4.1 U+ 1. Voltage output 0..5 VDC or 0..10 VDC
- X4.1 I+ 1. Current output 0..20 mA or 4..20 mA
- X4.U/I- Reference potential for all analog outputs
An external wiring of this terminal is stringently required.
- X4.2 U+ 2. Voltage output 0..5 VDC or 0..10 VDC
- X4.2 I+ 2. Current output 0..20 mA or 4..20 mA

5.2.2.5 X5: Alarm contacts

- | | |
|-------|---|
| X5.13 | 1. Potential-free contact (wire-break-proof) as relay contact |
| X5.14 | for loads until 250 VAC / 2 A or 24 VDC |
| X5.23 | 2. Potential-free contact (wire-break-proof) as relay contact |
| X5.24 | for loads until 250 VAC / 2 A or 24 VDC |



The two potential-free contacts are electrically isolated from each other and therefore, different voltage levels can be applied.



The alarm contacts are primarily intended to be used for application with pure ohmic loads. If there is an external circuitry with the correspondingly dimensioned RC interference suppression, also contactors can be used. The switched circuits are to be equipped externally with fuses!

5.2.2.6 X6: Digital outputs

- X6.OU1 1. Digital output 24 VDC / max. 12 mA
- X6.OU2 2. Digital output 24 VDC / max. 12 mA

For the two outputs applies: In case of failure - 0V, in case it is OK-24V



As reference potential, X6:0V is used for the digital outputs.



The digital outputs are intended to be used for a high-ohmic 24 VDC input of the automation level. Therefore, no loads may be switched with it!

5.2.2.7 X6: Power supply

- X6. 24V Power supply 24 VDC (5W; 18VDC – 32 VDC)
- X6. 0V Power supply, earth (not internally connected with X3:IN- or X4:U/I-)



Fuses of 24 VDC power supply shall be installed externally.

5.3 Status LEDs

- ALM It lights up RED when an alarm occurred (HI alarm, WD alarm, sensor failure, internal hardware failure)
- OK It lights up GREEN when the device is in good order and condition
- DEV It lights up YELLOW when a deviation occurred
- CAL It lights up YELLOW when calibration is active
- CH1, CH2 They light up GREEN when actual measuring values are displayed on the 7-segment display

5.4 7-segment display

The 7-segment display serves for displaying values, status information or parameters.



Three-digit 7-segment display

In addition to the digits 0...9, the 7-segment display can also display decimal point and a selection of characters.

Display object	Presentation	Example
Parameter name	3 characters	HYS
Parameter values if displayed	Up to 3 digits, max. 1 decimal point	12.3
Parameter values during the change	Up to 3 digits, max. 3 decimal points	0.1.0.
Error message	1 character with decimal point and 1 digit	E. 1

5.5 Control buttons



UP

Menu control: Go up by one menu point
In input mode: Increment value by 1



DOWN

Menu control: Go down by one menu point
In input mode: Decrement value by 1



MODE

Change over between channel 1 and 2 for the display value
In input mode: Stop entry abortive.



ENTER

Start / End input mode

6 Operation

6.1 Switching on of module

After the module has been switched on by applying of the supply voltage, first the module name is shown in the display for some seconds (e.g. **AL.266**) and then its version number (e.g. **UEr.102**) is displayed.

6.2 Display of measured values

As standard, the higher measured value of the two values is displayed in the three-digit, 7-segment display. Which this will be, is indicated by the two green LEDs CH1 and CH2. Switch over to the display of the other measured values by actuation of the **M** key. If the two measured values are equal, the LEDs CH1 and CH2 light up simultaneously.

6.4 Display of parameters

Select one of the parameters described in chapter 6.8 using the arrow keys **▲** **▼**. Then the display shows the parameter name, e.g. **dF**. Releasing the key causes the display to toggle between the actual setpoint value and the parameter name, e.g. **≡ dF** and the setpoint value **„10“**.

6.5 Edit parameters

Actuation of the **E** key starts the editing of the selected parameter. The module has a locking unit protected by password. Therefore, it possibly will be required to input the password before editing can be started:

6.5.1 Unlock function

First **LOC** is flashing. Using the **▲** **▼** keys, a code must be entered to enable the input function (e.g. 22). It has to be confirmed by pressing the **E** key. If a wrong code was entered, the parameter change will be denied.

After successful input, the Input mode is enabled. This is indicated by three flashing decimal points in the parameter name (e.g. **d..F**).

After the code has been input, the device will be released for 120 seconds and for further changes it is not necessary to input it again. Each actuation of a key starts the time of 120 seconds again. After the 120 seconds, the device will be locked automatically.

6.5.2 Value entry

The arrow keys are used for setting the desired parameter values. As long as the keys remains pressed, only one setpoint value will be visible. If the key is released, the parameter name and the value will be displayed in turns. The set value must be confirmed within 3 seconds using the **E** key. When the three decimal points do not flash anymore, the value has been taken over.

It is not possible to enter values outside the permissible range. Parameters that are indicated as "not editable" cannot be changed as well. A longer actuation of the keys causes the keys to change the setpoint values faster.

If the **M** key is pressed, the entry will be aborted without confirmation (abortion).

If no key is pressed for more than 10 minutes, the display will return to the display of the measured values.

6.6 Acknowledge error messages

In case malfunctions or alarms occur, they must be acknowledged by the operator. This can be done via the **E** key on-site or by activation of the digital input IN3 > 100ms. The error description remains until it is acknowledged:

- * Alarm contacts OPEN,
- * Analog output overflow value,
- * Digital output 0V,
- * Error message in display as per table 6.10

6.7 Operation with only one strain gauge sensor

If only one sensor is connected, the unused measuring input should be deactivated so that no error messages are generated. Therefore the setting for the associated upper limit value (parameter *Hi1* or *Hi2*) must be set to 0. Further information can be found in chapter 6.10.

6.8 Reset to default settings

At any time the module can be reset to the default settings. With this, all former parameterization and results of calibration will get lost.

To return to the default settings, the two keys **M** and **▼** must be pressed for more than 10 seconds. During this time, a countdown is running can be aborted by releasing the keys.

After 10 seconds, the module will be reset to the status in which it was delivered.

6.9 List of parameters

Display	Meaning
<i>Lo</i>	Lower limit value, relative to the maximum displayed value <i>Ab5</i>
<i>Hi1</i>	Upper limit value 1 relative to the maximum displayed value <i>Ab5</i>
<i>Hi2</i>	Upper limit value 2 relative to the maximum displayed value <i>Ab5</i>
<i>dIF</i>	Maximum difference value
<i>Uou</i>	Config. Analog output U+
<i>Iou</i>	Config. Analog Output I+
<i>dLY</i>	Delay
<i>An2</i>	Function of the 2nd analog output
<i>Lin</i>	Smallest permitted negative limit value
<i>rEF</i>	Upper calibration value
<i>HYS</i>	Hysteresis for alarm
<i>Ab5</i>	Maximum displayed value
<i>Id</i>	Code input
<i>O-1</i>	Offset DMS1
<i>E-1</i>	Amplification DMS1
<i>S-1</i>	Sensitivity DMS1
<i>O-2</i>	Offset DMS2
<i>E-2</i>	Amplification DMS2
<i>S-2</i>	Sensitivity DMS2
<i>CF6</i>	Configuration hardware
<i>UEr</i>	Software version of device

6.10 Parameter descriptions in detail

Lo		Lower limit value, relative to <i>RbS</i>
Min	0	<p>If one of the two measured values undershoots the here pre-set value, the LO alarm will be triggered. Example: <i>RbS</i> = 350, <i>Lo</i> = 10 → Alarm will be triggered when 10% of 350, i.e. < 35, has been reached.</p> <p>In case of an LO alarm the following will happen:</p> <ul style="list-style-type: none"> * The digital output OU2 remains off permanently. * Contacts 13-14 as well as 23-24 are open * In the display, the error code E.7 and/or E.8 is displayed. <p>The alarm must be confirmed/acknowledged via the digital input QUIT (IN3) or manually by actuation of the E key.</p> <p>The setting <i>Lo</i> = 0 deactivates the Lo alarm monitoring.</p>
Max	The smaller one of the values set as <i>Hi</i> or <i>H2</i> - 1	
Default	0	
Unit	%	

Hi		Upper limit value 1, relative to <i>RbS</i>
Min	0	<p>If the measured value of the first sensor exceeds the here pre-set value, the HI alarm will be triggered. Example: <i>RbS</i> = 350, <i>Hi</i> = 90 → Alarm will be triggered when 90% of 350, i.e. < 315, has been reached.</p> <p>In case of an HI alarm the following will happen:</p> <ul style="list-style-type: none"> * The digital output OU1 remains off permanently. * Contact 13-14 are open * Error code E.5 is displayed. <p>The alarm must be confirmed/acknowledged via the digital input QUIT (IN3) or manually by actuation of the E key.</p> <p>The setting <i>Hi</i> = 0 disables the monitoring of strain gauge bridge 1. This suppresses any indications and error messages of the 1st measuring channel.</p>
Max	107	
Default	90	
Unit	%	

<i>H_{i2}</i>		Upper limit value 2, relative to <i>R_{BS}</i>
Min	0	<p>If the measured value of the second sensor exceeds the here pre-set value, the HI alarm will be triggered.</p> <p>Example: <i>R_{BS}</i> = 350, <i>H_{i2}</i> = 90 → Alarm will be triggered when 90% of 350, i.e. < 315, has been reached.</p> <p>In case of an HI alarm the following will happen:</p> <ul style="list-style-type: none"> * The digital output OU2 remains off permanently. * Contact 23-24 are open * Error code E.6 is displayed. <p>The alarm must be confirmed/acknowledged via the digital input QUIT (IN3) or manually by actuation of the E key.</p> <p>The setting <i>H_{i2}</i> = 0 disables the monitoring of strain gauge bridge 2. This suppresses any indications and error messages of the 2nd measuring channel.</p>
Max	107	
Default	90	
Unit	%	

<i>dF</i>		Max. permitted deviation between measured value 1 and measured value 2
Min	0	The two pressure values are not compared in the AT266 module.
Max	0	
Default	0	
Unit	%	

<i>U_{ou}</i>		Range of output voltage
Min	0	<p>This parameter is used to pre-set the value range of the analog output voltages at the terminal 1U+ and 2U+:</p> <p>0 = output inactive 1 = output 0..5V 2 = output 0..10V</p>
Max	2	
Default	0	
Unit	-	

<i>I_{ou}</i>		Range of output current
Min	0	<p>This parameter is used to pre-set the value range of the analog output current at the terminal 1I+ and 2I+:</p> <p>0 = output inactive 1 = output 0..20 mA 2 = output 4..20 mA 3 = output 0..24 mA (as per Namur NE43, also see Appendix)</p> <p>When <i>I_{ou}</i> is set to 3, <i>U_{ou}</i> will automatically be 0</p>
Max	3	
Default	2	
Unit	-	

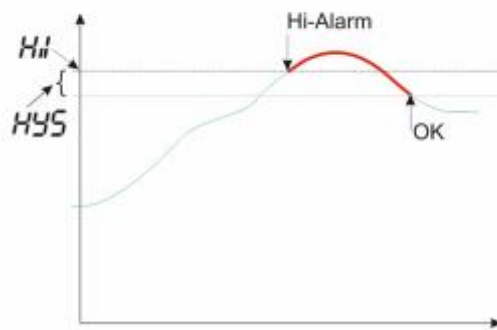
<i>dLY</i>		Alarm delay
Min	0	In module AT266, this function is not available
Max	0	
Default	0	
Unit	seconds	

<i>An2</i>		Function of the 2nd analog output
Min	0	In module AT266, this function is not available
Max	0	
Default	0	
Unit	-	

<i>nIn</i>		Smallest permitted negative measured value
Min	0	<p>If the measured value is negative, its absolute value may not exceed the limit value in % that has been pre-set here. If this is still the case, a MIN alarm will be triggered.</p> <p>In case of a MIN alarm the following will happen:</p> <ul style="list-style-type: none"> * Contacts 13-14 as well as 23-24 are open * At the analog outputs the overflow value is displayed (11V or 24mA). * Error code E.3 and E.4 are displayed.
Max	100	
Default	2	
Unit	%	

<i>rEF</i>		Upper calibration value
Min	10	<p>The calibration routine refers the upper reference value to the value pre-set here (see → calibration).</p> <p>Example: <i>RbS</i> = 350, <i>rEF</i> = 80 → The reference value that is used for calibration is 280.</p>
Max	100	
Default	80	
Unit	%	

<i>HYS</i>		Alarm hysteresis relative to <i>RbS</i>
Min	0	<p>An alarm is triggered when the HI value is exceeded and can be acknowledged only then when the measured value undershoots the HI value again by here pre-set value. The value can be set in steps of 0.1%.</p>
Max	20	
Default	5	
Unit	%	



<i>AbS</i>		Maximum displayed value
Min	10	<p>The here entered value defines the upper valid measured value that appears in the display. This must comply with the corresponding specified data of the sensors used.</p> <p>(Nonbinding example: 350 for 350bar; 100 for 100kg; 500 for 5kN...)</p> <p>When the measured value has reached this value, the maximum voltage is supplied on the analog output.</p> <p>Many parameters refer to the percentage of this characteristic.</p>
Max	999	
Default	350	
Unit	-	

<i>Id</i>		Password
Min	0	<p>Here, the password is defined which is required for editing of values. The value set as <i>Id</i> is only visible after the currently valid password has been entered.</p>
Max	999	
Default	22	
Unit	-	

<i>0-1</i>		Offset sensor 1
Min	Only read	<p>Here, the determined offset value can be read after calibration of sensor 1.</p>
Max	Only read	
Default	-	
Unit	%	

<i>E-1</i>		Amplification sensor 1
Min	Only read	<p>Here, the determined amplification value can be read after calibration of sensor 1.</p>
Max	Only read	
Default	-	
Unit	nV / digit	

<i>S-1</i>		Sensitivity sensor 1
Min	Only read	<p>Here, the determined sensitivity can be read after calibration of sensor 1.</p>
Max	Only read	
Default	-	
Unit	mV / 10V	

<i>0-2</i>		Offset sensor 2
Min	Only read	<p>Here, the determined offset value can be read after calibration of sensor 2.</p>
Max	Only read	
Default	-	
Unit	%	

<i>E-2</i>		Amplification sensor 2
Min	Only read	<p>Here, the determined amplification value can be read after calibration of sensor 2.</p>
Max	Only read	
Default	-	
Unit	nV / digit	

S-2		Sensitivity sensor 2
Min	Only read	Here, the determined sensitivity can be read after calibration of sensor 2.
Max	Only read	
Default	-	
Unit	mV / 10V	



CF6		Module name
Min	Only read	Here, the designation of the module can be read (265, 266 or 267)
Max	Only read	

UEr		Software version
Min	Only read	Here, the software version of the module can be read
Max	Only read	

7 Error messages

7.1 Fault messages on the display

In case a failure or malfunction occurs, the following error messages will be displayed and the relay contacts 13-14 and 23-24 will be opened and the digital output OU2 will be switched off.

Error messages - sensors			
Display	Meaning (s)	Cause	Remedy
E.1	Broken sensor, short-circuited sensor, wrong wiring at DMS1	An error occurred in the connection of the strain gauge measuring bridge 1. This can be caused by a broken connection, wrong wiring, or a defective strain gauge measuring bridge.	Check the strain gauge measuring bridge 1 and the connecting lines to the module.
E.2	Broken sensor, short-circuited sensor, wrong wiring at DMS2	An error occurred in the connection of the strain gauge measuring bridge 2. This can be caused by a broken connection, wrong wiring, or a defective strain gauge measuring bridge.	Check the strain gauge measuring bridge 2 and the connecting lines to the module.
E.3	Negative limit value  has been undershot at strain gauge measuring bridge DMS1	The pressure load acts in the reverse direction, the maximum negative input voltage on the connection of strain gauge measuring bridge DMS1 was undershot.	Carry out the calibration again under depressurized conditions. If this does not provide a remedy, check the installation position of the strain gauge measuring bridge 1 again.
E.4	Negative limit value  has been undershot at strain gauge measuring bridge DMS2	The pressure load acts in the reverse direction, the maximum negative input voltage on the connection of strain gauge measuring bridge DMS2 was undershot.	Carry out the calibration again under depressurized conditions. If this does not provide a remedy, check the installation position of the strain gauge measuring bridge 2 again.

E.5	Maximum limit value HI has been undershot at strain gauge measuring bridge DMS1	The pressure value of the strain gauge measuring bridge DMS1 is higher than the pre-set maximum value.	When the alarms occur too early or too often, adapt the upper limit value accordingly.
E.6	Max. limit value HI exceeded at strain gauge measuring bridge DMS2	The pressure value of the strain gauge measuring bridge DMS2 is higher than the pre-set maximum value.	When the alarms occur too early or too often, adapt the upper limit value accordingly.
E.7	Lo -alarm on strain gauge measuring bridge DMS1 or DMS2	One of the two measured pressure values is lower than the permitted LO value.	Find out the reason for the lower deviation. Possibly, a basic load is missing. If the message occurs too early or too often, adapt the LO value.
E.8	Lo -alarm on strain gauge measuring bridge DMS1 or DMS2	One of the two measured pressure values is lower than the permitted LO value.	Find out the reason for the lower deviation. Possibly, a basic load is missing. If the message occurs too early or too often, adapt the LO value.
E.9	dF -message (difference - exceeding) NOT USED WITH MODULE AT266	The amount of the difference value between the measured pressure values of DMS1 and DMS2 is higher than the maximum permitted difference value.	Find out the reason for the pressure difference. If the message occurs too early or too often, adapt the maximum difference value.

Error messages - hardware

Display	Meaning (s)	Cause	Remedy
E.17	Source of supply voltage outside the permitted tolerance value.	Hardware failure	Send the module for examination.
E.18	Reference voltage source defective	Hardware failure	Send the module for examination.
E.19	Sensor monitoring voltage for DMS1 defective	Hardware failure or short-circuit on the sensor input	Send the module for examination.
E.20	Sensor monitoring voltage for DMS2 defective	Hardware failure or short-circuit on the sensor input	Send the module for examination.
E.21	Voltage supply unit for the analog outputs Uout/Iout defective	Hardware failure	Send the module for examination.
E.22	Parameter storage for the configuration defective	Hardware failure	Send the module for examination.

E.23	AD-converter for channel 1 defective	Hardware failure	Send the module for examination.
E.24	AD-converter for channel 2 defective	Hardware failure	Send the module for examination.
E.25	Checking-back of the digital inputs and of the input keyboard of the display defective	Hardware failure	Send the module for examination.
E.26	External hardware monitoring (watch-dog) defective	Hardware failure	Send the module for examination.
E.27	Signal failure at analog output 1	Connection of analog output between module and machine control is interrupted.	Check the external wiring of the outputs Uout and Iout: Load for Iout greater than 500 Ohm? Wiring between Iout and the machine broken? Shorted circuit at Uout? If analogue output 1 is not used, terminals 1I+ and U/I- should be bridged to avoid the error.
E.28	Signal failure at analog output 2	Connection of analog output between module and machine control is interrupted.	Check the external wiring of the outputs Uout and Iout: Load for Iout greater than 500 Ohm? Wiring between Iout and the machine broken? Shorted circuit at Uout? If analogue output 2 is not used, terminals 2I+ and U/I- should be bridged to avoid the error.

Error messages - calibration

Display	Meaning (s)	Cause	Remedy
E.29	Calibration failure: DMS1 upper reference value not recognized.	No signal or too low signal from sensor DMS1 when calibrating the (upper) reference value.	Repeat calibration; check the sensor and its installation position, if necessary
E.30	Calibration failure: DMS2 upper reference value not recognized.	Like E.29, but for DMS2	Like E.29, but for DMS2
E.31	Calibration failure: DMS1 amplification	Too high signal from sensor DMS1 when calibrating the (upper) reference value.	Repeat calibration; check the sensor and its installation position, if necessary
E.32	Calibration failure: DMS2 amplification	Like E.31, but for DMS2	Like E.31, but for DMS2

7.2 Warnings

In case a warning is triggered the following warning messages can be displayed that cause the switching off of the digital output OU1. In contrast to error messages, warnings are not required to be acknowledged.

Warnings			
Display	Meaning (s)	Cause	Remedy
<i>H!</i>	Not used in module At266		

7.3 Behaviour of outputs in case of failures

Output	Error cause	Action
Analog output 1	<ul style="list-style-type: none"> • DMS1 < lower limit Lo or • DMS1 > upper limit Hil or • DMS1 broken sensor, short-circuit, wrong wiring 	Overflow value (11V or 24mA) until acknowledgement
Analog output 2	<ul style="list-style-type: none"> • DMS2 < lower limit Lo or • DMS2 > upper limit H₂ or • DMS2 broken sensor, short-circuit, wrong wiring 	Overflow value (11V or 24mA) until acknowledgement
Relay output 1 (terminal 13-14)	<ul style="list-style-type: none"> • DMS1 < lower limit Lo or • DMS1 > upper limit Hil or • DMS1 broken sensor, short-circuit, wrong wiring, or • Hardware failure 	Contact opens until acknowledgement
Relay output 2 (terminal 23-24)	<ul style="list-style-type: none"> • DMS2 < lower limit Lo or • DMS2 > upper limit H₂ or • DMS2 broken sensor, short-circuit, wrong wiring • Hardware failure 	Contact opens until acknowledgement
24V output OU1	<ul style="list-style-type: none"> • DMS1 < lower limit Lo or • DMS1 > upper limit Hil or • DMS1 broken sensor, short-circuit, wrong wiring 	Switches off until acknowledgement
24V output OU2	<ul style="list-style-type: none"> • DMS2 < lower limit Lo or • DMS2 > upper limit H₂ or • DMS2 broken sensor, short-circuit, wrong wiring 	Switches off until acknowledgement

8 Commissioning and set-up

8.1 Calibration of the strain gauge measuring bridge DMS

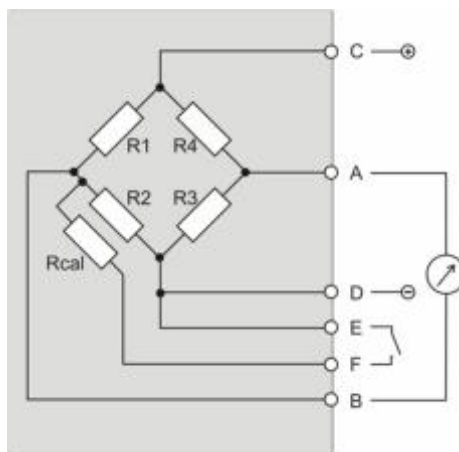
The device must be adapted to the DMS measuring bridge (calibrated) to consider its electrical characteristics.

Notwithstanding the above, after heating up or electrical pre-stressing, the initial or offset value can be re-calibrated.

The module is tested and set-up at the factory. The DMS measuring bridge is individually adapted during commissioning and can be changed at any time.

8.1.1 Suitable strain gauge measuring bridges

The device is designed for the use with DMS measuring bridges that are structured in accordance with the following electrical circuit diagram:



*Equivalent circuit diagram of the DMS pressure gauge
(Wheatstone bridge)*

Suitable pressure gauges must comply with the following technical data:

Overall bridge resistance	$\geq 350 \Omega$
Signal level at maximum value:	0.1mV/V..10mV/V

:

8.2 Calibration

procedure

To minimize temperature influences, calibration should be carried out only after 10 min after the commissioning of the module and the DMS sensor and at the usual operating temperature.

Before carrying out the calibration procedure, reasonable specifications for the DMS measuring bridge have to be entered in the parameters *AbS* and *rEF*.

Optionally, calibration can be started via the control keys or via the input IN1:



This procedure is only allowed to be done under depressurized conditions and with unloaded DMS measuring bridges!

8.2.1 Starting of the calibration procedure via the digital input

- 1.) For zero balancing, the measuring bridges must be depressurized
- 2.) Connect the digital input IN1 to 24VDC for at least 100ms.
- 3.) Calibration is running automatically.

In the display, *CAL* appears with an incrementing digit from 0 to 5 in turns.

- 4.) The module has been calibrated.

If the DMS measuring bridge is missing or is not suitable or other failure causes appear, an appropriate error code will be displayed.

8.2.2 Starting of the calibration procedure via the keyboard

- 1.) For zero balancing, the measuring bridges must be unloaded
- 2.) Simultaneously actuate the **E** and **M** buttons for 5 seconds. During this time a count-down of 5 0 and the term *CAL* are displayed in turns.
- 3.) Release the keys.
- 4.) Calibration is running automatically. In the display, now *CAL* appears with an incrementing digit from 0 to 5 in turns.
- 5.) The module has been calibrated.

8.2.3 Display of calibration results

The determined parameters for amplification and the zero point (offset) can then be called via the control system of the device (parameter *0-1 0-2 E-1 E-2 5-1 5-2*)

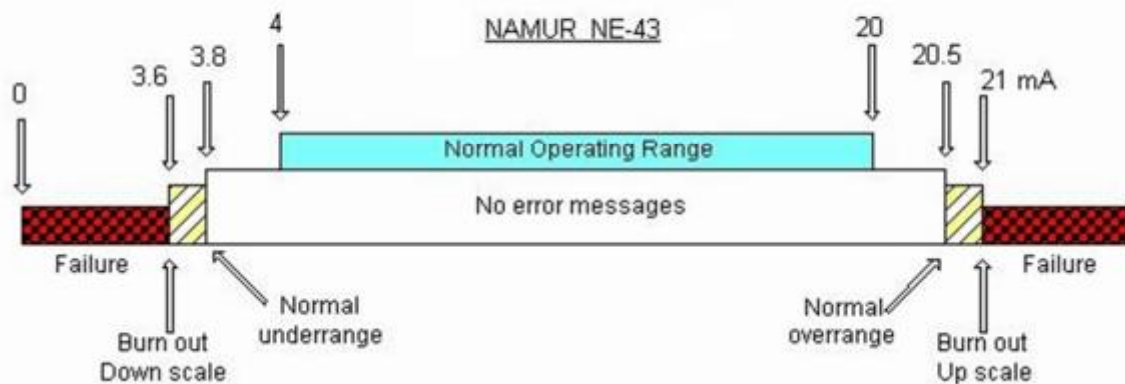
9 Appendix

9.1 Definition „Namur NE43“

The signal 4 ... 20 mA is very widely used in the transmission of sensor values. With this, for instance, the pressure signal of a pressure sensor to be measured in the production process 0 ... 10 bar is converted to 4...20 mA in the electronic module.

To make a detected defect of a sensor recognizable via this current loop, a current value of > 21mA is output by the module as per Namur NE43. With this, small overruns or undershoots of the measured values can be measured within the range of 20 and 21mA as well as between 3.6 und 4mA.

The Namur characteristics can be activated by setting the parameter **lou** to the value 3. In this case, the simultaneous output of a 0...10V value is not possible.



9.2 Accessories optionally available

9.2.1 Mounting angle with screened terminals and PE connection

For optimum installation of the cable conduit, a mounting angle with screened terminal and PE-connection is available under the order number 99-00162. This provides for a safe strain relief of the lines and for reliable earthing of the protective screening.

The mounting angle is pre-assembled and can be easily and subsequently fastened in the two threaded bores of the housing using the two screws that come with the device.

Alternatively to the fixations on the top side shown in the figure the angle can also be mounted on the bottom side of the housing.

If this mounting angle is used, the installation height of the module is then about 40mm higher.



9.3 Technical Data

Housing and assembly	
Dimensions (WxHxD)	53 mm x 116 mm x 125 mm
Weight	550 g
Housing material	Metal
Protection class	IP 20
Fixture	Snap-in fixation for mounting angle TS35
Operating temperature	0..50°C / no condensation
Operation	
Display	3 x 7-segment
Membrane keys	4 pieces
Electrical power supply	
Supply voltage	
Min...Typical...Max	18V DC ... 24V DC ... 32V DC
Power consumption	max. 5 W
Digital inputs	
Number of inputs	4
Digital inputs	24 VDC / 2.5 mA
Analog inputs	
Number of channels	2
Connection of DMS sensors	2 x 6-pole connector (A1... F1 / A2...F2)
Measurement bridge supply	10 VDC stabile / max. 120 mA per sensor
Input sensitivity:	1 mV/10V ... 100 mV/10V
Zero point/ Amplification	Automatic set-up with calibration
Resolution inputs	23 bit
Resolution inputs per digit	163.3 nV
Scanning cycle inputs	80 PLC
Analog outputs	
Voltage output	Optional: 0...10 VDC or 0..5 VDC
Load resistance - voltage output	> 3 kOhm
Current output	Optional: 0...20 mA or 4...20 mA or 3.6...21 mA (as per Namur NE43)
Burden - current output	max. 500 ohms
3 dB limit frequency	15 Hz
Resolution - outputs	16 bit
Accuracy	
Temperature coefficient TK	max. 1.2 ppm FSR/°C (FSR = F ull S cale R ange)
Linearity error	max. 0.065 %FSR
Alarm	
Hysteresis - alarm	Adjustable
Alarm relay, potential-free	2 x 250 VAC, 2 A
Digital alarm output	2 x 24 VDC, 12 mA
Delay	Adjustable

FMEDA parameters*	
Performance level	PL c
Hardware failure tolerance	HFT = 0
Structure MooN	1oo1
Proof test interval	T1(PL c) = 10 years
Average lifetime MTTF _d per channel	
Digital OUT	1401 years
Analog OUT	867 years
Relay OUT	744 years
Useful life	10 years
PFH _d per channel	
Digital OUT	81.5 FIT
Analog OUT	131.7 FIT
Relay OUT	153.5 FIT
PFD _{avg} (T1) per channel	
Digital OUT	3.57×10^{-3}
Analog OUT	5.77×10^{-3}
Relay OUT	6.72×10^{-3}

* Excerpt from the FMEDA-characteristic data sheet for AT266 (can be ordered separately)

Standards and regulations

CE Conformity:	EN 61326-1, EN 61000
EMC directive:	2014/30/EU
Low voltage directive:	2014/35/EU
RoHS:	2011/65/EU
Insulation Test:	DIN EN 60204-1

9.4 Service address

For technical questions or in case of complaints, please contact:

FELLER ENGINEERING GmbH
 Carl-Zeiss-Str. 14
 D-63322 Rödermark
 Phone: +49 (0)6074 8949-0
 Fax: +49 (0)6074 8949-49
www.fellereng.de

9.5 Parameters pre-set by the customer

Project _____

Date _____

Name _____

Display	Meaning	Set value
<i>Lo</i>	Lower limit value, relative to the maximum displayed value <i>Ab5</i>	
<i>Hi1</i>	Upper limit value 1 relative to the maximum displayed value <i>Ab5</i>	
<i>Hi2</i>	Upper limit value 2 relative to the maximum displayed value <i>Ab5</i>	
<i>dIF</i>	Maximum difference value	
<i>Uou</i>	Config. Analog output U+	
<i>Iou</i>	Config. Analog Output I+	
<i>dLY</i>	Delay	
<i>An2</i>	Function of the 2nd analog output	
<i>n_{in}</i>	Smallest permitted negative limit value	
<i>rEF</i>	Upper calibration value	
<i>HYS</i>	Hysteresis for alarm	
<i>Ab5</i>	Maximum displayed value	
<i>Id</i>	Code input	

