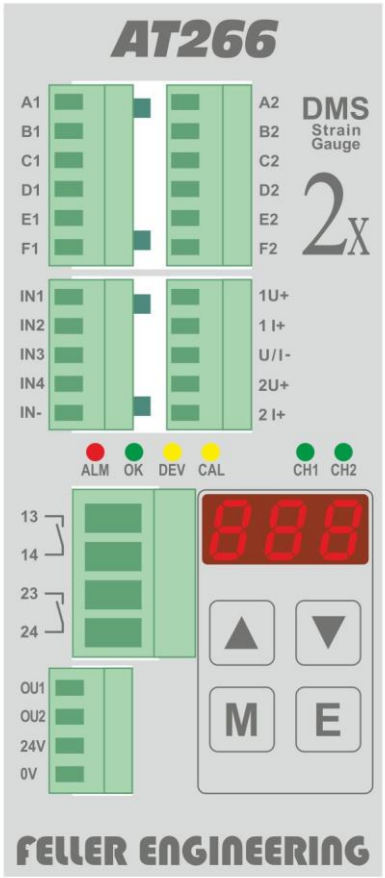
FELLER ENGINEERING GmbH

AT266

2-Channel
Strain Gauge Amplifier Module
with Digital Display

User Manual

for Firmware V1.09



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Content

1 Brief Description

The module is used to record the signals of two strain gauge measuring bridges and to provide current values and status information for further processing at the automation level. Two analogue outputs (each as current and voltage), two 24V digital outputs and two potential-free relay contacts are available for this purpose.

The pressure values of both measured values are monitored as a voltage and/or current signal at the analogue outputs of the AT266 module. Among other things, an alarm is triggered if one of the two measured values exceeds or falls below a limit value. By default, an alarm is triggered in the event of a sensor defect (line break, 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 mounting rail type TS35 in a cabinet and is operated with a supply voltage of 24 VDC (5W).

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

The unit has been developed according to the following directives:

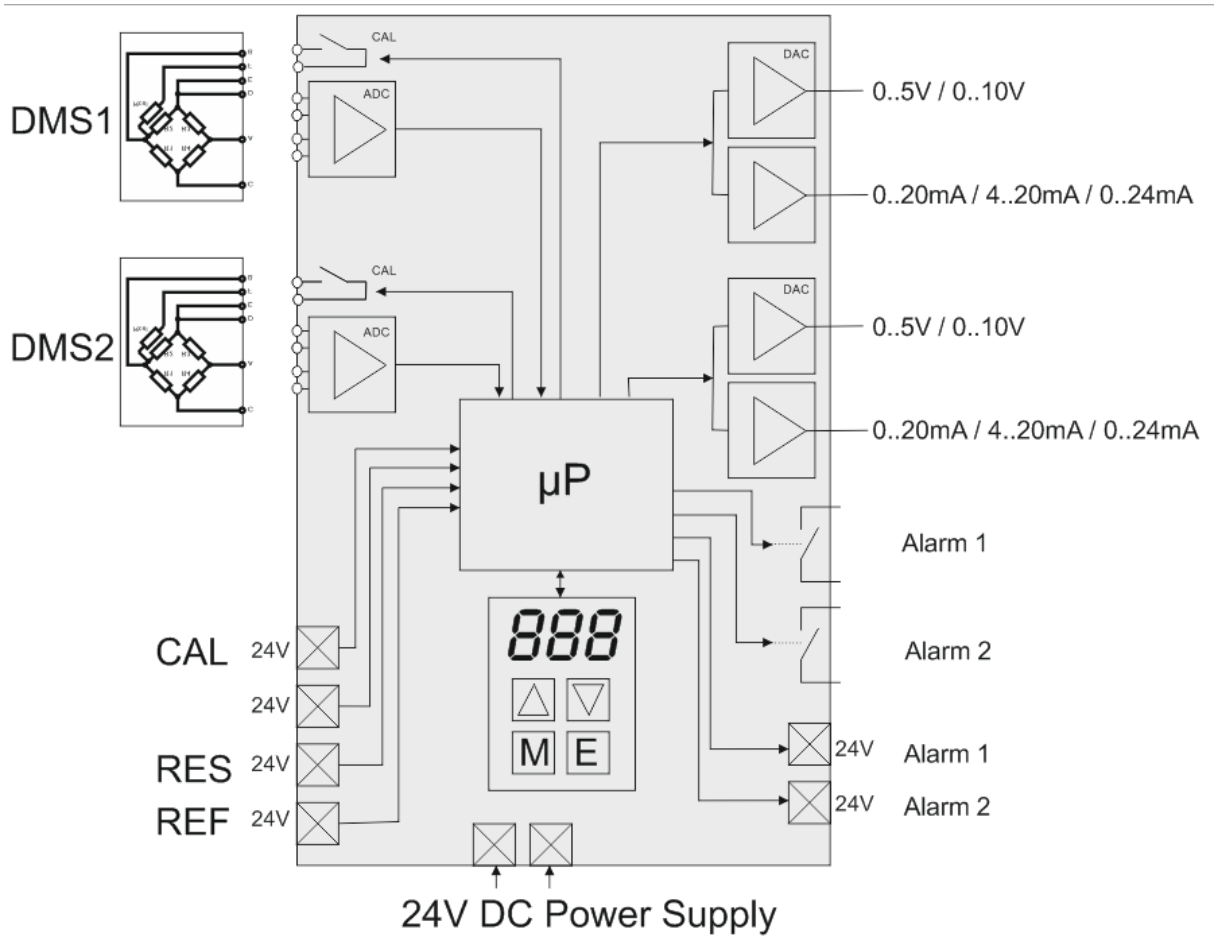
EMC Directive according to 2014/30/EU
Low Voltage Directive according to 2014/35/EU

1.1 Used Symbols

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 following the steps shown below, a quick and successful commissioning of the module is possible in a short time:

1.3.1 Electrical Connection of the Module

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

Connect current output 4..20mA for recording the measured variable (chapter 5.2.2.4) or - if it is not needed - switch it off via parameter Iou = 0 (chapter 6.5).

Apply voltage supply 24VDC to terminal X6 (chapter 5.2.2.7)

1.3.2 Adapting the Module to the used Sensor

Reading the relevant parameters on the sensor

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

With firmware version 1.07, two sensors with different end values can be connected. These end values are to be entered as parameter Ab1 for sensor 1 and as parameter Ab2 for sensor 2. (In this example value "350" entered for each channel)
Input 80 for parameter rEF. (Find both in chapter 6.5)

1.3.3 Calibrating the Module in a depressurized Condition

Carry out calibration according to 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 unit has been developed for use in industrial applications and is intended for installation in the control cabinet.

The electrical connections must be made by a qualified electrician!

Only authorized specialist personnel are allowed to put the device into operation and to operate it during operation!

Further safety-relevant notes are marked in the respective sections of this documentation.

The unit has been carefully checked before delivery and has passed the tests prescribed for manufacture in accordance with the manufacturer's applicable quality guideline in the test plan.

In order to ensure reliable and safe operation, every user is obliged to observe the instructions and warnings. In the case of subcontracting, this documentation must be enclosed and reference must be made to compliance with these safety instructions.

The manufacturer and distributor of this appliance cannot be held liable for direct or indirect damage resulting from improper handling or treatment.

2.2 Electrical Connection

The electrical cables must be laid in accordance with the respective national regulations and the plant operator's factory standards. It must be ensured that the measuring lines are laid separately from the signal and mains lines.

The unit is intended for use with a fused power supply.

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 switching on the unit for the first time, make sure that the following points 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 Decommissioning

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 down-stream evaluation of the alarms does not cause any unintended effects.

4 Maintenance and Care

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

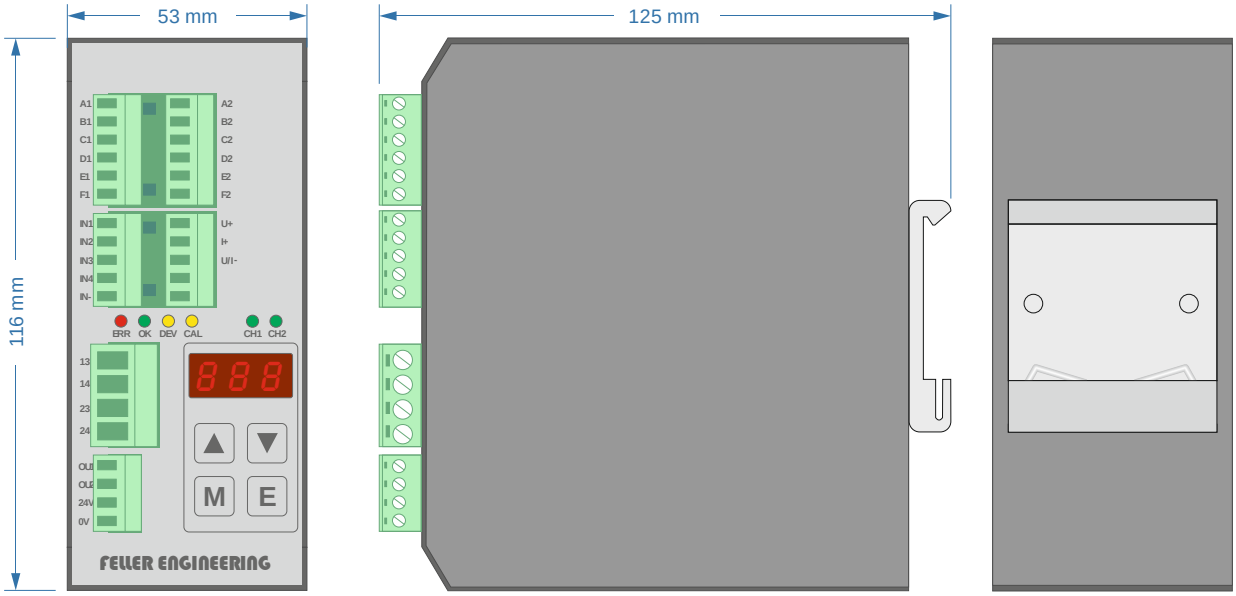
Each device comes with a set of appropriate screw terminals. They are coded in a way that they only match to the correct connection and cannot be confused during assembly. This is especially advantageous when a device is replaced.

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.

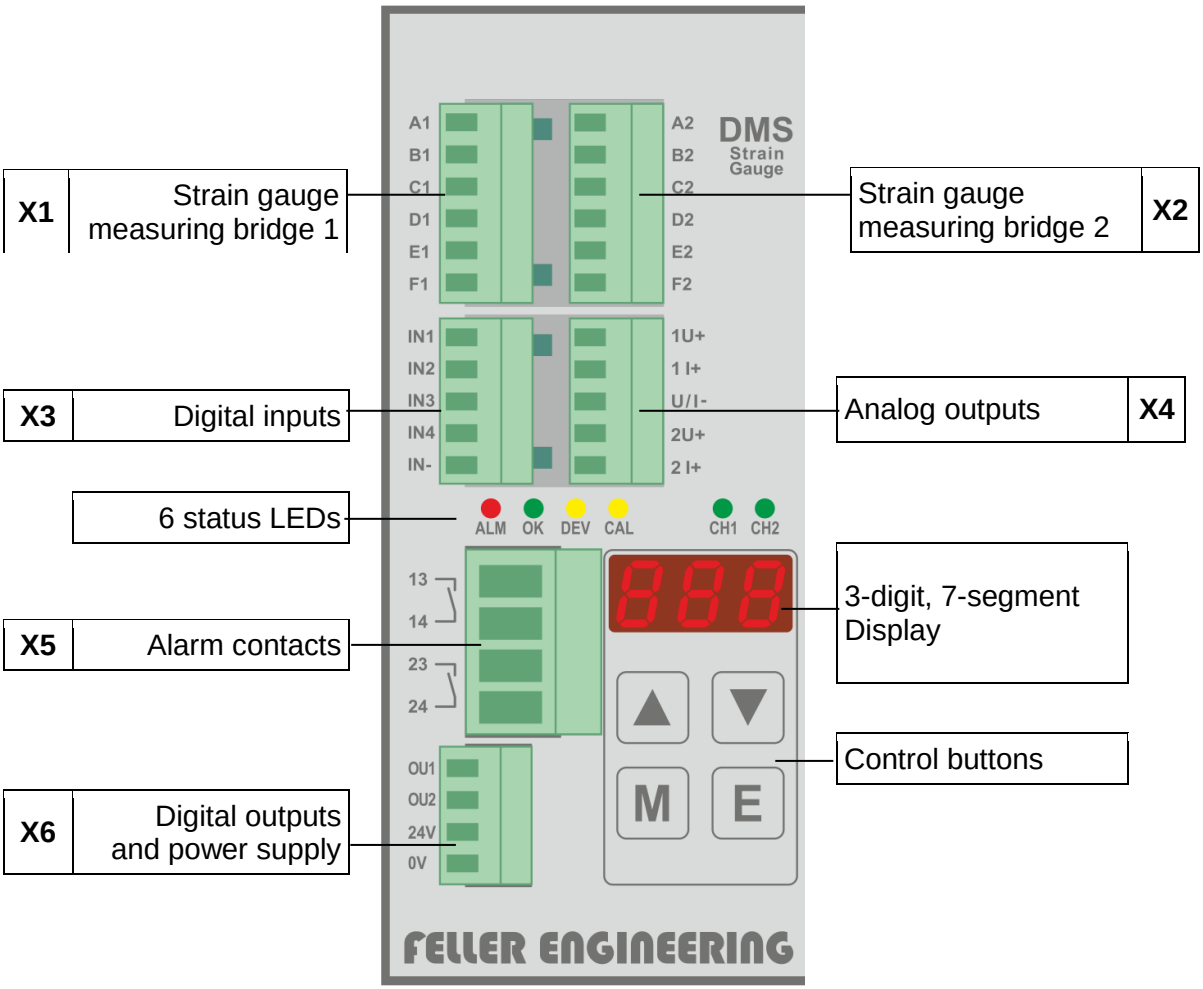
4.2 Dimensions of the Device and Instructions for Assembly



5 Pin Assignment, Display and Operating Elements

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 screw terminals are designed for wiring with wire end ferrules.

5.1 Use of Terminal Strips

Terminal Strip	Use	Assignment	Wire size
X1	Strain gauge measuring bridge 1	10 VDC	1.5 mm²
X2	Strain gauge measuring bridge 2	10 VDC	1.5 mm²
X3	Digital inputs	24 VDC	1.5 mm²
X4	Analogue outputs	10 VDC / 20 mA	1.5 mm²
X5	Alarm contacts (potential-free)	250 VAC / 2 A	2.5 mm²
X6	Digital outputs & supply	24 VDC	1.5 mm²

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.**
Hint:	***)** As of firmware version 1.09, the digital **inputs IN1/IN2** work **edge-oriented!**

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

Unused current outputs must be short-circuited with a jumper against U/I- to avoid error messages

5.2.2.5 X5: Alarm Contacts

X5.13 X5.14	1. Potential-free contact (wire-break-proof) as relay contact for loads until 250 VAC / 2 A or 24 VDC
X5.23 X5.24	2. Potential-free contact (wire-break-proof) as relay contact 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. AT_266) and then its version number (e.g. VEr.109) 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. dIF Releasing the key causes the display to toggle between the actual setpoint value and the parameter name, e.g. = dIF 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.i.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 Hi 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
LoI	Lower limit value 1 for Strain Gauge 1, relative to the maximum displayed value AbI
HiI	Upper limit value 1 for Strain Gauge 1, relative to the maximum displayed value AbI
Lo2	Lower limit value 2 for Strain Gauge 2, relative to the maximum displayed value Ab2
Hi2	Upper limit value 2 for Strain Gauge 2, relative to the maximum displayed value Ab2
dif	Maximum difference value
Uou	Config. Analog output U+
Iou	Config. Analog Output I+
dLY	Delay
An2	Function of the 2nd analog output
Min	Smallest permitted negative limit value
rEF	Upper calibration value
HYS	Hysteresis for alarm
AbI	Maximum displayed value for Strain Gauge 1
Ab2	Maximum displayed value for Strain Gauge 2
Id	Code input
O-1	Offset DMS1
E-1	Amplification DMS1
S-1	Sensitivity DMS1
O-2	Offset DMS2
E-2	Amplification DMS2
S-2	Sensitivity DMS2
CFG	Configuration hardware
UEr	Software version of device

6.10 Parameter Descriptions in Detail

LoI		**Lower limit value Strain Gauge 1, relative to AbI**
Min	0	If one of the two measured values undershoots the here pre-set value, the LO alarm will be triggered. Example: AbI = 350, LoI = 10 → Alarm will be triggered when 10% of 350, i.e. < 35, has been reached. In case of an LO alarm the following will happen: * The digital output OU2 remains off permanently. * Contacts 13-14 is open * In the display, the error code E.7 is displayed. The alarm must be confirmed/acknowledged via the digital input QUIT (IN3) or manually by actuation of the **E** key. The setting LoI = 0 deactivates the Lo alarm monitoring.
Max	HmI - 1	
Default	0	
Unit	%	

HI		**Upper limit value Strain Gauge 1, relative to AbI**
Min	LoI + 1	If the measured value of the first sensor exceeds the here pre-set value, the HI alarm will be triggered. Example: AbI = 350, HmI = 90 → Alarm will be triggered when 90% of 350, i.e. < 315, has been reached. In case of an HI alarm the following will happen: * The digital output OU1 remains off permanently. * Contact 13-14 is open * Error code E.5 is displayed. The alarm must be confirmed/acknowledged via the digital input QUIT (IN3) or manually by actuation of the **E** key. The setting HmI = 0 disables the monitoring of strain gauge 1. This suppresses any indications and error messages of the 1st measuring channel.
Max	107	
Default	90	
Unit	%	

LoC2	Lower limit value Strain Gauge 2, relative to AbC2
Min: 0 Max: HiC2 - 1 Default: 0 Unit: %	If one of the two measured values undershoots the here pre-set value, the LO alarm will be triggered. Example: AbC2 = 350, LoC2 = 10 → Alarm will be triggered when 10% of 350, i.e. < 35, has been reached. In case of an LO alarm the following will happen: * The digital output OU2 remains off permanently. * Contacts 23-24 is open * In the display, the error code E.8 is displayed. The alarm must be confirmed/acknowledged via the digital input QUIT (IN3) or manually by actuation of the **E** key. The setting LoC2 = 0 deactivates the Lo alarm monitoring.

HiC2	Upper limit value Strain Gauge 2, relative to AbC2
Min: LoC2 + 1 Max: 107 Default: 90	If the measured value of the first sensor exceeds the here pre-set value, the HI alarm will be triggered. Example: AbC2 = 350, HiC2 = 90 → Alarm will be triggered when 90% of 350, i.e. < 315, has been reached. In case of an HI alarm the following will happen: * The digital output OU1 remains off permanently. * Contact 23-24 is open * Error code E.6 is displayed. The alarm must be confirmed/acknowledged via the digital input QUIT (IN3) or manually by actuation of the **E** key. The setting HiC2 = 0 disables the monitoring of strain gauge 2. This suppresses any indications and error messages of the 2nd measuring channel.

dnF	Without function

Uou	Range of output voltage
Min: 0 Max: 2 Default: 0 Unit: -	This parameter is used to pre-set the value range of the analog output voltages at the terminal 1U+ and 2U+: 0 = output inactive 1 = output 0..5V 2 = output 0..10V

Iou	Range of output current
Min 0 Max 3 Default 2 Unit -	This parameter is used to pre-set the value range of the analog output current at the terminal 1I+ and 2I+: 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) When Iou is set to 3, Uou will automatically be 0

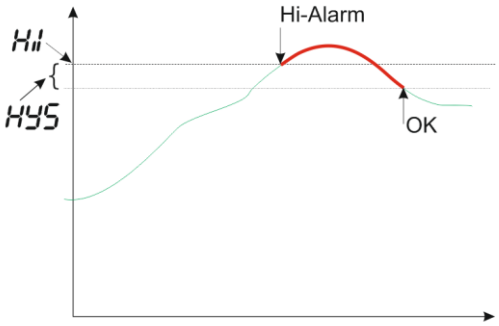
dLY	Alarm delay
Min 0 Max 20 Default 0 Unit sec	**In module AT266, this function is not available**

An2	Without function

Min	Smallest permitted negative measured value
Min 0 Max 100 Default 5 *) Unit %	If the measured value is negative, its absolute value must not fall below the value set here in % of the final value. If this is the case, the MIN alarm is triggered. (**Note:** *) changed from -2% to -5% as of V1.09!) In the event of a MIN alarm from DMS1: * contact 13-14 is opened * Overflow value is output on analogue output 1 (11V or 24mA). * Error code E.3 is shown in the display. In the event of a MIN alarm from DMS2: * Contact 23-24 opened * Overflow value is output on analogue output 2 (11V or 24mA). * Error code E.4 is shown in the display. The alarm must be confirmed/acknowledged either via the digital input QUIT (IN3) or manually by pressing the E key.

rEF	Upper calibration value
Min 10 Max 100 Default 80 Unit %	The calibration routine refers the upper reference value to the value pre-set here (see → calibration). Example: Ab1 and Ab2 = 350, rEF = 80 → The reference value that is used for calibration is 280.

HYS	Alarm hysteresis relative to Ab1 and Ab2
Min 0 Max 20 Default 5 Unit %	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%.



Ab1	Maximum display value of Strain Gauge 1
Min 10 Max 999 Default 350 Unit -	The value entered here defines the upper valid measured value of strain gauge 1 that appears in the display. This must correspond to the corresponding characteristic data of the sensors used. (non-binding examples: 350 for 350bar; 100 for 100kg; 500 for 5kN...) If the recorded measured value reaches this value, the maximum voltage is output at the analogue output. Many of the parameters refer to this value as a percentage.

Ab2	Maximum display value of Strain Gauge 2
Min 10 Max 999 Default 350 Unit -	The value entered here defines the upper valid measured value of strain gauge 2 that appears in the display. This must correspond to the corresponding characteristic data of the sensors used. (non-binding examples: 350 for 350bar; 100 for 100kg; 500 for 5kN...) If the recorded measured value reaches this value, the maximum voltage is output at the analogue output. Many of the parameters refer to this value as a percentage.

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

0-1	Offset sensor 1
Min	Only read
Max	Only read
Default	-
Unit	%

Here, the determined offset value can be read after calibration of sensor 1.

E-1	Amplification sensor 1
Min	Only read
Max	Only read
Default	-
Unit	nV / digit

Here, the determined amplification value can be read after calibration of sensor 1.

S-1	Sensitivity sensor 1
Min	Only read
Max	Only read
Default	-
Unit	mV / 10V

Here, the determined sensitivity can be read after calibration of sensor 1.

0-2	Offset sensor 2
Min	Only read
Max	Only read
Default	-
Unit	%

Here, the determined offset value can be read after calibration of sensor 2.

E-2	Amplification sensor 2
Min	Only read
Max	Only read
Default	-
Unit	nV / digit

Here, the determined amplification value can be read after calibration of sensor 2.

S-2	Sensitivity sensor 2
Min	Only read
Max	Only read
Default	-
Unit	mV / 10V

Here, the determined sensitivity can be read after calibration of sensor 2.

CFG	Module name
Min	Only read
Max	Only read

Here, the designation of the module can be read (265, 266 or 267)

UEr	Software version
Min	Only read
Max	Only read

Here, the software version of the module can be read

7 Error Messages

7.1 Error Messages in 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 Strain Gauge 1	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 Strain Gauge 2	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 Min has been undershot at strain gauge measuring bridge Strain Gauge 1	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 Min has been undershot at strain gauge measuring bridge Strain Gauge 2	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	Max. limit value HI1 exceeded at strain gauge 1	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 HI2 exceeded at strain gauge 2	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	Lo1-alarm on strain gauge 1	One of the two measured pressure values is lower than the permitted LO1 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 LO1 value.
E.8	Lo2-alarm on strain gauge 2	One of the two measured pressure values is lower than the permitted LO2 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 LO2 value.
E.9	dif-message (difference - exceeding) NOT USED WITH MODULE AT266		

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 (watchdog) 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.

Warning messages			
Display	**Meaning(s)**	**Cause**	**Remedy**
H!	Not used in module AT266		

7.3 Behaviour of the outputs in the event of errors

Output	Cause of Error	Action
Analog output 1	• DMS1 < lower limit Lo1 or • DMS1 > upper limit Hi1 or • DMS1 broken sensor, short-circuit, wrong wiring	Overflow value (11V or 24mA) until acknowl-edgement
Analog output 2	• DMS2 < lower limit Lo2 or • DMS2 > upper limit Hi2 or • DMS2 broken sensor, short-circuit, wrong wiring	Overflow value (11V or 24mA) until acknowl-edgement
Relay output 1 (termi-nal 13-14)	• DMS1 < lower limit Lo1 or • DMS1 > upper limit Hi1 or • DMS1 broken sensor, short-circuit, wrong wiring, or • Hardware failure	Contact opens until acknowledgement
Relay output 2 (termi-nal 23-24)	• DMS2 < lower limit Lo2 or • DMS2 > upper limit Hi2 or • DMS2 broken sensor, short-circuit, wrong wiring • Hardware failure	Contact opens until acknowledgement
24V output OU1	• DMS1 < lower limit Lo1 or • DMS1 > upper limit Hi1 or • DMS1 broken sensor, short-circuit, wrong wiring	Switches off until acknowledgement
24V output OU2	• DMS2 < lower limit Lo2 or • DMS2 > upper limit Hi2 or • DMS2 broken sensor, short-circuit, wrong wiring	Switches off until acknowledgement

8 Commissioning and Setup

8.1 Calibration of the strain gauge measuring bridges

The device must be adapted (calibrated) to the strain gauge measuring bridges in order to take into account its electrical properties.

Independently of this, calibration can be repeated after heating or preloading to an initial or offset value.

The module is checked and adjusted at the factory. An individual adjustment to the strain gauge measuring bridges is made during commissioning and can then be changed again at any time.

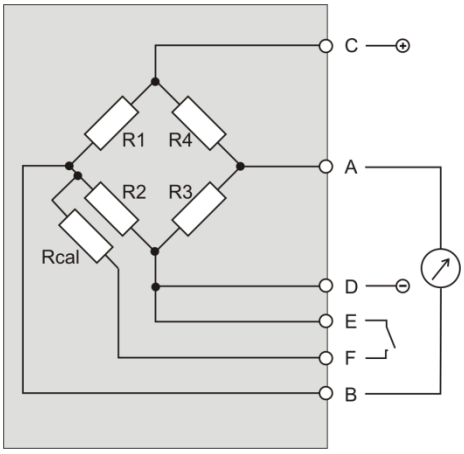
When starting the calibration process via the keyboard, no distinction can be made between the two channels. Therefore, both channels are always calibrated here if they are activated.

Individual calibration of each channel is possible via the digital inputs IN1 or IN2.

Hint:
During the calibration process, an unselected channel outputs the last recorded measured value for the duration of the calibration process.

8.1.1 Suitable strain gauge measuring bridges

The unit is designed for use with strain gauge measuring bridges constructed according to the following circuit diagram:



Equivalent circuit diagram of the strain gauge pressure transducer (Wheatstone Bridge)

Suitable pressure transducers must have the following technical data:

Overall bridge resistance	>= 350 Ω
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 countdown 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 the 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 S-1 S-2)

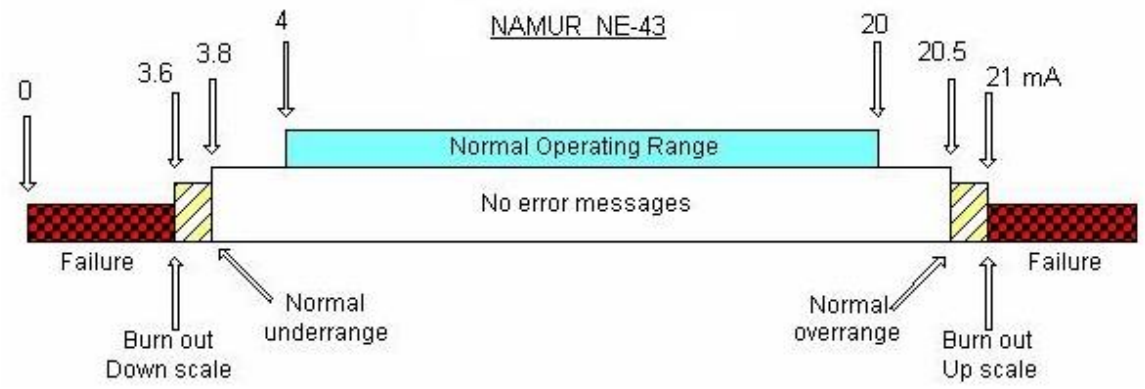
9 Appendix

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 IOU to the value 3. In this case, the simultaneous output of a 0...10V value is not possible.



9.2 Accessories optionally available

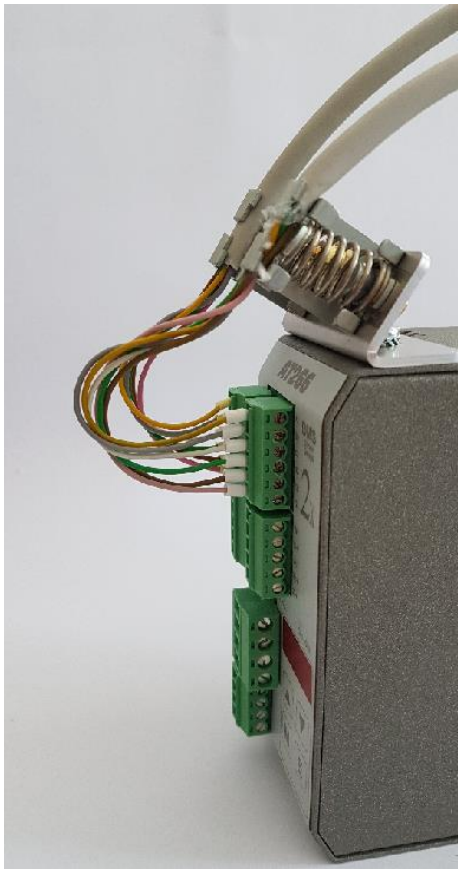
9.2.1 Mounting bracket with shield clamps and PE connection

9.2.2 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 Analog OUT Relay OUT	 1401 years 867 years 744 years
Useful life	10 years
PFH_d per channel Digital OUT Analog OUT Relay OUT	 81.5 FIT 131.7 FIT 153.5 FIT
PFD_{avg}(T1) per channel Digital OUT Analog OUT Relay OUT	 3.57×10^{-3} 5.77×10^{-3} 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
LoI	Lower limit value, relative to the maximum displayed value AbI	
HiI	Upper limit value 1 relative to the maximum displayed value AbI	
Lo2	Lower limit value, relative to the maximum displayed value Ab2	
Hi2	Upper limit value 2 relative to the maximum displayed value Ab2	
dif	Maximum difference value	
Uou	Config. Analog output U+	
Iou	Config. Analog Output I+	
dLY	Delay	
Min	Smallest permitted negative limit value	
rEF	Upper calibration value	
HYS	Hysteresis for alarm	
AbI	Maximum displayed value 1	
Ab2	Maximum displayed value 2	
Id	Code input	