Operating Manual EMGZ411

Digital microprocessor controlled
Tension Measuring Amplifier

Version 2.04 05/04 sd

This operation manual is also available in german, french and italian.
Please contact your local representative.

Diese Bedienungsanleitung ist auch in deutsch, französisch und italienisch erhältlich.
Bitte kontaktieren Sie die Vertretung im zuständigen Land.

Ce mode d'emploi est également disponible en français, en italien et en allemand.
Veuillez contacter la représentation locale.

Queste manuale d'installazione è disponibile anche in lingua italiano, francese e tedesco.
Vogliate cortesemente contattare la locale rappresentanza.

1 Safety Instructions

1.1 Description conditions

a) High danger of health injury or loss of life

Danger

This symbol refers to high risk for persons to get health injury or loss life. It has to be followed strictly.

b) Risk of damage of machines

Caution

This symbol refers to informations, that, if ignored, could cause heavy mecanical damage. This warning has to be followed absolutely.

c) Notice for proper function

Notice

This symbol refers to an important information about proper use. If not followed, malfunction can be the result.

1.2 List of safety instructions

- Proper function of the tension measuring amplifier is only guaranteed with the recommended application of the components. In case of other arrangement, heavy malfunction can be the result. Therefore, the installation instructions on the following pages must be followed strictly.
- Local installation regulations are to preserve safety of electric equipment. They are not taken into consideration by this operating manual. However, they have to be followed strictly.
- Bad earth connection may cause electric shock to persons, malfunction of the total system or damage of the measuring amplifier! It is vital to ensure that proper earth connection is done.
- The processor board is mounted directly behind the operation panel. Improper handling may damage the fragile electronic equipment! Don’t use rough tools as screwdrivers or pliers! Don’t touch processor board! Touch earthed metal part to discharge static electricity before removing operation panel!
- Some contacts on the power supply are under 110V resp. 230V tension! Mortal danger! Disconnect power supply before open the housing!

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2 Definitions

Offset: Correction value for compensation of the zero point difference. Thanks to the offset, it is ensured that a force of 0N will generate a signal of 0V exactly.

Gain: Amplification factor for the measuring signal. Use of proper value will set the measuring range of the sensor exactly corresponding to the signal output range (0...10V).

Strain gauge: Electronic component that will change its resistance while its length has changed. Strain gauges are used in the FMS force sensors for acquisition of the feedback value.

3 System components

The EMGZ411 consists of the following components (refer also to fig. 1):

Force sensors

- For mechanical/electrical conversion of the tension force
- Force measuring bearing
- *Force measuring roller*
- *Force measuring journal*
- *Force measuring bearing block*

Electronic unit EMGZ411

- For supplying of the force sensors and amplifying of the mV signal
- With operation panel for parametrization
- Analogue correction input for processing varying wrap angles, etc.
- Interface RS232
- *Interface CAN-Bus*
- For mounting into insert card support block EMGZ555959 (by mounting into control cabinet)
- *Mounted in separate housing (EMGZ411.E)*
- *Integrated power supply (by using separate housing)*
- Supports connection of an external feedback display

(Italic components as variant or option)

4 System description

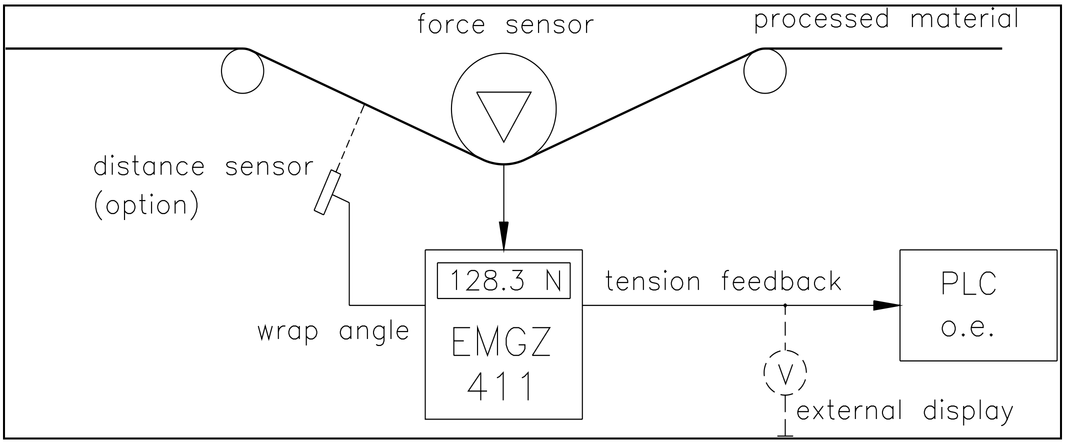

fig. 1: Basic structure of the EMGZ411 tension measuring amplifier E411002e

4.1 Functional description

The force sensors measure the tension force in the material and transmit the measuring value as a mV signal to the electronic unit EMGZ411. The electronic unit amplifies the mV signal depending on configuration. The resulting feedback value is shown in the display in [N]. In addition, the feedback value is provided at the analogue outputs and can be evaluated by an analogue instrument, a PLC or equivalent devices.

4.2 Force sensors

The force sensors are based on the flexion beam principle. The flexion is measured by strain gauges and transmitted to the electronic unit as mV signal. Due to the wheatstone wiring of the strain gauges, the measured value is according also to the power supply. So, the force sensors are supplied from the EMGZ411 by a very accurate power supply.

4.3 Electronic unit EMGZ411

Common

The electronic unit contains a microprocessor to handle all calculations and communications, the highly accurate sensor power supply and the signal amplifier for the measuring value. As operation interface it provides 4 keys, 4 LED’s and a 2x16 characters display in the front of the electronic unit. All inputs are saved in an EEPROM. The electronic unit has no jumpers or trimmers to keep most accurate long-time and temperature stability.
There can be connected one or two force sensors to the electronic unit.

Strain gauge amplifier

The strain gauge amplifier provides the highly accurate 4V power supply. A highly accurate, fixed difference amplifier rises the mV signal up to 10V. This signal will be fed to the A/D converter. The microprocessor then does all application-specific calculations with the digitized measuring value (such as offset, gain, low-pass filter, limit switches, etc).
Using digital inputs, the amplifier can be switched easily between 3 different gain parameters (for ex. to process different operating conditions). There is no reconfiguration required to switch the gain parameters.
If a measuring point has a varying wrap angle or other non-linear measuring values, gain may be adjusted using a linear or a cosine correction.

Interface
As standard, the electronic unit supports an RS232 interface. As an option, there is an additional board with CAN-Bus interface available.

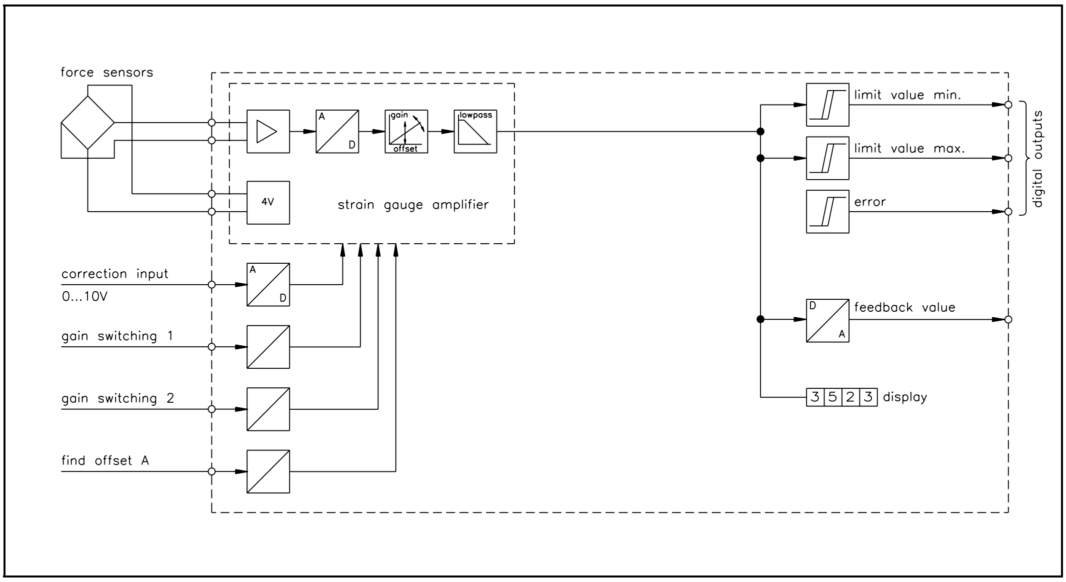

fig. 2: Block diagram of the electronic unit EMGZ411 E411003e

5 Quick installation guide

- Check all your requirements such as:
  – configuration of the analogue outputs (signal level)?
  – gain switching required?
  – correction input required?
  – linking by serial interface etc.?

- Draw your final wiring diagram according to the wiring diagrams (refer to „7.3 Wiring diagram variant for insert card support block“ / „7.4 Wiring diagram variant with separate housing“)

- Install and wire all your components (refer to „7. Installation and wiring“)

- Parametrize and calibrate the measuring amplifier (refer to „8.2 Calibrating the measuring amplifier“)

- Put system into operation; proceed a test run with low speed

- If required, do additional settings (refer to „8.3 Additional settings“)

6 Dimensions

6.1 Dimensions: Variant for insert card support block (EMGZ411)

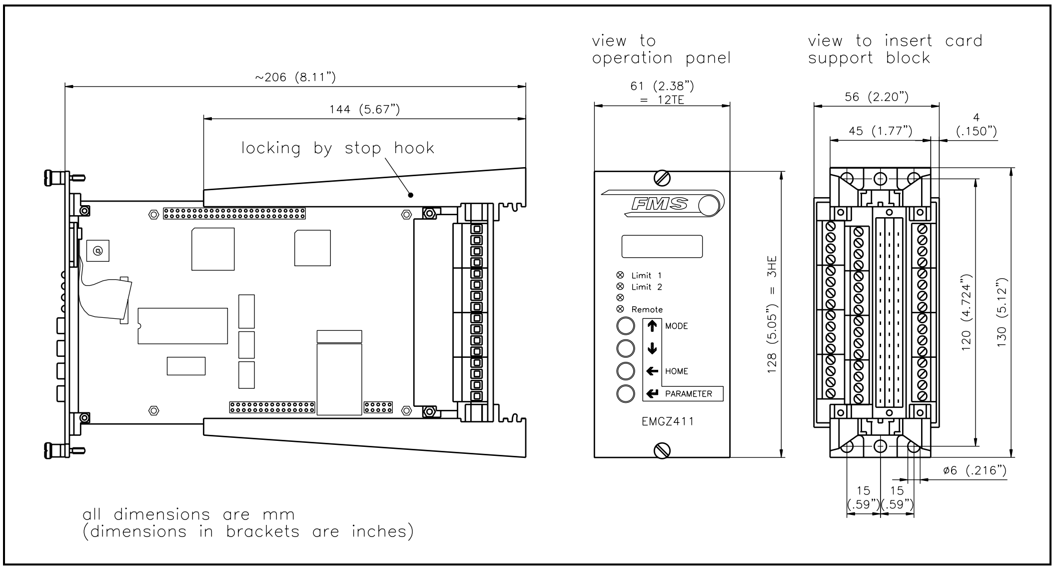

fig. 3: Dimensions of the variant using insert card support block (EMGZ400 series). The support block EMGZ555959 has to be ordered separately. E411004us

If the electronic unit should be mounted into a 19“ rack, a multipoint plug is used instead of the support block.

6.2 Dimensions: Variant with separate housing (EMGZ411.E)

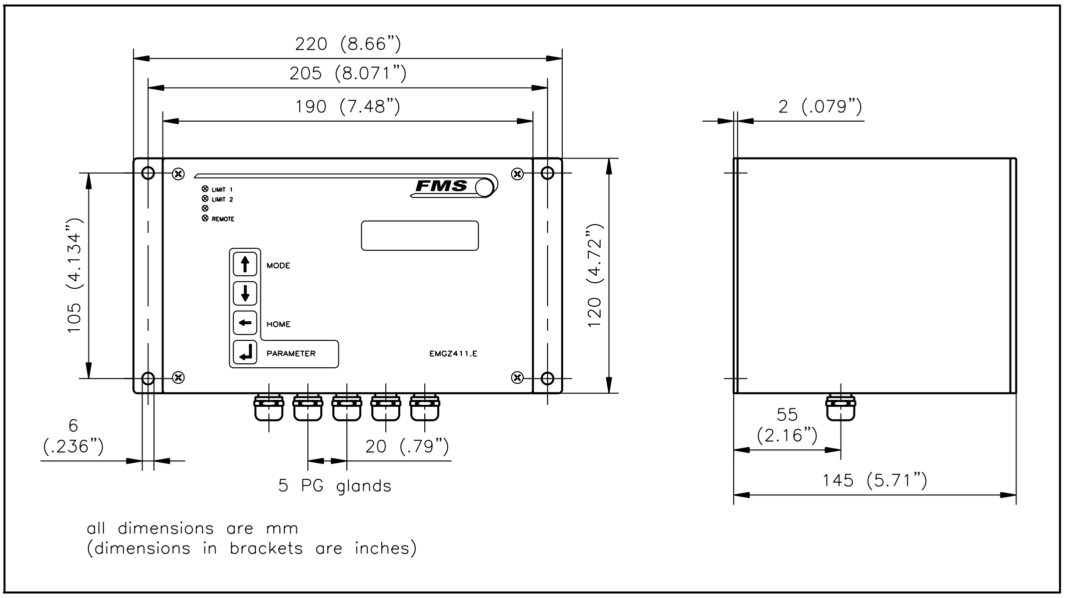

fig. 4: Dimensions of the variant using separate housing (option, EMGZ400.E series)
E411005e

7 Installation and wiring

Caution

Proper function of the tension measuring amplifier is only guaranteed with the recommended application of the components. In case of other arrangement, heavy malfunction can be the result. Therefore, the installation instructions on the following pages must be followed strictly.

Caution

Local installation regulations are to preserve safety of electric equipment. They are not taken into consideration by this operating manual. However, they have to be followed strictly.

7.1 Mounting and wiring of the measuring amplifier

Variant for insert card support block (EMGZ411)

The insert card support block can be mounted in a control cabinet. Wiring to the terminals is done according to „7.3 Wiring diagram: Variant for insert card support block“ (fig. 5). The electronic unit then will be inserted into the insert block. It will be locked by a stop hook (fig. 3).

Variant with separate housing (EMGZ411.E)

The housing can be mounted in a control cabinet or directly beside the machine. All connections are led through glands to the screw terminals and connected according to „7.4 Wiring diagram: Variant with separate housing“ (fig. 6 and 7).

7.2 Mounting the force sensors

Mounting of the force sensors is done referring to the FMS Installation manual which is delivered together with the force sensors.

Wiring to the terminals of the electronic unit is done according to wiring diagram (fig. 5 resp. 6).

Notice

Connecting the shield of the signal cable to the measuring amplifier *and* to the force sensor may cause ground circuits which may interfere the measuring signal massively. Malfunction can be the result. The shield should be connected only to the measuring amplifier. On the „force sensor side“, the shield should stay open.

7.3 Wiring diagram: Variant for insert card support block (EMGZ411)

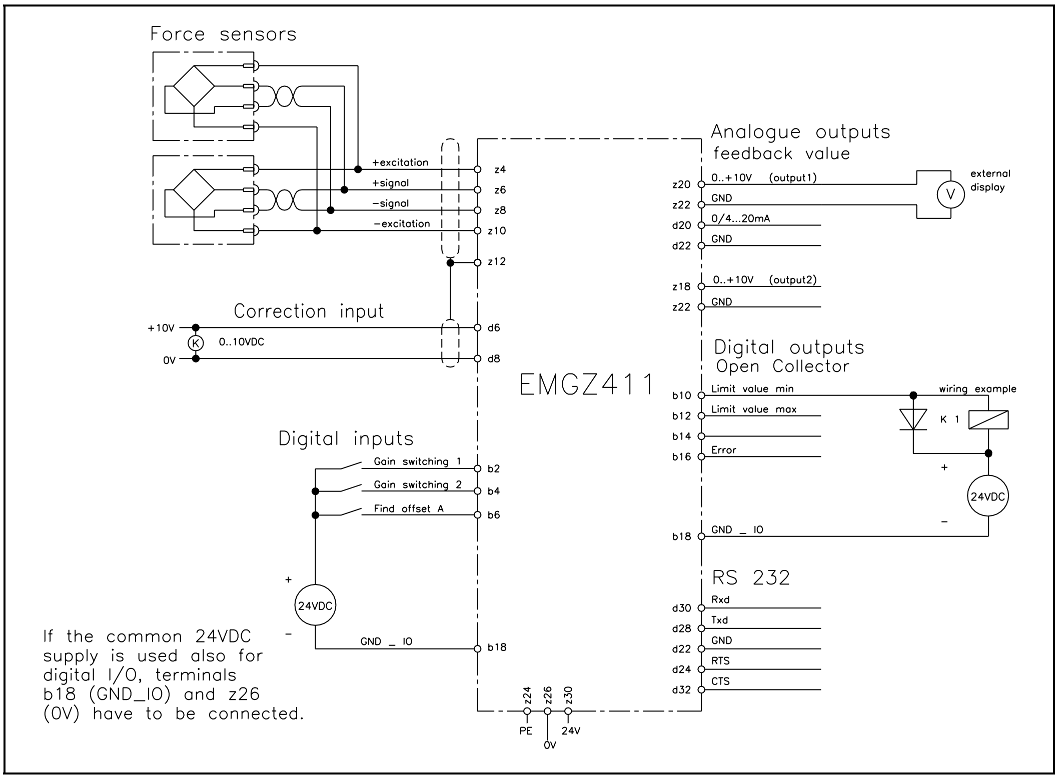

fig. 5: Wiring diagram: Variant for insert card suppor block E411006e

Caution

Bad earth connection may cause electric shock to persons, malfunction of the total system or damage of the measuring amplifier! It is vital to ensure that proper earth connection is done.

Caution

The processor board is mounted directly behind the operation panel. Improper handling may damage the fragile electronic equipment! Don’t use rough tools as screwdrivers or pliers! Don’t touch processor board! Touch earthed metal part to discharge static electricity before removing operation panel!

Danger

Some contacts on the power supply are under 110V resp. 230V tension! Mortal danger! Disconnect power supply before open the housing!

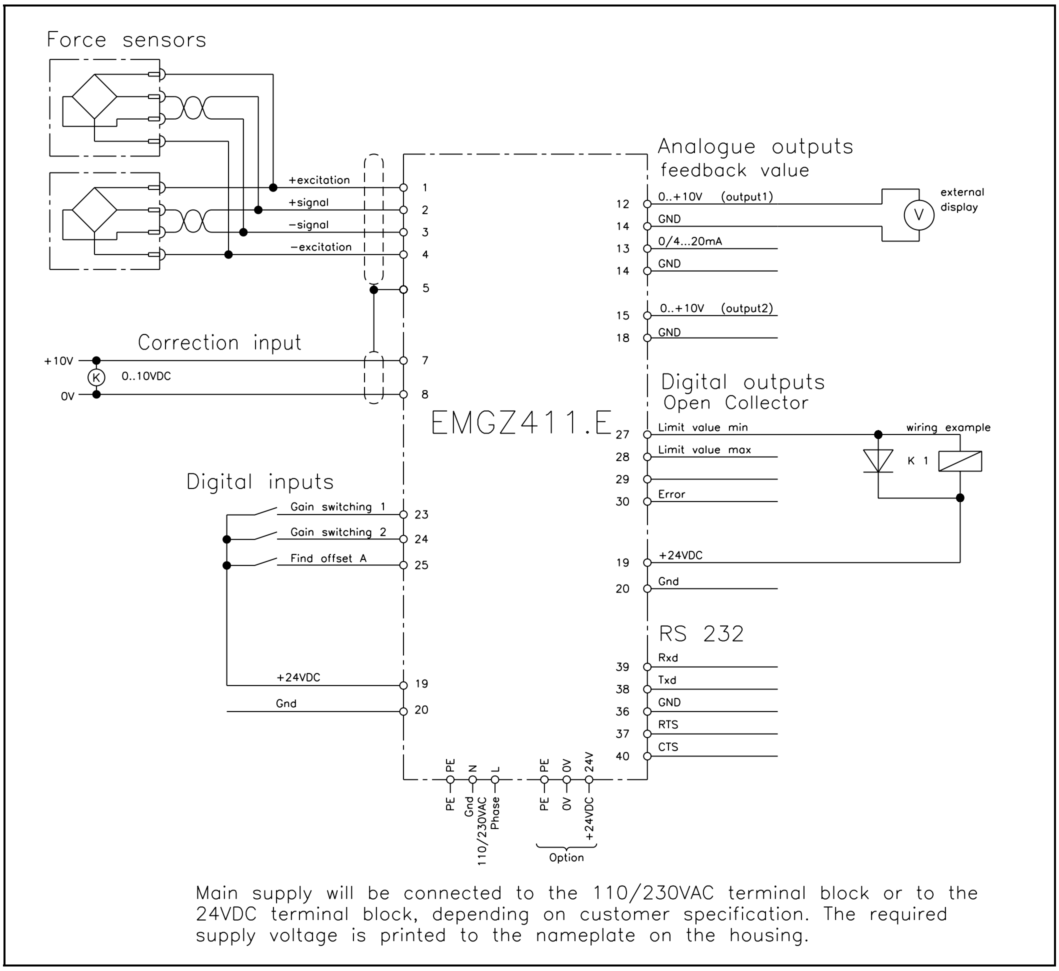

fig. 6: Wiring diagram: Variant with separate housing E411014e

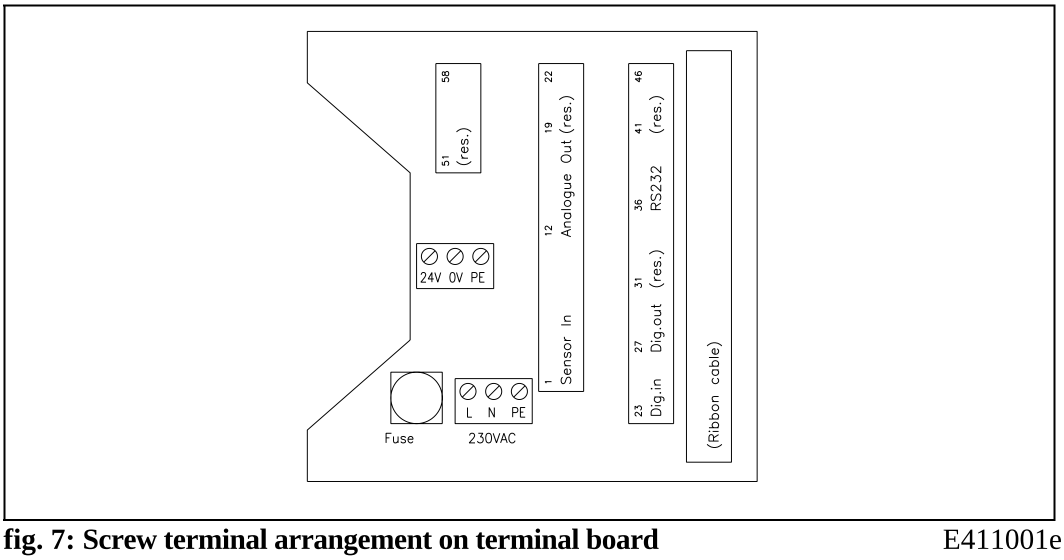

fig. 7: Screw terminal arrangement on terminal board E411001e

7.4 Mounting the distance sensor

If the measuring point operates with a varying wrap angle as it is found with winders or unwinders with no intermediate roller (fig. 13), the actual wrap angle has to be transmitted to the measuring amplifier. FMS recommends to acquire the actual reel diameter with a distance sensor and to led the distance signal to the analogue correction input (terminals d6 / d8 resp. 7 / 8).
It has to be ensured that the measuring axis of the distance sensor is straight radial to the reel (refer to fig. 8).

Optical distance sensor CMGZ581934
FMS recommends to use the optical distance sensor CMGZ581934 because its accuracy and signal output is adapted to the FMS tension measuring amplifiers and tension controllers.

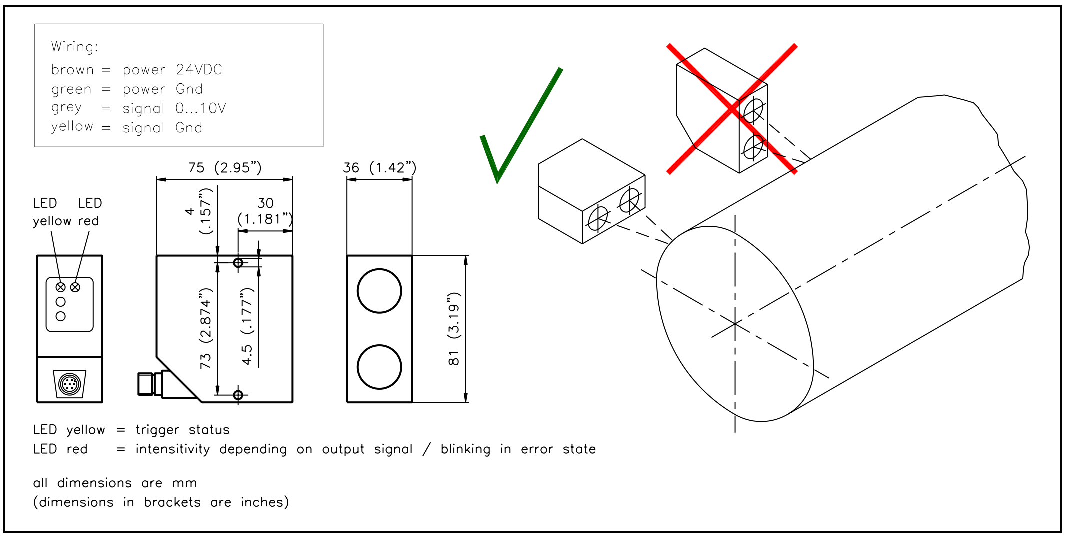

fig. 8: Mounting of the distance sensor CMGZ581934 E411012e

The distance sensor operates with the 3-beam-correction principle. It is considerable insensible to secondary light and changes of the surface colour of the detected object. But while mounting it must be ensured that the sensor is mounted in „horizontal“ position (fig. 8).
The output signal is proportional to the reel radius: Small radius = small signal; large radius = large signal.

Technical data distance sensor CMGZ581934

Type	HT77MGV80, Infrared light 880nm
Measuring range	1000mm [40“]
Ø Measuring distance	800mm [32“]
Min. measuring distance	300mm [12“]
Max. measuring distance	1300mm [51“]
Resolution	0.2...30mm [.008...1.2“] depending on width of spot
Reaction time	10ms
Linearity	2%
Temperature drift	0.5mm / K [.01“ / °F]
Supply voltage	18...30VDC / 70mA
Temperature range	–10...+60°C [14...140°F]
Protection class	IP67

8 Operation

8.1 View of the operating panel

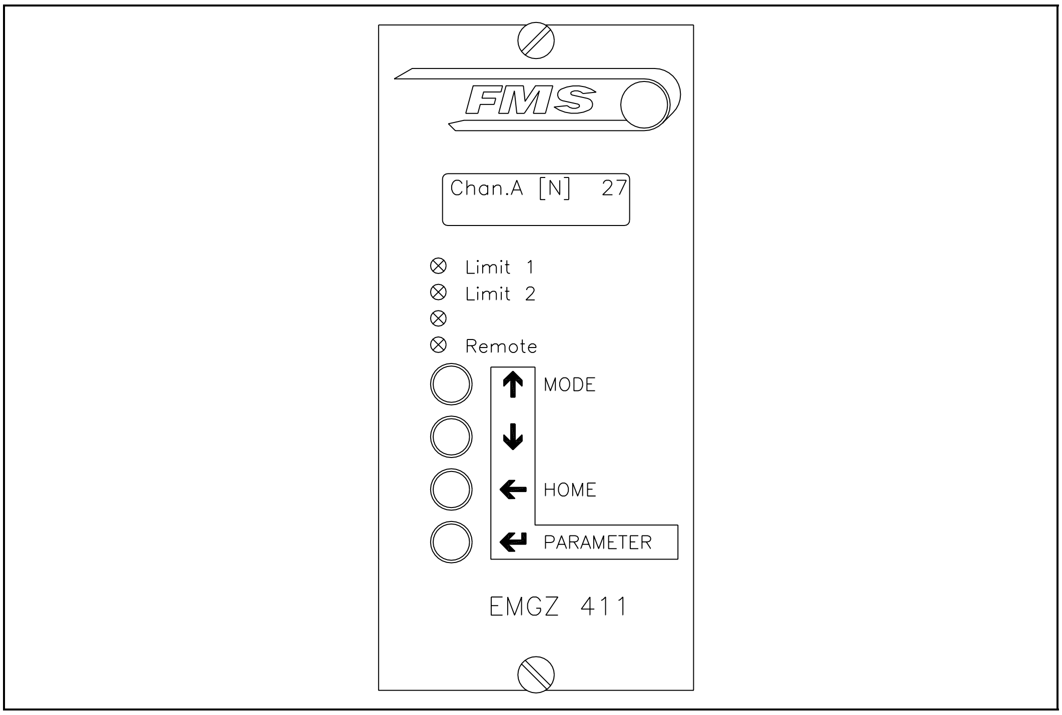

fig. 9: Operating panel: Variant for insert card support block (EMGZ411) E411007e

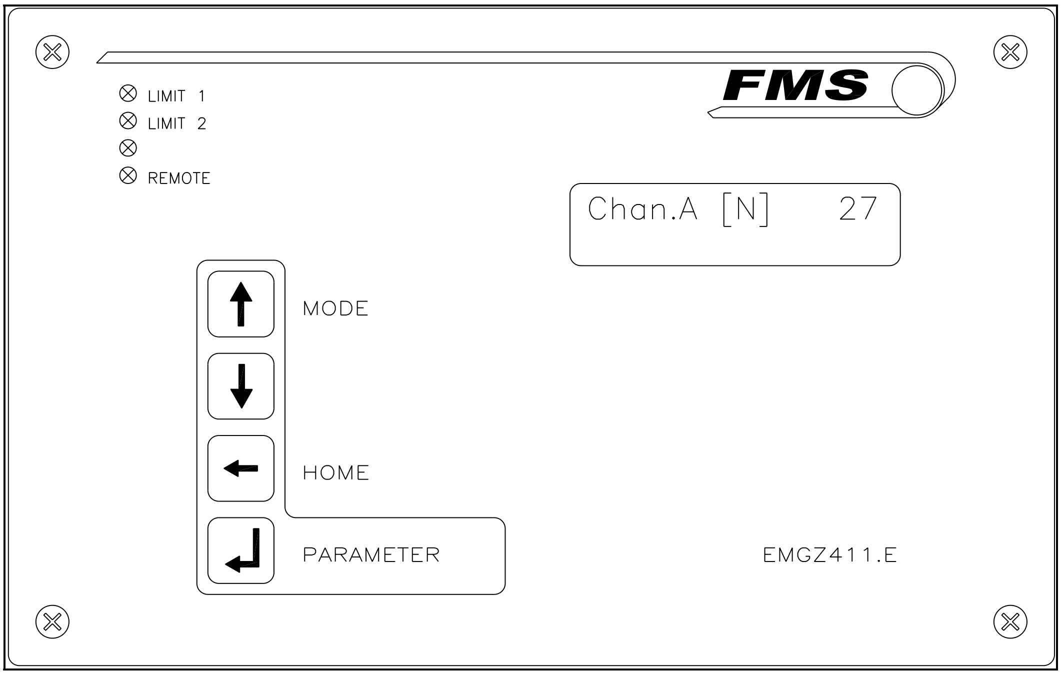

fig. 10: Operating panel: Variant with separate housing (EMGZ411.E) E411008e

8.2 Calibrating the measuring amplifier

Parametrizing the measuring amplifier

The following parameters have to be set resp. to be checked before the first calibration is done (ref. to „10. Parametrisation“):

- *Nominal force*
- *Unit of force*
- *Sensitivity*
- *1 or 2 sensors*
- *Config. output 1*
- *Scale output 1*
- *Scale output 2*
- *Input correction* (for the time being set to *none*)

Simulating Method (recommended)

The following instructions are referring to a setup and calibration on-site. The material tension will be simulated by a weight (fig. 11).

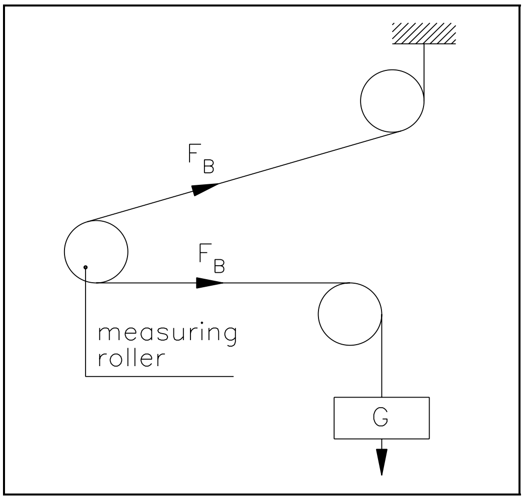

fig. 11: Calibrating the measuring amplifier C431011e

- Connect the first force sensor
- Check, if a positive value is displayed when loading the sensor in measuring direction. If not, exchange terminals z6 / z8 (resp. 2 / 3)
- If used, connect the second force sensor
- Check, if a positive value is displayed when loading the sensor in measuring direction. If not, exchange terminals z6 / z8 (resp. 2 / 3)
- Insert material or a rope loosely to the machine
- Adjust offset by activating the parameter function *find offset A* and pressing the ↵ key for 3 seconds (ref. to „10. Parametrisation“). The electronic unit calculates automatically the new offset value.
- Load material or rope with a defined weight (fig. 11)
- Activate parameter function *Calibration A*. Input the force referring to the applied weight (refer to „10. Parametrization“). The electronic unit calculates automatically the new gain value.
- Quit calibration with *Home* key.

Mathematical method

If the material tension cannot be simulated, calibration has to be done by calculation. This way of calibrating is less accurate because the exact angles are often unknown and the effective mounting conditions, which usually deviate from the ideal, are not taken into account.

- Offset adjustment has to be done as described under „Simulating method“.
- The Gain value will be calculated by the following formula and then inputted in the parameter *gain channel A* (refer to „10. Parametrization“).

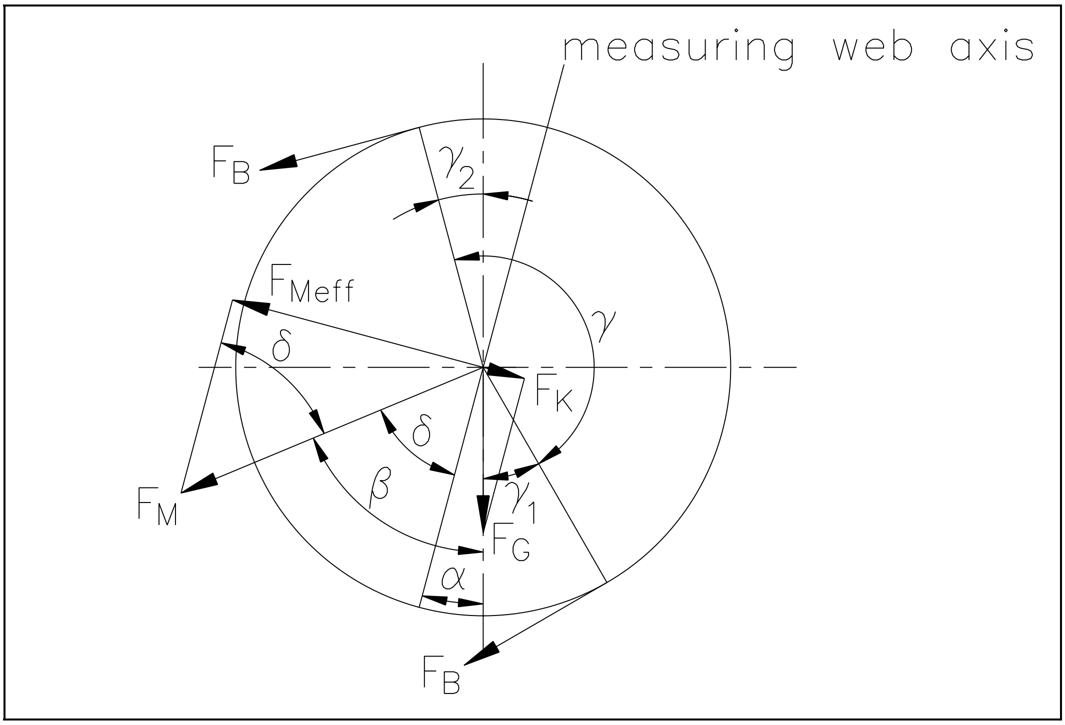

fig. 12: Force vectors in the FMS force measuring bearing C431012e

$$GainFeedback = \frac{1}{\sin\delta \cdot \sin(\gamma / 2) \cdot n}$$

Definition of symbols:

α	angle between vertical and measuring web axis	F_B	material tension
β	angle between vertical and F_M	F_G	roller weight
γ	material wrap angle	F_M	measuring force resulting from F_B
γ_1	entry angle of material	F_{Meff}	effective measuring force
γ_2	exit angle of material	n	number of force sensors
δ	Angle between measuring web axis and F_M		

8.3 Additional settings

Setting of the lowpass filters

The measuring amplifier provides 3 lowpass filters independently adjustable from each other. They are used to prevent noise which is added to the signals. Signal variations which are faster than the cut-off frequency are then suppressed. The lower the cut-off frequency, the more sluggish the output signal will be.
The lowpass filters are configured by setting its cut-off frequency to an appropriate value. The cut-off frequency is set in the parameter *Lowpass display* resp. *Lowpass output 1 / Lowpass output 2* (ref. to „10. Parametrisation“).

☞ **Notice**

If the cut-off frequency is set to a value too low, the output signal will become sluggish. It may be that the feedback value is no longer suitable for control loop applications. You have to pay attention that the cut-off frequency is set to a suitable value.

Setting of the limit switches

The measuring amplifier provides 2 limit switches which can be tapped at the digital outputs (terminals b10 and b12 resp. 27 and 28). The limit switches are actuated when the feedback value exceeds (Limit value max.) resp. undershoots (Limit value min.) the force values stored in parameters *Minimum limit value* resp. *Maximum limit value*.
Tapping of the limit switches is done according to wiring diagram (fig. 5 or 6).

Scaling of the analogue outputs

With default setting, the analogue outputs give the maximum signal (10V resp. 20mA) when the nominal force of the sensors is reached. The output signal level can be customized with the parameters *Scale output 1 / Scale output 2*.

Gain switching

If a measuring point is operated with varying measuring conditions (for ex. different material paths), the gain factor may be switched between up to 3 values depending on the material path. Switching is done using the digital inputs „Gain switching 1“ resp. „Gain switching 2“. Therefore, the extra gain values have to be calibrated during setup too (ref. to parameters *Cal. gain 1 A / Cal. gain 2 A / Gain 1 channel A / Gain 2 channel A*).

Tare function

If parameter *Config. of key* is set to *TareA*, pressing the ↓ key will set the display and the feedback value to zero. Therefore, variations of the display during retooling may be compensated.
The original offset value remains in the measuring amplifier. If the ↓ key is pressed again, the original offset value is restored; display and output signal show the original feedback value.

8.4 Setup of the correction input

If the measuring point is operated with a varying wrap angle as it is found with winders or unwinders (fig. 13), the effective measuring force F_{Meff} is varying due to the geometric relations between F_B and F_{Meff} (ref. to fig. 12). The variations do also appear when material tension F_B is constant.

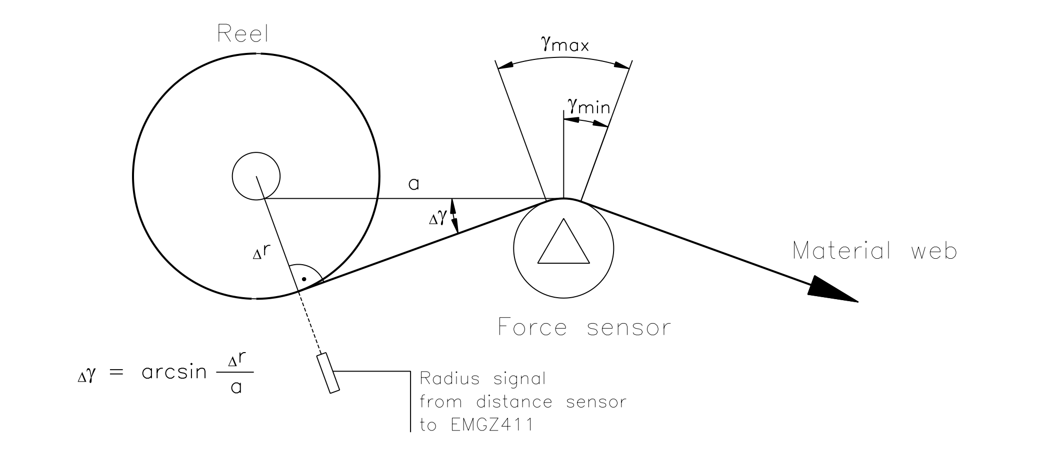

fig. 13: Application with varying wrap angle E411011e

To get even though a constant value for tension feedback, the gain factor has to be adjusted dynamically to the actual wrap angle during operation.
The measuring amplifier is able to do that correction. You can select between cosine correction and linear correction. FMS recommends using the cosine correction because it calculates the effective correction at any time. If the simulating setup of the cosine correction is not possible, the linear correction may be used. However, the linear correction has a certain inaccuracy due to its function principle. The maximum error can be calculated. This allows to decide if the amount of deviation is allowed or not.

Transmission of the wrap angle signal
To transmit the actual wrap angle to the measuring amplifier, an analogue signal 0...10V (from a distance sensor or PLC) is fed to the correction input (terminals d6 / d8 resp. 7 / 8).

However, the distance sensor (ref. to „7.5 Mounting the distance sensor“) detects the actual reel radius $_\Delta r$ but not the actual wrap angle $_\Delta\gamma$.

$$_\Delta\gamma = \arcsin \frac{_\Delta r}{a}$$

If the wrap angle varies not more than 30° ($_\Delta\gamma \leq 30°$), the relation between $_\Delta r$ and $_\Delta\gamma$ is almost linear. In that case the $_\Delta r$ signal can be fed directly to the correction input.
If the wrap angle varies more than 30° ($_\Delta\gamma > 30°$), the relation between $_\Delta r$ and $_\Delta\gamma$ becomes non-linear. In that case the $_\Delta r$ signal has to be converted to the $_\Delta\gamma$ value using a PLC or special software.

Variation of the gain factor in relation to the wrap angle

The gain factor is adjusted by a correction factor *k* depending on the wrap angle γ to provide the correct feedback values in the display and at the outputs. If the measuring amplifier is calibrated at γ_{min} the correction factor *k* results as shown in the following diagram:

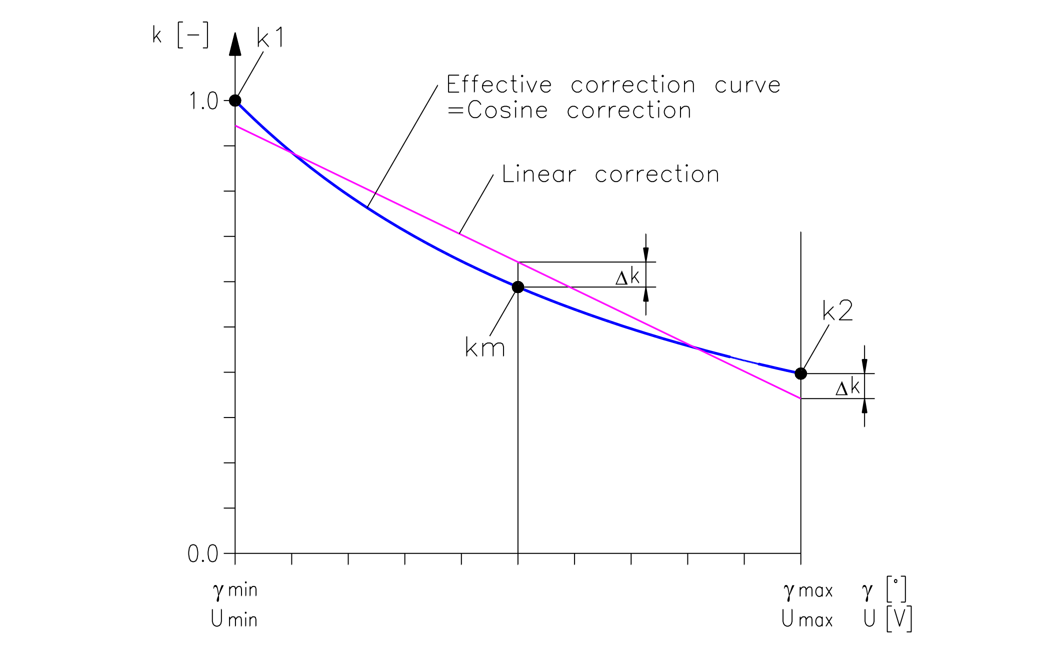

fig. 14: Correction curves for gain factor E411013e

Cosine correction (recommended)

The cosine correction calculates internally the effective correction based on three reference points (*k1, km, k2*) and therefore it works very accurate. It is calibrated as follows:

- Set arrangement to minimum wrap angle γ_{min} (ref. to fig. 13). Calibrate gain and offset as written in „8.2 Calibrating the measuring amplifier“.
- Set parameter *Input correction* to *Cosine*.
- Check the voltage signal of the distance sensor (should be approx. 0...3V). Proceed for parameter function *Cal. gain cos 1*; the correction k1 (ref. to fig. 14) will be saved.
- Set arrangement roughly to medium wrap angle (ref. to fig. 13)
- Check the voltage signal of the distance sensor (should be approx. 4...6V). Proceed for parameter function *Cal. gain cos 2*; the correction km (ref. to fig. 14) will be saved.
- Set arrangement to maximum wrap angle γ_{max} (ref. to fig. 13).
- Check the voltage signal of the distance sensor (should be approx. 7...10V). Proceed for parameter function *Cal. gain cos 3*; the correction k2 (ref. to fig. 14) will be saved.

Now the cosine correction is ready for operation. The measuring amplifier tracks now the effective correction curve, depending on the radius signal of the distance sensor.

Linear correction

If the three points *k1*, *km, k2* can't be reached during simulating setup, a linear correction can be calculated. A straight line is centered to the effective correction curve by setting the parameters *Correction at 0V* and *Correction at 10V* to appropriate values (fig. 14). However, this procedure will cause a certain error. The maximum error e_{max} appears at the maximum wrap angle (γ_{max}).

The linear correction is calibrated as follows:

- Set arrangement to minimum wrap angle γ_{min} (ref. to fig. 13). Calibrate gain and offset as written in „8.2 Calibrating the measuring amplifier".
- Determine the following application data as accurate as possible referring to fig. 12:

Minimum wrap angle	γ_{min} = ________________	[°]
Minimum angle δ (at position γ_{min})	δ_{min} = ________________	[°]
Signal of distance sensor (at position γ_{min})	U_{min} = ________________	[V]
Maximum wrap angle	γ_{max} = ________________	[°]
Minimum angle δ (at position γ_{max})	δ_{max} = ________________	[°]
Signal of distance sensor (at position γ_{max})	U_{max} = ________________	[V]

- Calculate the following values (precision at least 5 digits):

$$k_m = \frac{\sin\delta_{min} \cdot \sin\frac{\gamma_{min}}{2}}{\sin\frac{\delta_{min}+\delta_{max}}{2} \cdot \sin\frac{\gamma_{min}+\gamma_{max}}{4}}$$ = ________________ [-]

$$k_2 = \frac{\sin\delta_{min} \cdot \sin\frac{\gamma_{min}}{2}}{\sin\delta_{max} \cdot \sin\frac{\gamma_{max}}{2}}$$ = ________________ [-]

$$_{\Delta}k = \frac{1}{2} \cdot \left(\frac{k_2 - 1}{2} + 1 - k_m \right)$$ = ________________ [-]

$$e_{max} = \frac{_{\Delta}k}{k_2} \cdot 100\,\%$$ = ________________ [%]

$$P_0 = 1 - U_{min} \cdot \frac{k_2 - 1}{U_{max} - U_{min}} - {_{\Delta}k}$$ = ________________ [-]

$$P_{10} = 10 \frac{k_2 - 1}{U_{max} - U_{min}} + P_0$$ = ________________ [-]

- Set parameter *Input correction* to *Linear*.
- Store the P_0 value in parameter *Correction at 0V.*
- Store the P_{10} value in parameter *Correction at 10V.*

Now the linear correction is ready for operation. The measuring amplifier tracks now the straight line (fig. 13), depending on the radius signal of the distance sensor. Maximum deviation of the feedback value in relation to the effective material tension equals to e_{max}.

9 Serial interface (RS232)

The serial interface is operated for example by a personal computer as a kind of „question and answer“ game: The PC sends a question resp. a command; the measuring amplifier will send an answer back. If the answer is missing, the measuring amplifier or the connection cable may fail.

9.1 Wiring diagram: RS232 interface

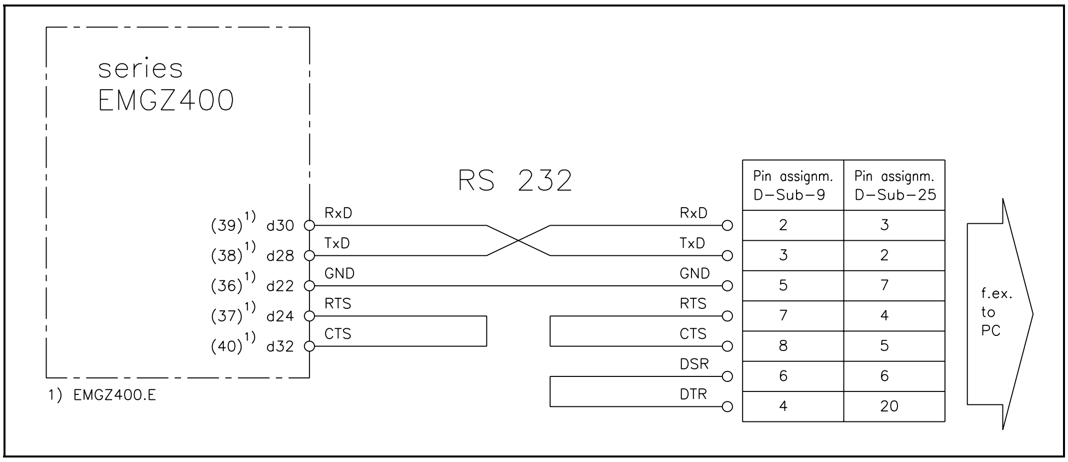

fig. 15: Wiring diagram RS232 interface E400001e

Reliable connection using maximum baudrate (9600) is guaranteed up to wire length of 10m. If the baudrate is reduced and/or good conditions prevail, considerably greater distances can be bridged in some cases.
Connection to a PC etc. is done with a 9- or 25-pole Sub-D connector.

9.2 Command list

command	answer	purpose
ERR?<CR>	XXXXXX<CR>	read actual errors Pos. 1...6 : Err1...Err6 Value of Pos. = 0 : No Err; Value of Pos. = 1 : Err active
IDNT<CR>	EMGZ411 V2.00 1198 < Type > <Version> <S >	10 characters type, fix 10 characters version, fix 4 characters serial number, fix
INRS<CR>	PACC<CR> / FAIL<CR>	initialize interface (for ex. after loading of new interface parameters)
REMR<CR>	PACC<CR> / FAIL<CR>	turn off remote mode (enabling the keys on the operating panel)
REMS<CR>	PACC<CR> / FAIL<CR>	turn on remote mode (disabling the keys on the operating panel)
VALS<CR>	XXXXXX<CR>	read feedback value

9.3 Read parameter

command	answer	purpose
RP01<CR>	XXXXX<CR>	Offset channel A
RP02<CR>	X.XXX<CR>	Gain channel A
RP05<CR>	X.XXX<CR>	Gain1 channel A
RP06<CR>	X.XXX<CR>	Gain2 channel A
RP07<CR>	XXXX<CR>	Nominal force
RP09<CR>	X<CR>	Unit of force
RP10<CR>	X.X<CR>	Sensitivity
RP12<CR>	X<CR>	1 or 2 sensors
RP13<CR>	XXXXX<CR>	Minimum limit value
RP14<CR>	XXXXX<CR>	Maximum limit value
RP18<CR>	XX.X<CR>	Lowpass display
RP19<CR>	XXX.X<CR>	Lowpass output 1
RP20<CR>	XXX.X<CR>	Lowpass output 2
RP23<CR>	XX.XX<CR>	Scale output 1
RP24<CR>	XX.XX<CR>	Scale output 2
RP27<CR>	X<CR>	Config. output 1
RP28<CR>	X<CR>	Language
RP29<CR>	X<CR>	Config. of key
RP33<CR>	X<CR>	Input correction
RP34<CR>	XX.XXX<CR>	Correction at 0V
RP35<CR>	XX.XXX<CR>	Correction at 10V
RP36<CR>	X.XXX<CR>	Gain cosine U1
RP37<CR>	X.XXX<CR>	Gain cosine U2
RP38<CR>	X.XXX<CR>	Gain cosine U3
RP39<CR>	XXX<CR>	Identifier
RP40<CR>	X<CR>	Baud rate RS232
RP41<CR>	X<CR>	7 or 8 data bit
RP42<CR>	X<CR>	1 or 2 stop bit
RP43<CR>	X<CR>	Parity bit RS232

All parameter numbers and input ranges refer to the parameter list.

9.4 Write parameter

command	answer	purpose
WP01XXXXX<CR>	PACC<CR> / FAIL<CR>	Offset channel A
WP02X.XXX<CR>	PACC<CR> / FAIL<CR>	Gain channel A
WP05X.XXX<CR>	PACC<CR> / FAIL<CR>	Gain1 channel A
WP06X.XXX<CR>	PACC<CR> / FAIL<CR>	Gain2 channel A
WP07XXXX<CR>	PACC<CR> / FAIL<CR>	Nominal force
WP09X<CR>	PACC<CR> / FAIL<CR>	Unit of force
WP10X.X<CR>	PACC<CR> / FAIL<CR>	Sensitivity
WP12X<CR>	PACC<CR> / FAIL<CR>	1 or 2 sensors
WP13XXXXX<CR>	PACC<CR> / FAIL<CR>	Minimum limit value
WP14XXXXX<CR>	PACC<CR> / FAIL<CR>	Maximum limit value
WP18XX.X<CR>	PACC<CR> / FAIL<CR>	Lowpass display
WP19XXX.X<CR>	PACC<CR> / FAIL<CR>	Lowpass output 1
WP20XXX.X<CR>	PACC<CR> / FAIL<CR>	Lowpass output 2
WP23XX.XX<CR>	PACC<CR> / FAIL<CR>	Scale output 1
WP24XX.XX<CR>	PACC<CR> / FAIL<CR>	Scale output 2
WP27X<CR>	PACC<CR> / FAIL<CR>	Config. output 1
WP28X<CR>	PACC<CR> / FAIL<CR>	Language
WP29X<CR>	PACC<CR> / FAIL<CR>	Config. of key
WP33X<CR>	PACC<CR> / FAIL<CR>	Input correction
WP34XX.XXX<CR>	PACC<CR> / FAIL<CR>	Correction at 0V
WP35XX.XXX<CR>	PACC<CR> / FAIL<CR>	Correction at 10V
WP36X.XXX<CR>	PACC<CR> / FAIL<CR>	Gain cosine U1
WP37X.XXX<CR>	PACC<CR> / FAIL<CR>	Gain cosine U2
WP38X.XXX<CR>	PACC<CR> / FAIL<CR>	Gain cosine U3
WP39XXX<CR>	PACC<CR> / FAIL<CR>	Identifier
WP40X<CR>	PACC<CR> / FAIL<CR>	Baud rate RS232
WP41X<CR>	PACC<CR> / FAIL<CR>	7 or 8 data bit
WP42X<CR>	PACC<CR> / FAIL<CR>	1 or 2 stop bit
WP43X<CR>	PACC<CR> / FAIL<CR>	Parity bit RS232

All parameter numbers and input ranges refer to the parameter list. Depending on the value being ok or not, the electronic unit replys PACC<CR> (value accepted) or FAIL<CR> (value not accepted).

10 Parametrization

10.1 Parameter list

Parameter	Unit	Default	Min	Max	Selected
Find offset A	(Parameter function)				
Calibration A	(Parameter function)			________	
Cal. gain 1 A	(Parameter function)			________	
Cal. gain 2 A	(Parameter function)			________	
Cal. gain cos 1	(Parameter function)				
Cal. gain cos 2	(Parameter function)				
Cal. gain cos 3	(Parameter function)				
Offset channel A	[Digit]	0	–4000	4000	________
Gain channel A	[-]	1.000	0.100	9.000	________
Gain 1 channel A	[-]	1.000	0.100	9.000	________
Gain 2 channel A	[-]	1.000	0.100	9.000	________
Nominal force	[N,kN]	1000	1	9999	________
Unit of force	N, kN	N			________
Sensitivity	[mV/V]	1.8	0.1	3.0	________
1 or 2 sensors	[-]	1	1	2	________
Minimum limit value	[N, kN]	0	–9999	9999	________
Maximum limit value	[N, kN]	0	–9999	9999	________
Lowpass display	[Hz]	1.0	0.1	10.0	________
Lowpass output 1	[Hz]	10.0	0.1	200.0	________
Lowpass output 2	[Hz]	10.0	0.1	200.0	________
Scale output 1	[-]	1.00	0.01	10.00	________
Scale output 2	[-]	1.00	0.01	10.00	________
Config. output 1	±10V, 0...10V, 0...20mA, 4...20mA				________
Language	German, English, French, Italian				________
Config. of key	None, TareA	None			________
Input correction	None, Linear, Cosine				________
Correction at 0V	[-]	1.000	–9.999	9.999	________
Correction at 10V	[-]	1.000	–9.999	9.999	________
Gain cosine U1	[-]	1.000	0.001	9.999	________
Gain cosine U2	[-]	1.000	0.001	9.999	________
Gain cosine U3	[-]	1.000	0.001	9.999	________
Identifier	[-]	0	0	127	________
Baud rate RS232	300, 600, 1200, 2400, 4800, 9600				________
7 or 8 data bit	[-]	8	7	8	________
1 or 2 stop bit	[-]	1	1	2	________
Parity bit RS232	None, Odd, Even				________

10.2 Schematic diagram of parametrization

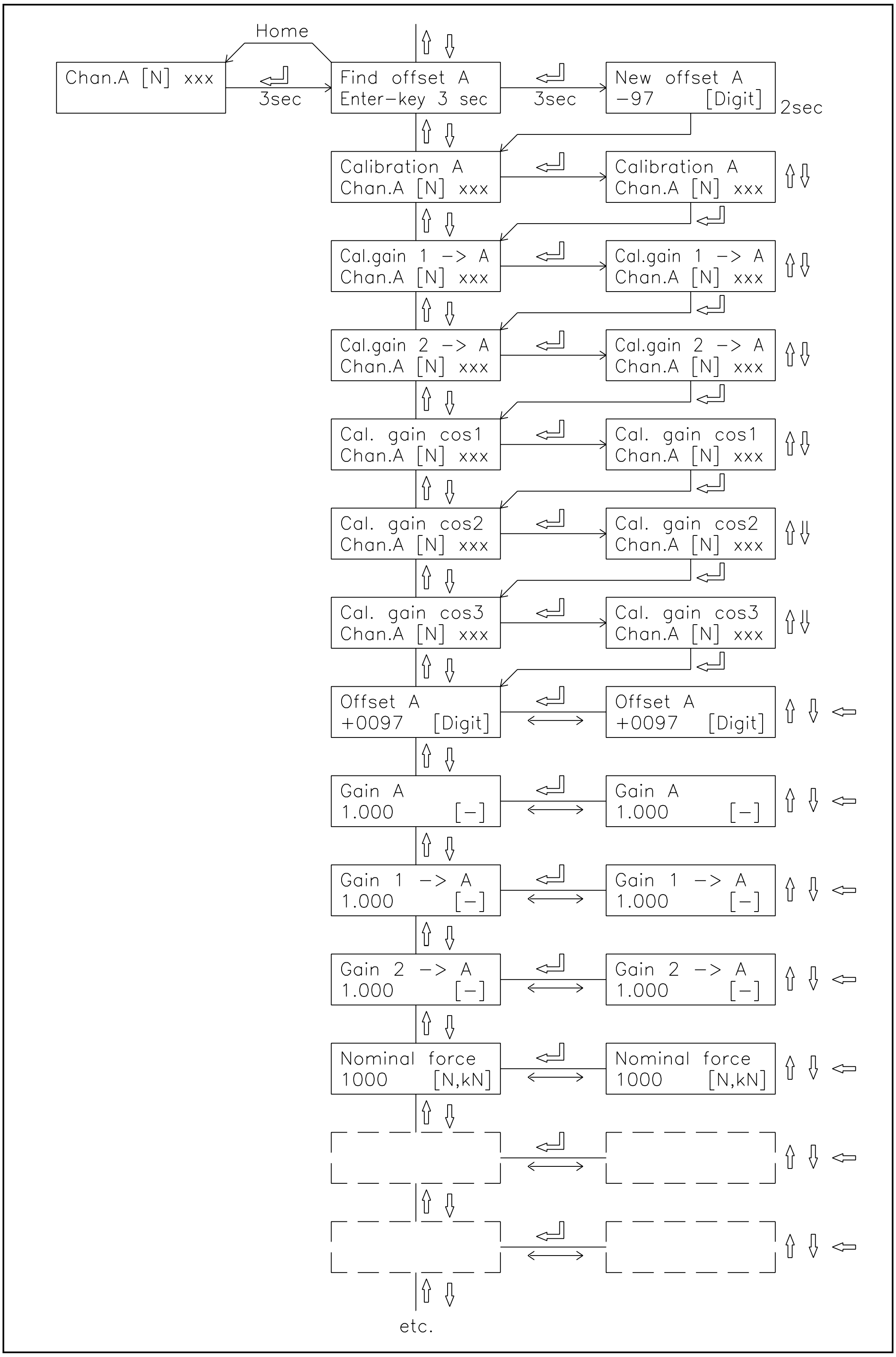

fig. 16 E411010e

10.3 Description of the parameters

The parameter changing mode will be activated by pressing the ↵ key for 3 seconds. Generally, the parameters are settable using the keys as follows:

↵	choose
↑ ↓	switch the selections or increase / decrease numeric values
←	change the decimal (while inputting a numeric value)
↵	enter

Find offset A

Use: The actual force value will be saved by pressing the ↵ key for 3 seconds. This is used to compensate the weigth of the material and the roller. The determined value will be shown for 2 seconds and then stored under parameter *Offset channel A.*
The offset may be determinded also by activating the digital input *Find offset A* (terminal b6 resp. 25) for at least 100ms. This procedure is equal to executing the parameter function *Find offset A*.

Calibration A

Use: In this parameter, using the ↑ ↓ keys you can input the force value referring to the calibration load you applied to the sensor (force feedback value). The processor then calculates the actual gain value and stores it under parameter *Gain channel A.*
Notice: The input can be aborted with the ← key. In this case the previously saved value remains.

Range:	1	to	9999	**Default:**	1000
Increment:	1			**Unit:**	[N,kN]

Calibration gain 1 -> A

Use: Identical with *Calibration A*, but the result is stored under parameter *Gain 1 channel A*. This gain value is used if the digital input „Gain switching 1“ is activated.

Range:	1	to	9999	**Default:**	1000
Increment:	1			**Unit:**	[N,kN]

Calibration gain 2 -> A

Use: Identical with *Calibration A*, but the result is stored under parameter *Gain 2 channel A*. This gain value is used if the digital input „Gain switching 2“ is activated.

Range:	1	to	9999	**Default:**	1000
Increment:	1			**Unit:**	[N,kN]

Calibration gain cos 1

Use: Only used if Parameter *Input correction* is set to *Cosine*. In this parameter, using the ↑ ↓ keys you can input the force value referring to the calibration load you applied to the sensor (force feedback value). The processor then calculates the actual gain value and stores it together with the actual voltage signal of the correction input (terminals d6 / d8 resp. 7 / 8) under parameter *Gain cosine U1*. It is used later to calculate cosine correction.

Notice: The input can be aborted with the ← key. In this case the previously saved value remains.

Range:	1	to	9999	**Default:**	1000
Increment:	1			**Unit:**	[N,kN]

Calibration gain cos 2

Use: Identical with *Calibration gain cos 1*, but the result is stored under parameter *Gain cosine U2*. This value is used later to calculate cosine correction.

Range:	1	to	9999	**Default:**	1000
Increment:	1			**Unit:**	[N,kN]

Calibration gain cos 3

Use: Identical with *Calibration gain cos 1*, but the result is stored under parameter *Gain cosine U3*. This value is used later to calculate cosine correction.

Range:	1	to	9999	**Default:**	1000
Increment:	1			**Unit:**	[N,kN]

Offset channel A

Use: This parameter stores the value determined with *Find offset A* in [Digit]. It is not necessary to note this parameter, because a new offset adjustment is done very easy; also when changing the whole electronic unit.

The offset can also be inputted by using the ↑ ↓ ← keys.

Range:	-4000	to	4000	**Default:**	0
Increment:	1			**Unit:**	[Digit]

Gain channel A

Use: This parameter stores the value determined with *Calibration A*, resp. you can input a value calculated using the formulas described under „8.2 Calibrating the measuring amplifier“, if the material tension cannot be simulated.

Range:	0.100	to	9.000	**Default:**	1.000
Increment:	0.001			**Unit:**	[-]

Gain 1 channel A

Use:	Identical with *Gain channel A*, but the value stored here was determined by *Calibration gain 1 -> A*. The value stored here is used if the digital input „Gain switching 1“ is activated.				
Range:	0.100	to	9.000	**Default:**	1.000
Increment:	0.001			**Unit:**	[-]

Gain 2 channel A

Use:	Identical with *Gain channel A*, but the value stored here was determined by *Calibration gain 2 -> A*. The value stored here is used if the digital input „Gain switching 2“ is activated.				
Range:	0.100	to	9.000	**Default:**	1.000
Increment:	0.001			**Unit:**	[-]

Nominal force of sensor

Use:	To get the correct force value, the electronic unit has to know the nominal force of the sensors.				
Range:	1	to	9999	**Default:**	1000
Increment:	1			**Unit:**	[N,kN]

Unit of force

Use:	This parameter stores the force unit of the sensor.				
Range:	N, kN			**Default:**	N

Sensitivity of sensor

Use:	To get the correct force value, the electronic unit has to know the sensitivity of the force sensors, that means how much signal the sensor will answer by nominal force. Standard for FMS force sensors is 1.8mV/V.				
Range:	0.1	to	3.0	**Default:**	1.8
Increment:	0.1			**Unit:**	[mV/V]

1 or 2 sensors

Use:	To get the correct force value, the electronic unit has to know if the measuring roller is beared by one or two force sensors.				
Range:	1	to	2	**Default:**	1
Increment:	1			**Unit:**	[-]

Minimum limit value

Use:	The digital output „Limit value min.“ will be activated if the threshold value stored in this parameter is passed under. If the parameter contains a zero value, limit switch monitoring is inactive.				
Range:	-9999	to	9999	**Default:**	0
Increment:	1			**Unit:**	[N,kN]

Maximum limit value

Use:	The digital output „Limit value max.“ will be activated if the threshold value stored in this parameter is passed over. If the parameter contains a zero value, limit switch monitoring is inactive.				
Range:	-9999	to	9999	**Default:**	0
Increment:	1			**Unit:**	[N,kN]

Lowpass display

Use:	The measuring amplifier provides a lowpass filter to prevent noise which is added to the integrated display. This parameter stores the cut-off frequency. The lower the cut-off frequency, the more sluggish the output signal will be. Due to this filter, the value shown in the integrated display will be much more stable in the case of high fluctuations of the force value. The lowpass display filter is independent of the other filters.				
Range:	0.1	to	10.0	**Default:**	1.0
Increment:	0.1			**Unit:**	[Hz]

Lowpass output 1

Use:	The measuring amplifier provides a lowpass filter to prevent noise which is added to the output 1 (terminals z20 / z22 resp. d20 / d22 resp. 12 / 14 resp. 13 / 14). This parameter stores the cut-off frequency. The lower the cut-off frequency, the more sluggish the output signal will be. Due to this filter, the output signal will be much more stable in the case of high fluctuations of the force value. The lowpass output 1 filter is independent of the other filters.				
Range:	0.1	to	200.0	**Default:**	10.0
Increment:	0.1			**Unit:**	[Hz]

Lowpass output 2

Use:	The measuring amplifier provides a lowpass filter to prevent noise which is added to the output 2 (terminals z18 / z22 resp. 15 / 18). This parameter stores the cut-off frequency. The lower the cut-off frequency, the more sluggish the output signal will be. Due to this filter, the output signal will be much more stable in the case of high fluctuations of the force value. The lowpass output 2 filter is independent of the other filters.				
Range:	0.1	to	200.0	**Default:**	10.0
Increment:	0.1			**Unit:**	[Hz]

Scale output 1

Use:	At default setting of 1.00, the output 1 (±10V / 0...10V / 0...20mA / 4...20mA) provides the nominal signal level (10V resp. 20mA) when reaching the nominal force value. If the scale value stored here is reduced, the nominal output signal is reduced too; if the scale value is enlarged, the nominal output signal is enlarged too.				
Range:	0.01	to	10.00	**Default:**	1.00
Increment:	0.01			**Unit:**	[-]

Scale output 2

Use:	At default setting of 1.00, the output 2 (0...10V) provides the nominal signal level (10V) when reaching the nominal force value. If the scale value stored here is reduced, the nominal output signal is reduced too; if the scale value is enlarged, the nominal output signal is enlarged too.				
Range:	0.01	to	10.00	**Default:**	1.00
Increment:	0.01			**Unit:**	[-]

Configuration output 1

Use:	With this parameter you can select the output signal provided by the output 1.		
Range:	±10V, 0...10V, 0...20mA, 4...20mA	**Default:**	±10V

Language

Use:	With this parameter, the language in the display can be chosen.
Range:	English, German, French, Italian

Configuration of key

Use:	This parameter defines wheter the free key (↓ key) is assigned to the Tare function or not. (Refer to „8.3 Additional settings“)		
Range:	None, TareA	**Default:**	None

Input correction

Use:	The correction input (terminals d6 / d8 resp. 7 / 8) is used for defined adjustment of the feedback value (for ex. when processing with varying wrap angle, etc.) With this parameter, a linear or a cosine correction may be selected.		
Range:	None, Linear, Cosine	**Default:**	None

Correction at 0V

Use:	This parameter is used if parameter *Input correction* is set to *Linear*. The correction factor stored here is used if the correction input (terminals d6 / d8 resp. 7 / 8) shows 0V. With this value the linear correction is calculated during operation.				
Range:	–9.999	to	9.999	**Default:**	1.000
Increment:	0.001			**Unit:**	[-]

Correction at 10V

Use:	This parameter is used if parameter *Input correction* is set to *Linear*. The correction factor stored here is used if the correction input (terminals d6 / d8 resp. 7 / 8) shows 10V. With this value the linear correction is calculated during operation.				
Range:	–9.999	to	9.999	**Default:**	1.000
Increment:	0.001			**Unit:**	[-]

Gain cosine U1

Use:	This parameter is used if parameter *Input correction* is set to *Cosine*. It was calculated by parameter function *Calibration gain cos 1*. With this value the cosine correction is calculated during operation.				
Range:	0.001	to	9.999	**Default:**	1.000
Increment:	0.001			**Unit:**	[-]

Gain cosine U2

Use:	Identical with *Gain cosine U1*, but the value was calculated by parameter function *Calibration gain cos 2*.				
Range:	0.001	to	9.999	**Default:**	1.000
Increment:	0.001			**Unit:**	[-]

Gain cosine U3

Use:	Identical with *Gain cosine U1*, but the value was calculated by parameter function *Calibration gain cos 3*.				
Range:	0.001	to	9.999	**Default:**	1.000
Increment:	0.001			**Unit:**	[-]

Identifier

Use:	This parameter is to identificate the device when using a CAN-Bus interface. For future applications.				
Range:	0	to	127	**Default:**	0
Increment:	1			**Unit:**	[-]

Baud rate RS232

Use:	Setting of the transmission rate of the RS 232 interface.			
Range:	300, 600, 1200, 2400, 4800, 9600 baud		**Default:**	9600

7 or 8 data bit

Use:	Setting of the number of data bits of the RS 232 interface.			
Range:	7	to 8	**Default:**	8
Increment:	1		**Unit:**	[-]

1 or 2 stop bit

Use:	Setting of the number of stop bits of the RS 232 interface.			
Range:	1	to 2	**Default:**	1
Increment:	1		**Unit:**	[-]

Parity bit RS232

Use:	Setting of the paroty of the RS 232 interface.			
Range:	none, odd, even		**Default:**	none

11 Trouble shooting

Error	Cause	Corrective action
„Err1“ is displayed: A/D-converter receives values < -9.7mV continuously	Force sensors are wrong connected	Exchange wires on terminals z6 / z8 (resp. 2 / 3)
	Parting of the cable	Replace connection cable between force sensor and measuring amplifier
„Err2“ is displayed: A/D-converter receives values > 9.7mV continuously	Force sensors are wrong connected	Exchange excitation and signal (terminals z4 ... z10 resp. 1 ... 4)
	Short circuit in the plug or connection cable	Check and correct wiring
	Force sensor overload	Use sensor with higher nominal force
	Force sensor has too much sensitivity	Set parameter *sensitivity* to the correct value or use other sensor
„Err5“ is displayed: Output shows minimum continuoulsy	Offset badly adjusted	Proceed for offset adjustment again
„Err6“ is displayed: Output shows maximum continuoulsy	Output scaling badly adjusted	Set parameter *Scale output 1* resp. *Scale output 2* to appropriate value
	Offset badly adjusted	Proceed for offset adjustment again
	Gain badly adjusted	Proceed for sensor calibration again
Feedback value is > 0 even though material is loosely	Offset badly adjusted	Proceed for offset adjustment again
	Current output is set to 4...20mA	Adjust parameter *Config. output 1* if required
Feedback value isn’t stable even though material tension doesn’t change	Cut-off frequency of the filters set too high	Adjust cut-off frequency (ref. to „8.3 Additional settings“)
	Ground terminal ogf the output isn’t 0V	Connect Gnd terminal of the output (terminal z22 resp. 14) with earth (terminal z24 resp. PE)
Feedback value doesn’t correspond with the effective material tension	Gain badly adjusted	Proceed for sensor calibration again
	If correction input is used: Calibration of the correction input is done badly	Proceed for calibration of the correction input again (ref. to „8.4 Setup of the correction input“)
No message on the display	Display contrast setting is bad	Set display potentiometer correctly. (It is located on the processor board on the upper right edge beside the ribbon connector)
	Fuse blown	Replace fuse on power supply
	Power supply not correct	Check / correct power supply
	Electronic unit defect	Contact FMS customer service

If the measuring amplifier recognizes an error, the digital output „Error“ (terminal b16 resp. 30) is activated and the LED on the operating panel is on. In addition, the error state can be requested using the interface.

12 Technical data EMGZ411

Connection of force sensors	1 or 2 parallel force sensors of 350Ω
Excitation of sensors	4VDC
Input signal voltage	0...7.2mV (max. 9.92mV)
Resolution A/D converter	±4096 Digit (13 Bit)
Measuring error	<0.05% FS
Cycle time	4ms
Operation	4 keys, 4 LED's, LCD display 2x16 characters
Analogue output 1 (Feedback value)	±10V / 0...10V / 0...20mA / 4...20mA (12 Bit)
Analogue output 2 (Feedback value)	0...10V (12 Bit)
Analogue output 3 (not connected)	0...5V (8 Bit)
Analogue output 4 (not connected)	0...5V (8 Bit)
Digital output 1 (Limit value min.)	Open collector, galvanic separated
Digital output 2 (Limit value max.)	Open collector, galvanic separated
Digital output 3 (not connected)	Open collector, galvanic separated
Digital output 4 (Error)	Open collector, galvanic separated
Digital input 1 (Gain switching 1)	24VDC galvanic separated
Digital input 2 (Gain switching 2)	24VDC galvanic separated
Digital input 3 (Find offset A)	24VDC galvanic separated
Digital input 4 (not connected)	24VDC galvanic separated
Interface RS232	standard
Interface RS485 galvanic separated	Option
Interface CAN-Bus	Option
Power supply	24VDC (18...36VDC) 0.15A (EMGZ411.E: 230VAC, 110VAC or 24VDC)
Main connector	DIN41612 type F b+d+z
Temperature range	0...50°C [32...122°F]
Weight	0.22kg [.5 lbs]

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