Operating Manual CMGZ 622

Digital Tension Controller
for double range force sensors

Version 1.25 01/2011 ff

Firmware Version 1.07
Hardware Rev. D

This operation manual is also available in German.
Please contact your local representative.

Diese Bedienungsanleitung ist auch in Deutsch erhältlich.
Bitte kontaktieren Sie Ihre nächstgelegene FMS Vertretung.

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1 Safety Instructions

1.1 Description conditions

High danger of health injury or loss of life	**Risk of damage to machines**	**Notice for proper function**
Danger This symbol refers to high risk for persons to get health injury or loss life. It has to be followed strictly.	**Caution** This symbol refers to risk of heavy mecanical damage. This warning has to be followed absolutely.	**Note** 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 electronic unit 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 electrical equipment. They are not taken into consideration in 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 electronic unit! It is vital to ensure that proper earth connection is done.
- The processor board is mounted to the housing cover. Improper handling may damage the fragile electronic equipment! Don't use rough tools such as screwdrivers or pliers! Touch processor board as little as possible! Touch earthed metal part to discharge static electricity before opening the housing!
- Wrong setting of the jumpers and solder bridges may cause malfunction of the electronic unit or the total system! Setting of the solder bridges and jumpers must be checked carefully prior to power on! Setting of the solder bridges should be carried out by trained personnel only!
- The Tension Controller has no built-in „Emergency Stop Function". However he can drive brakes with high kinetic energy and drive units with high performance. Depending on the kind of possible malfunctions, full braking or complete release may cause heavy damage of man and/or machine. The same applies also for drive units. Therefore, the person responsible for system design has to establish a security concept that is providing appropriate emergency procedures for the possible malfunctions.

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 zero exactly.

Gain: Amplification factor for the measuring signal. Use of an appropriate value will adjust the force sensor signal to the material tension feedback value exactly.

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.

Subprint: Electronic extension module which can be plugged in to the main board of the electronic unit if required. That way, the possibilities of the electronic unit can be extended easily.

Channel: The analogue inputs and outputs of a subprint, used for a certain purpose. There can be up to four channels in a single electronic unit.

Module: The software running on the microprocessor is spread over various function units (modules). A module can be used multiple times, i.e. when two measuring points are operated, the module „measuring amplifier“ is used twice. Each module has its own parameters and special functions.

Pilot control: If pilot control is activated, a reel diameter signal (from a distance sensor, PLC or similar) is taken into the calculation of the drive power and the drive will be „pilot controlled“ with the calculated value. Then, the controller has only to control the variation of the material tension. Due to that, the stability of controlling will be improved.

Single quadrant and four quadrant drive: Expression refers to the speed/torque diagram used in the drive technology. A single quadrant drive can only drive in forward direction; a four-quadrant drive can both drive and brake in forward and reward direction.

3 System Components

A CMGZ622 tension control system consists of the following components (refer to fig. 1):

Force sensors
- Double range force measuring bearings
- For mechanical/electrical conversion of the tension force

Electronic unit CMGZ622
- For supplying the force sensors and amplifying of the mV signal
- With integrated digital PID-controller
- Can operate unwind brake, unwind drive, winding drive or line drive
- Speed or torque control supported
- External diameter or line speed signal can be processed an added to the output value
- *Integrated brake amplifier*
- With operation panel for parametrization
- With robust aluminium housing
- Supports connection of external feedback displays
- Interface RS232
- *Interface CAN-Bus, PROFIBUS*
- *Internal brake power amplifier CMGZ.B to drive a brake*

External brake power amplifier
- *any suitable brake power amplifier to drive a brake*

Brake
- *any suitable electrical brake*
- *Pneumatic brake (when using electric/pneumatic converter)*

Drive
- *any suitable speed or torque controlled four quadrant drive*
- *AC or DC motor*

(Components. variants or options indicated in italic text)

4 System Description

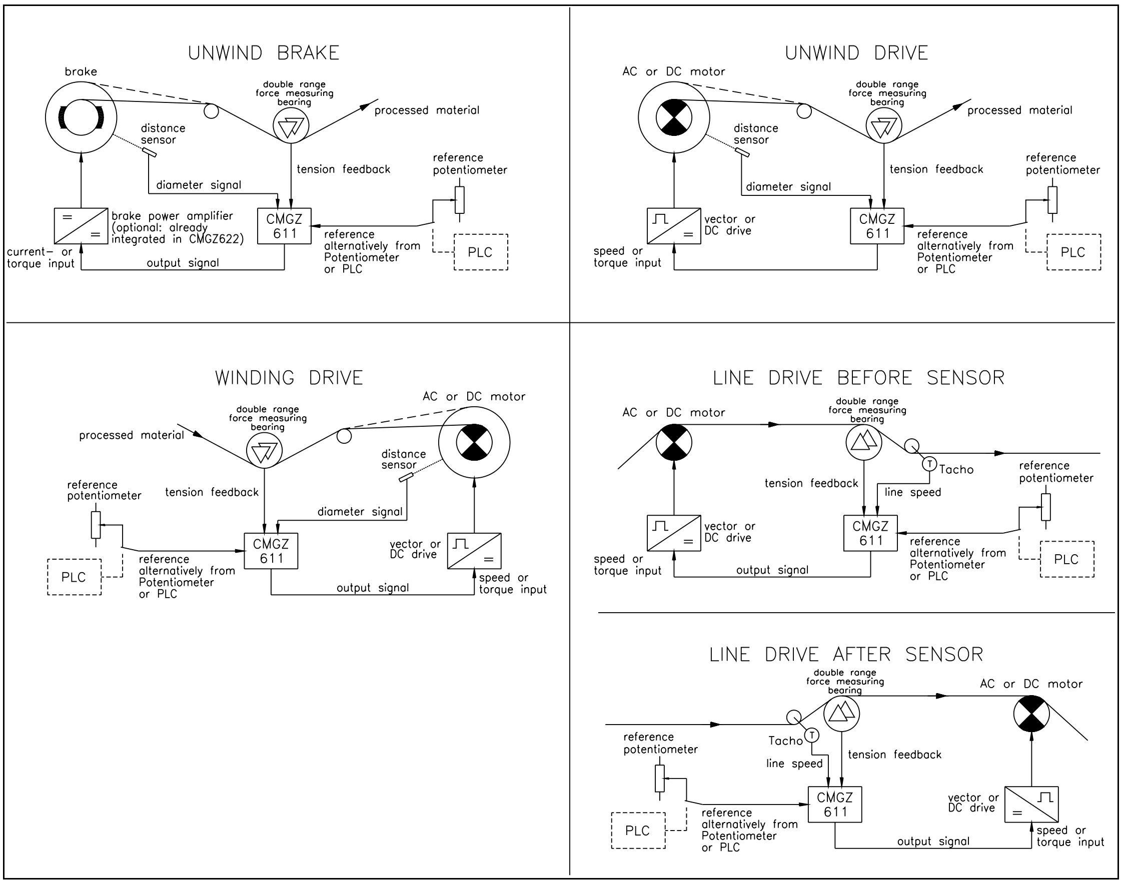

fig. 1: Basic structures of the CMGZ622 configurations C622001e

4.1 Functional Description

The double range force sensors measure the tension force in the material and transmit the measuring values as mV signals to the electronic unit CMGZ622. The electronic unit amplifies the mV signal depending on configuration. A digital input selects the measuring range to be used for the control loop. If the material tension deviates too much, the brake or the drive will be activated more ore less depending on configuration.

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 bridge wiring of the strain gauges, the measured value is depending also to the power supply. So, the force sensors are supplied from the electronic unit by a very accurate power supply.

4.3 Electronic Unit CMGZ622

Common

The electronic unit is mounted to a robust aluminium housing. It contains a microprocessor to handle all calculations and communications, the highly accurate sensor power supply and the signal amplifiers for the measuring values of a measuring point. The electronic unit has no trimmers and only few jumpers to keep most accurate long-time and temperature stability.

Operation

The large backlit display with 2x16 characters, 4 LED's and large keys guarantee simple operation. All information is in plain text with the following languages selectable: English, German, French and Italian. Most of the functions may be paramterized. The parametrization can be done via the keys or the interfaces. All inputs are fail-safe stored in an EEPROM. Additional settings can be made with jumpers or solder bridges.

Strain gauge amplifier

The strain gauge amplifier provides the highly accurate power supply (5VDC or 10VDC) for 1 or 2 force sensors per measuring point. The force sensors can be wired using 4 wire circuit or 6 wire circuit. This allows accurate control of the bridge excitation even with very long cabling.
The power supply is equipped with current control. This allows detecting of short circuit or cables break automatically and to output an error message if required.
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, lowpass filter, limit switches, etc). The resulting feedback value is provided as both tension and current signal at the same time.

PID Controller

The control unit compares the reference value with the measured feedback value and transmits the error to the PID controller. The PID controller calculates the output signal according to the difference. The output signal is 0...10V, ±10V, 0...20mA or 4...20mA, depending on configuration.
With a diameter sensor or other source, a 0...10V signal proportional to the actual reel diameter can be fed to the controller. Driving a winder, the controller calculates the pilot control resulting from this signal and the actual output value. The PID values are adjusted dynamically according to the changing reel diameter.
With a tachometer generator or other source, a 0...10V signal proportional to the line speed can be fed to the controller. Driving a line drive, the controller takes the line speed signal as a base to which the PID signal is overlaid. Therefore the controller must only control the deviation to the line speed.

Interface

(To be developed) As an option there are RS232, PROFIBUS or CAN-Bus interfaces available.

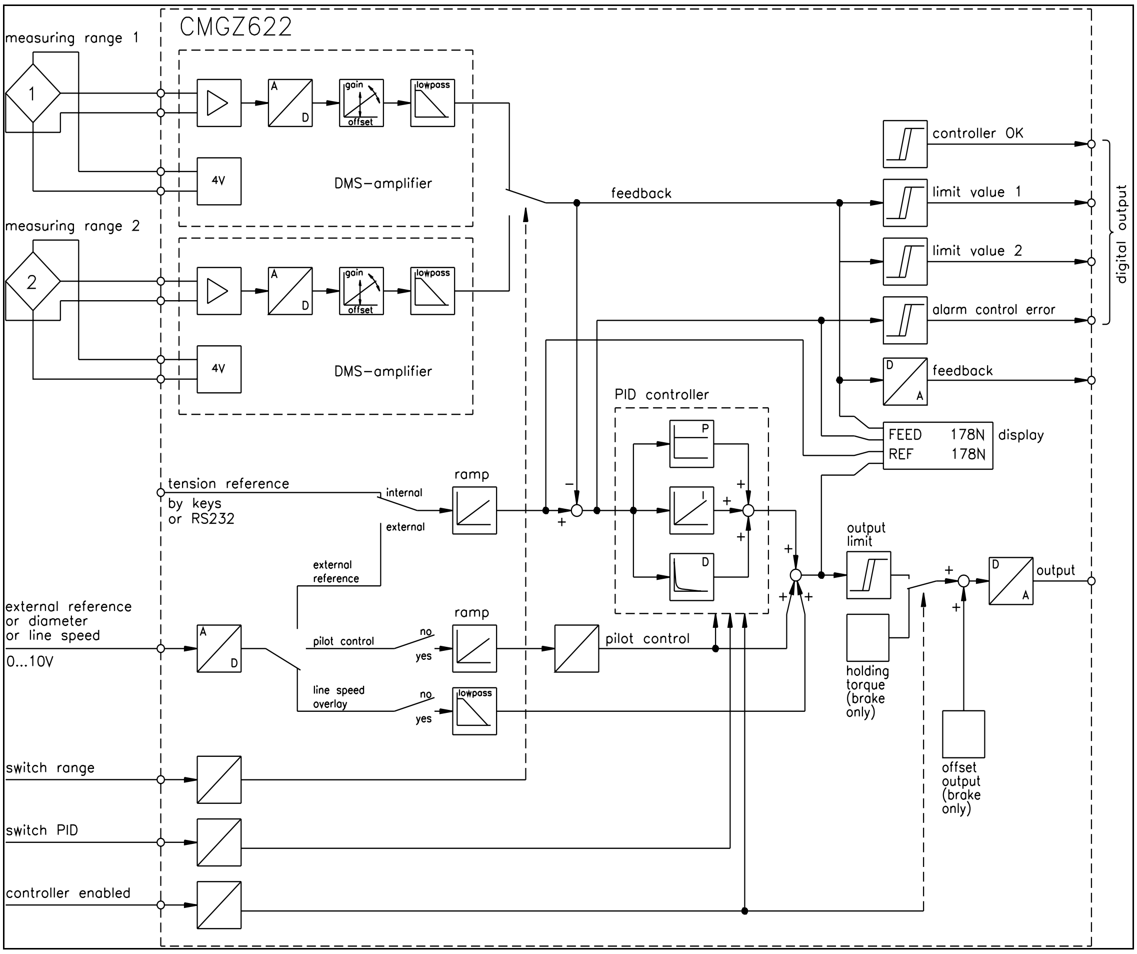

fig. 2: Block diagram of the electronic unit CMGZ622 C622002e

4.4 Power Amplifier and Brake

(Only if a brake is operated) The electronic unit can be ordered with integrated brake amplifier CMGZ.B.
If the electronic unit was ordered without brake amplifier, a separate power amplifier has to be used. The power amplifier drives the brake corresponding to the output signal of the electronic unit. Any power amplifier for brakes can be used.
Any electrical brake can be used or, when using an electric/pneumatic converter, any pneumatic brake.

4.5 Drive and Motor

(Only if a drive is operated) There can be used any AC or DC four quadrant drive suitable to the dynamics required and the motor used.

5 Controller theory

5.1 Tension control loops

When manufacturing and processing foils, wires, ropes, paper and fabric sheets, it is important that the product is under constant tension when guided across the rollers. Tension may change when humidity, temperature, winding or unwinding diameters vary or when the sheets are being printed, coated, glued or pressed. Tension is measured constantly and maintained at the correct value with the FMS force measuring and control system.

5.2 PID Controller

The function of any control loop is to maintain the feedback value exactly at the level of the reference and to minimize the influence of any interference on the control loop. In addition, the control loop must be stable under all operating conditions.
These aims can only be achieved if the dynamic behaviour of the control loop is adapted to the machine.
The PID controller used in the FMS tension control system calculates an output signal that corresponds to the addition of „P“, „I“ and „D“ component. The „D“ component can be skipped alternatively. Due to the digital design, the controller has an exactly reproducible behaviour, because every parameter is known as an exact number which doesn’t drift away. Due to that, it has high long-time and temperature stability. This feature also allows to exchange an electronic unit without readjusting.

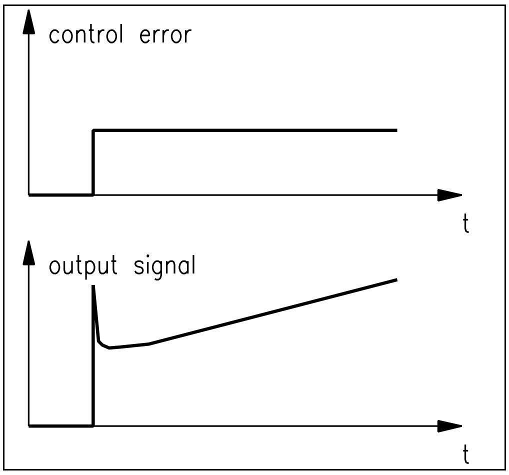

fig 3: Step response of a PID controller C432003e

„P“ component
A controller with only a proportional component gives an output signal that is proportional to the error. If the error is zero, the output signal also will be zero. A small error only can create a small output signal which is not high enough to compensate the complete error. That means, that a controller with only a proportional component will have a steady error. The characteristics of a. P-controller are the proportional factor X_p.

„I“ component
A controller with an integral component adds the error to the output signal continuously and emits this output signal. Due to that, the output signal will be enlarged or reduced until the error is zero. This output signal is maintained until a new error occurs. The integral component therefore allows zero error in steady state. The characteristic value of an „I“ controller is the settling time T_n.

„D“ component
A controller with a differential component has an output signal proportional to the changing speed of the error. If the error changes in a step, the output will show the characteristic peak impulse. Therefore, a „D“ controller reacts even if only a small controller error occurs. The characteristic value of a „D“ controller is the derivative action time T_V.

6 Quick Installation Guide

- Check all your requirements such as:
  – operating mode (unwind brake, unwind drive, winding drive, line drive)?
  – characteristics of the brake or drive (signal level, max. current, etc.)?
  – configuration of the force sensor (power supply, 4 wire or 6 wire circuit)?
  – operating mode of the additional analog input (external reference, etc.)?
  – controller output configuration (signal level)?
  – feedback output configuration (signal level)?
  – digital input / output assignment?
  – linking by interface etc.?
  – emergency stop procedures?
- Draw your final wiring diagram according to the wiring diagram (refer to „8.2 Wiring diagram“). Don’t forget the digital input „Controller enabled“
- Install and wire all your components (refer to „8. Installation and wiring“)
- Electronic unit: Parametrize and calibrate the measuring amplifier for each channel (refer to „9. General Operation“)
- Proceed a test run with low speed and low material tension:
  – Input reference value (ref. to „9.5 Inputting the reference value“)
  – Enable controller (ref. to „9.8 Automatic operation“)
  – Determine PID control parameters and set machine into operation (ref. to „9.6 Determination of the control parameters“)
- If required, setup pilot control or line speed overlay (ref. to „10.3 Setup of pilot control“ or „13.2 Setup of line speed overlay“)
- If required, do additional settings (refer to „9.9 Additional settings“

Note

It may be that the PID control parameters determined during the test run are no longer suitable for stable operation after setup of pilot control or increasing of material tension. Therefore it is useful to adjust the control parameters until the machine runs stable at the required reference values.

Note

Starting and stopping of the machine takes increased requirements to any control loop. For stable operating also in these phases, you have to pay special attention to the starting and stopping behaviour of the whole machine. It is not enough to get stable operating during normal operating conditions.

7 Dimensions

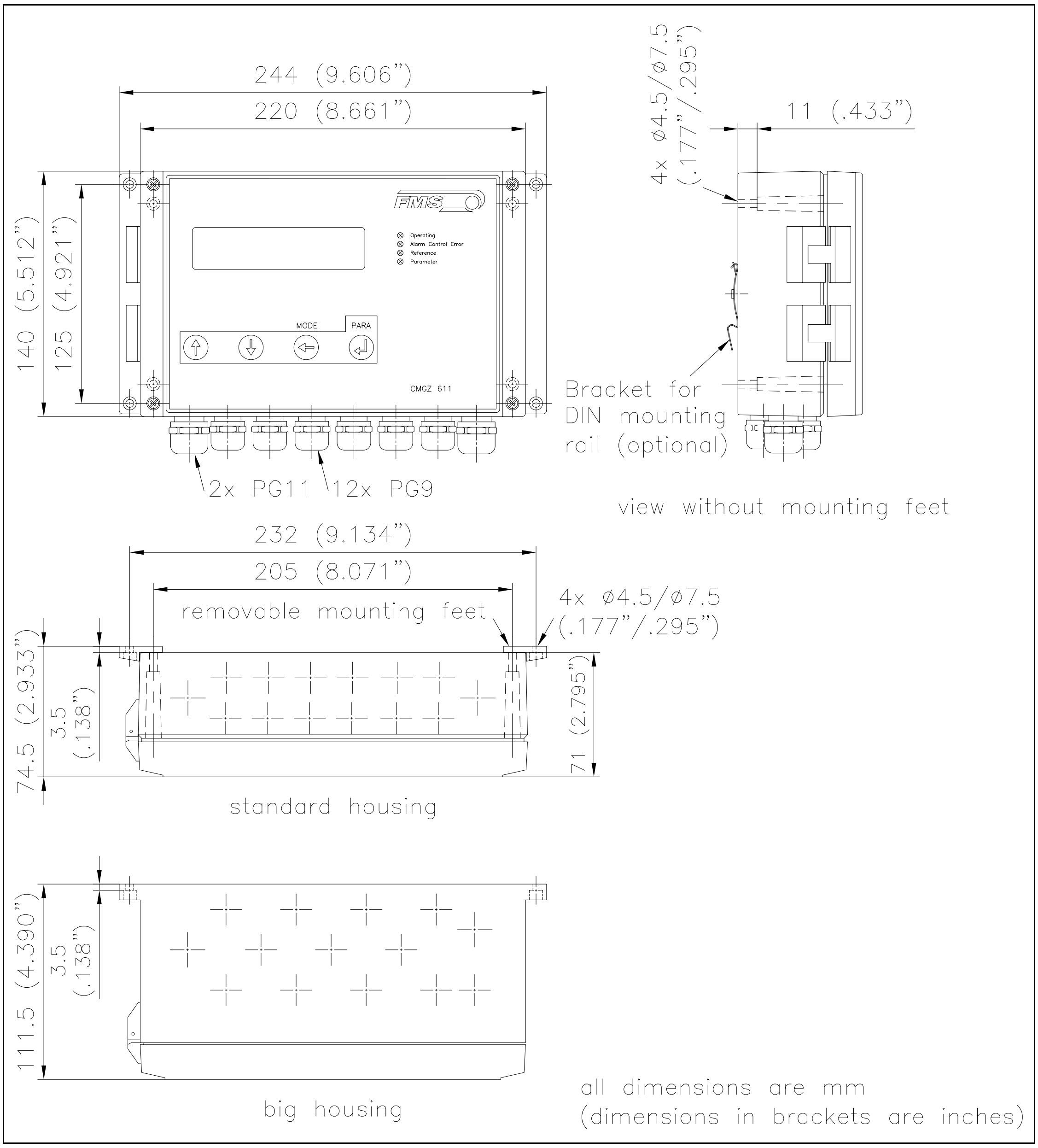

fig. 4: Dimensions C600005e

Type	Housing size
CMGZ622	standard
CMGZ622.B	big

8 Installation and Wiring

Caution

Proper function of the electronic unit 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 electrical equipment. They are not taken into consideration in this operating manual. However, they have to be followed strictly.

Caution

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

8.1 Mounting the Electronic Unit

The housing can be mounted in a control cabinet or directly beside the machine. All connections are led into the housing through glands and are connected to the plug-in screw terminals according to the wiring diagram (fig. 8 and 9).

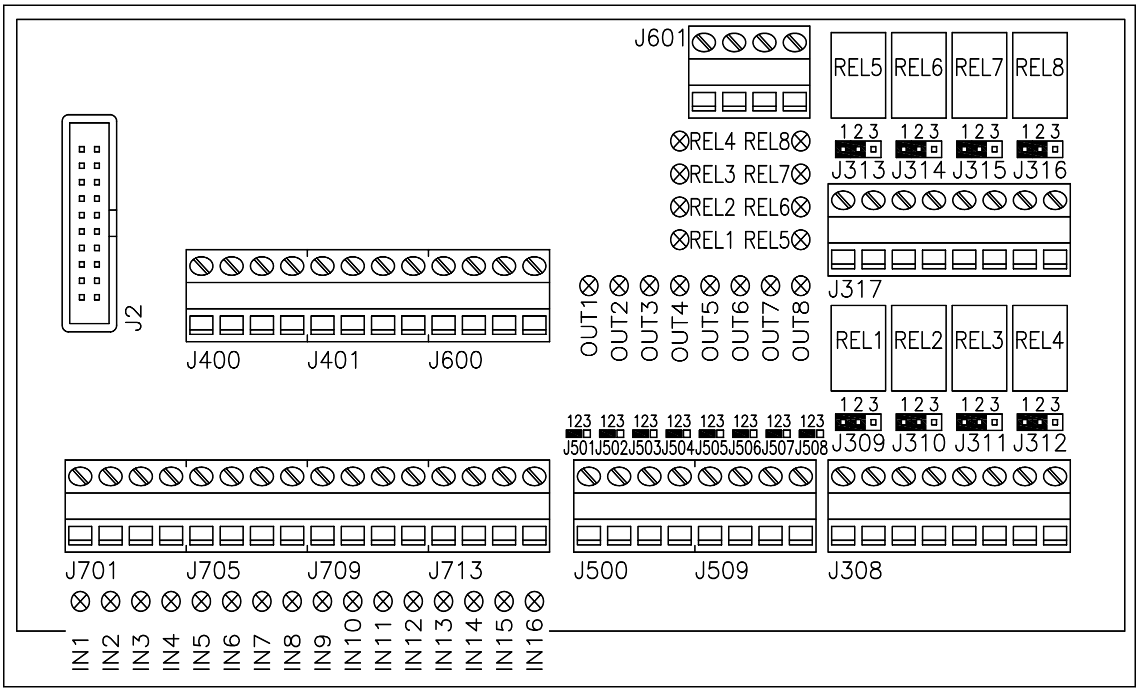

fig. 5: Wiring path inside the housing E600002e

Caution

The processor board is mounted to the housing cover. Improper handling may damage the fragile electronic equipment! Don’t use rough tools such as screwdrivers or pliers! Touch processor board as little as possible! Touch earthed metal part to discharge static electricity before open the housing!

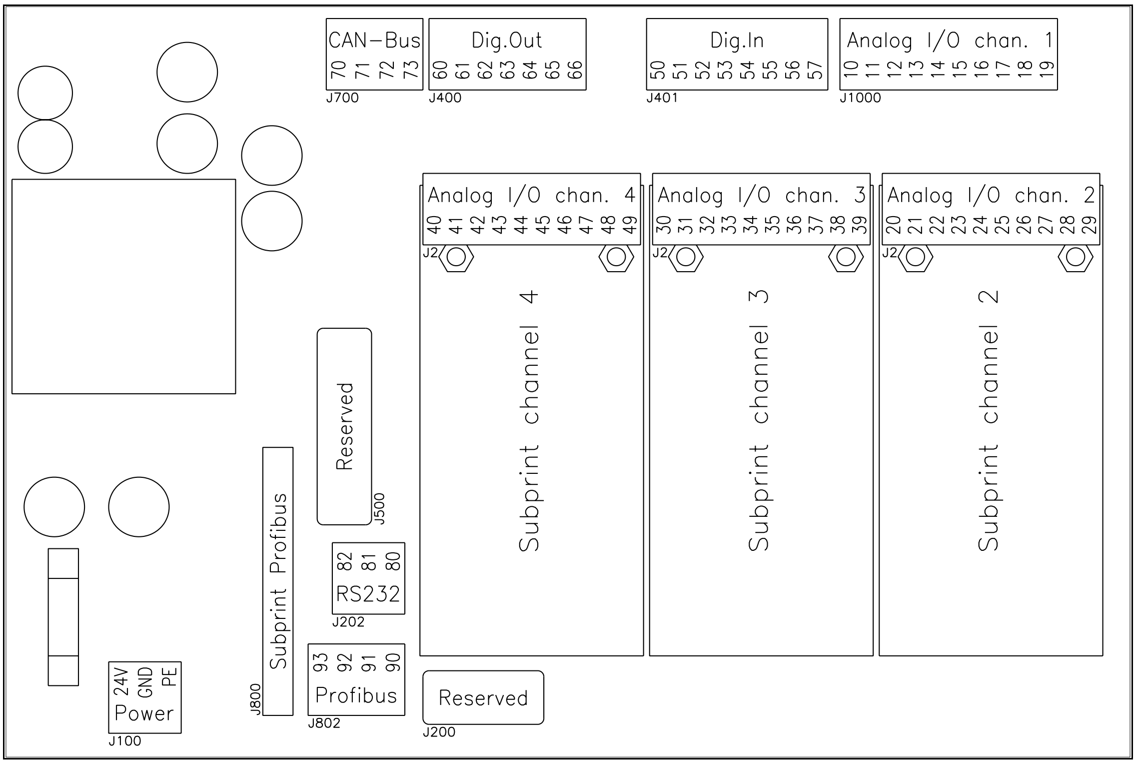

fig. 6: Screw terminal arrangement on the electronic unit E600003e

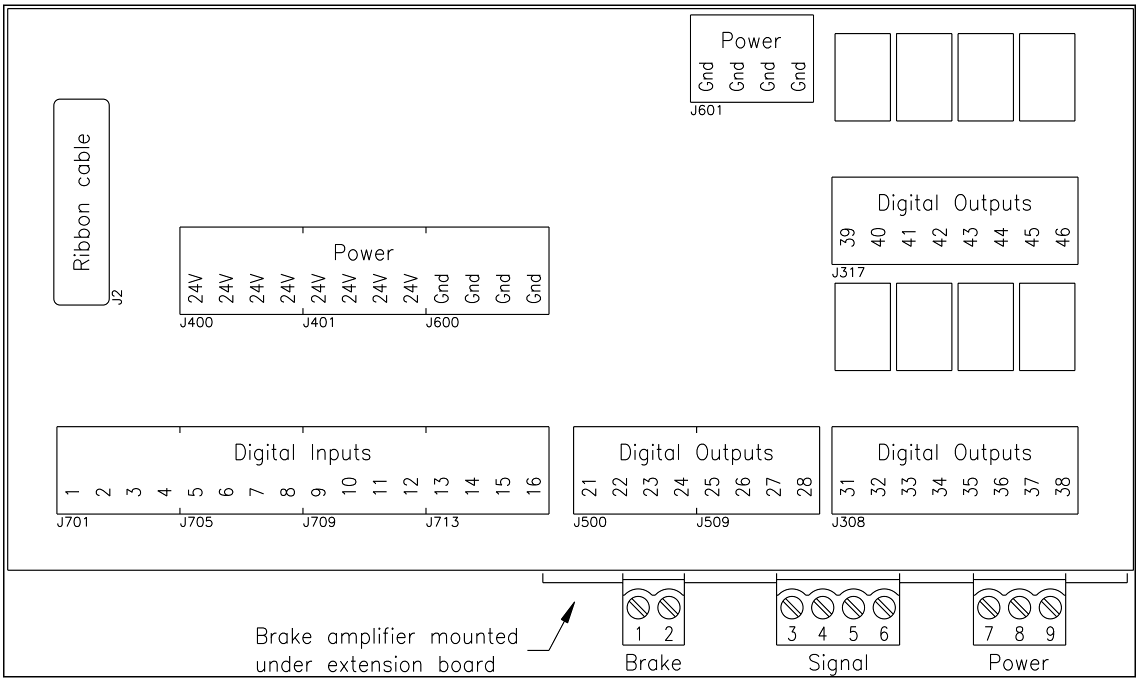

fig. 7: Screw terminal arrangement on the extension board and the brake amplifier C600003e

8.2 Wiring Diagram CMGZ622

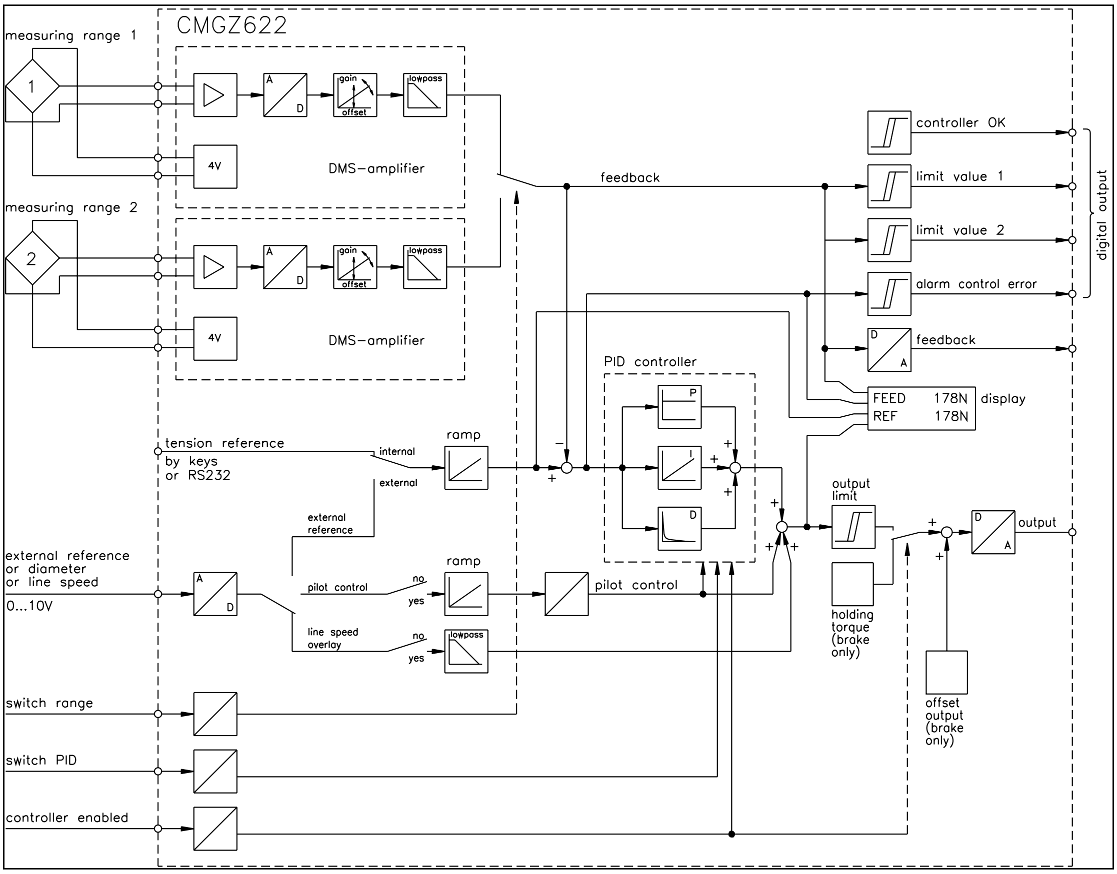

fig. 8: Wiring diagram CMGZ622 C622003e

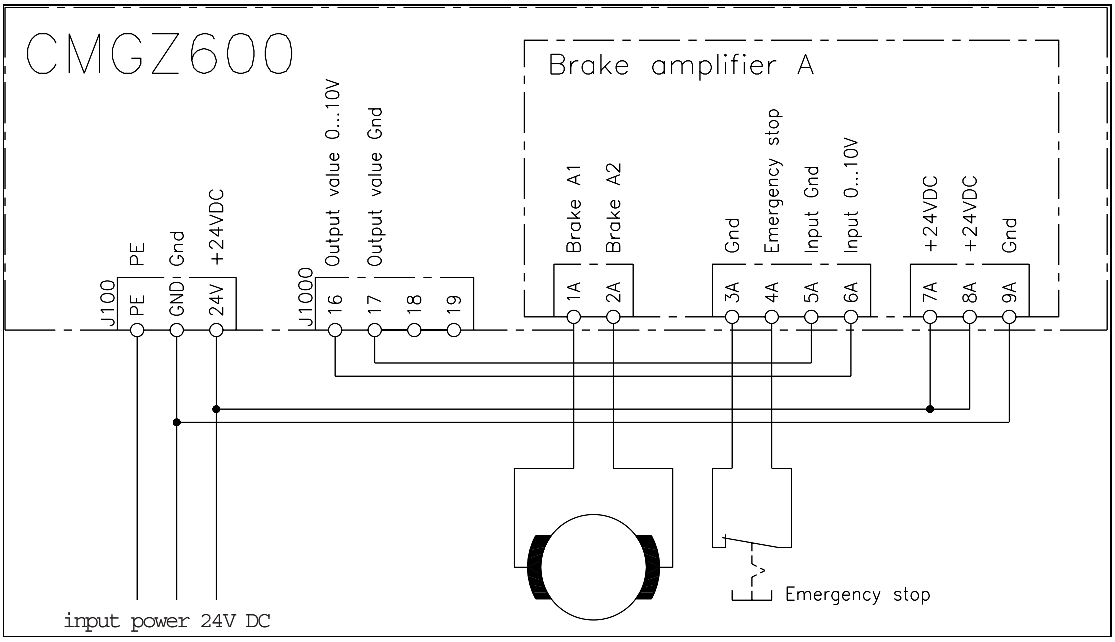

fig. 9: Wiring diagram for integrated brake amplifier CMGZ.B C600004e

8.3 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. The connection between the force sensors and the electronic unit is done using 4x2x0.75mm^2 [AWG 18] shielded twisted pair cable. (With cable length below 15m, 4x2x0.25 mm^2 [AWG 23] is also suitable.) The cable must be installed separate from power lines.

Wiring to the terminals of the electronic unit is done according to the wiring diagram. If two force sensors are used per measuring point, the cables are wired parallel (ref. to wiring diagram). If wiring is made using 6 wire circuit the solder bridges must be modified (ref. to „9.2 Configuring the electronic unit“).

Force sensor excitation can be made using 5VDC (default) or 10VDC (ref. to „9.2 Configuring the electronic unit“).

Note

The force sensor signal consists of only a few mV and is therefore susceptible to external influences to the cable. To increase immunity to interfering use one pair of the twisted pair cable for +signal and –signal.

Note

Connecting the shield of the signal cable to the electronic unit *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 electronic unit. On the „force sensor side“, the shield should stay open.

8.4 Mounting the brake amplifier or the drive unit

The brake and brake amplifier or drive unit and motor will be mounted according to manufacturer’s specification. Herein is no additional information written due to the wide variety of suitable types. Wiring is done according to the wiring diagram.

If an AC drive unit is used, the energy produced in the motor while braking must be led off to a brake resistor or equivalent.

Danger

The Tension Controller has no built-in „Emergency Stop-function. However he can drive brakes with high kinetic energy and drive units with high performance. Depending on the kind of possible malfunctions, full braking or complete release may cause heavy damage of man and/or machine. The same applies also for drive units. Therefore, the person responsible for system design has to establish a security concept that is providing appropriate emergency procedures for the possible malfunctions.

8.5 Mounting the distance sensor

If the control loop is operated with pilot control (processing of reel diameter), the actual reel diameter has to be transmitted to the electronic unit. For this purpose the actual reel diameter is detected with a distance sensor and the distance signal is fed to the analogue diameter input. It has to be ensured that the measuring axis of the distance sensor is straight radial to the reel (refer to fig. 1 and 10).

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.

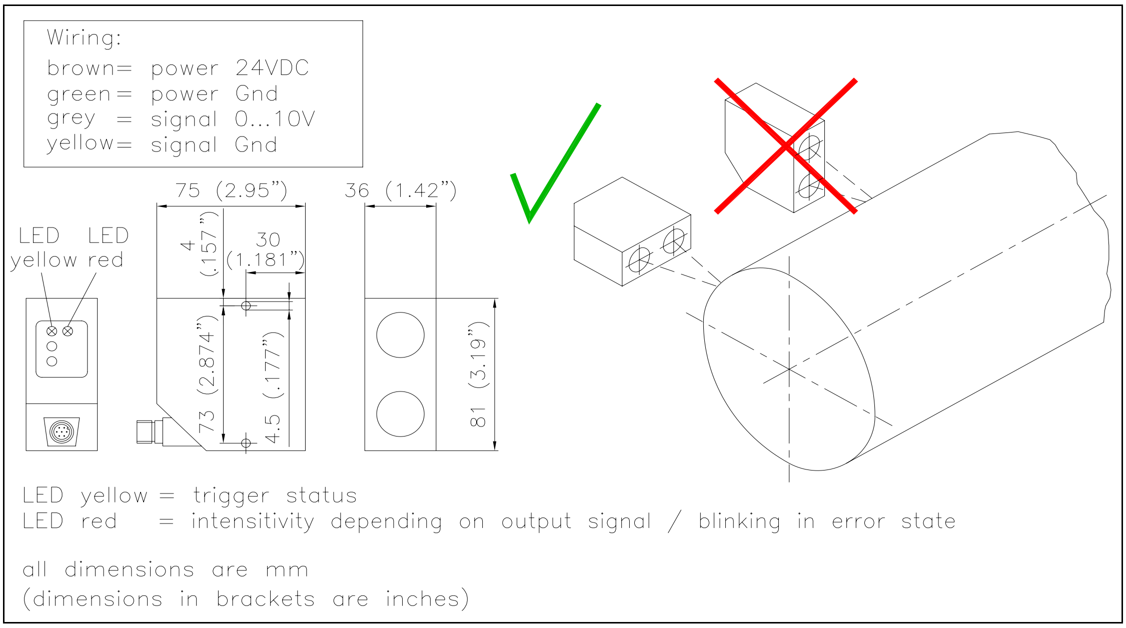

fig. 10: Mounting of the distance sensor CMGZ581924 E411012e

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. 12). 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

9 General Operation

9.1 View of the Operating Panel

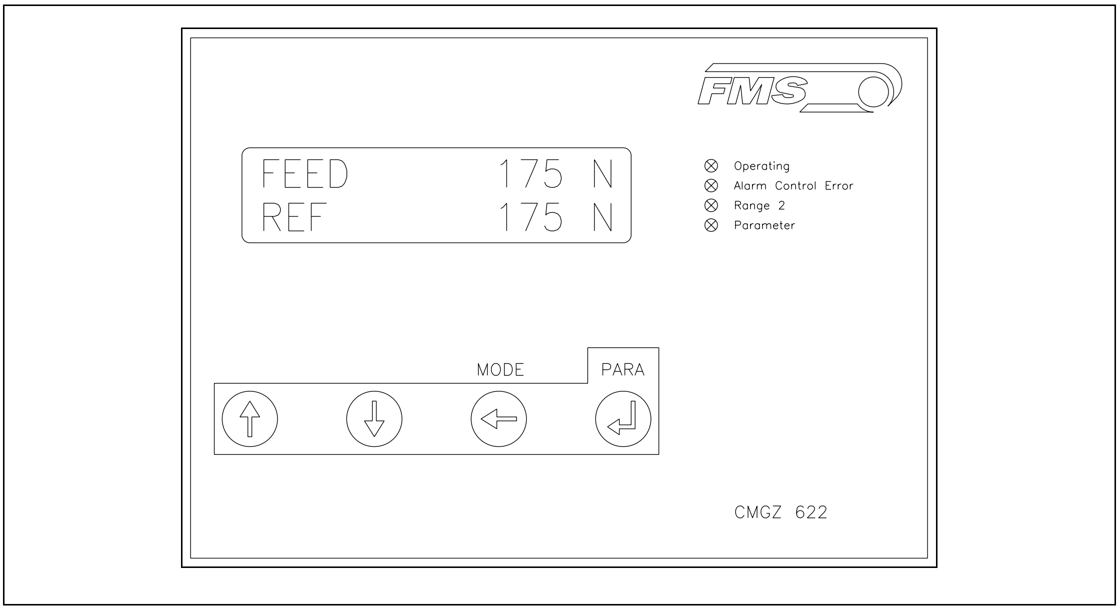

fig. 11: Operating panel CMGZ622 C622008e

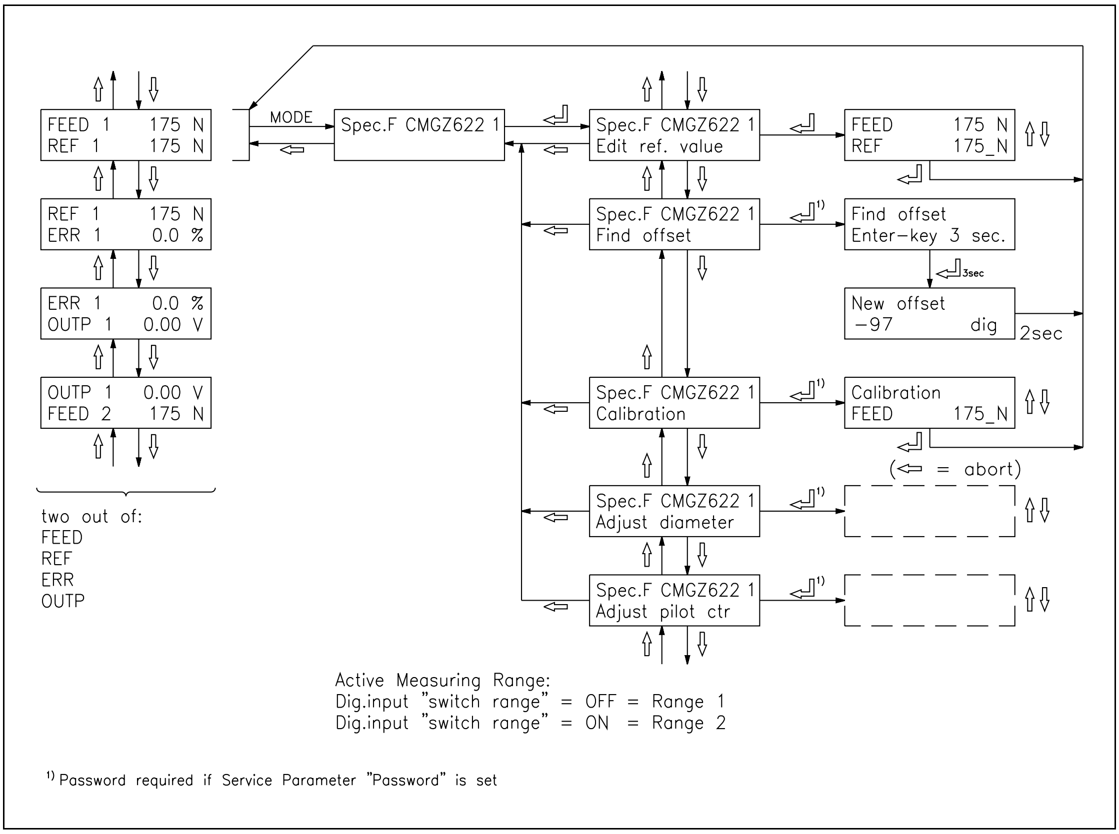

fig. 12: Main operating menu CMGZ622 C622005e

Configuring the Electronic Unit

The use of the input channels provided is as follows:

Input Channel assignment (ref. also to wiring diagram)	
	CMGZ622
Channel 1	Force Sensor, range 1 (low nominal force)
Channel 2	Force Sensor, range 2 (high nominal force)
Channel 3	External Reference / Diameter / Line Speed
Channel 4	–

Prior to the first calibration, the following settings must be done for each channel (ref. to „14. Parametrization“ and „19. Technical reference“):

Jumpers for the analog outputs (ref. also to „19. Technical Reference)	
	CMGZ622
Channel 1	±10V (using a drive) or 0...10V (using a brake)
Channel 2	0...10V (default)
Channel 3	–
Channel 4	–

System parameters	
Language	Required display language

Parameters CMGZ622	
Nominal force 1	Low nominal force, ref. to nameplate of the force sensor
Nominal force 2	High nominal force, ref. to nameplate of the force sensor
Unit of sensor	Ref. to nameplate of the force sensor
Sensitivity	FMS force sensors = 1.8mV/V (default)
1 or 2 sensors	1 or 2 per channel
Lowpass feedback	Reset to default = 50.0 Hz
Scale instrument 1	Which material tension feedback refers to 10V resp. 20mA?
Scale instrument 2	Which material tension feedback refers to 10V resp. 20mA?

These parameters are required to setup the measuring amplifier section of the electronic unit. There are additional parameters required to setup the PID controller section (refer to „10. Setup of an Unwind Brake Controller“ / „11. Setup of an Unwind Drive Controller“ / „12. Setup of a Winding Drive Controller“ / „13. Setup of a Line Drive Controller“)

Note

Wrong setting of the jumpers and parameters may cause malfunction of the electronic unit! Setting of the parameters must be done carefully prior to setting into operation!

9.2 Calibrating the Measuring Amplifier

The calibration can be done using the „simulating method“ or the „mathematical method“:

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. 13).

The calibration procedure is written for measuring range 1. It is valid analogous also for measuring range 2. The commands for measuring range 2 are writen in brackets.

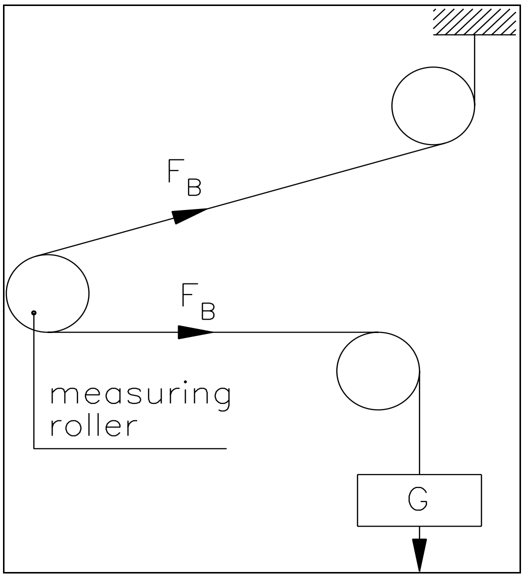

fig. 13: Calibration measuring amplifier
C431011e

Range 1: Make sure the digital input „switch range“ is OFF (Range 2 = ON)

Check force sensors

- Connect the first force sensor (ref. to wiring diagram).
- Check if a positive value is displayed when loading the sensor in measuring direction. If not, exchange terminals +*signal* and –*signal* on the measuring amplifier.
- 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 +*signal* and –*signal* on the measuring amplifier.

Find offset

- Insert material or a rope loosely to the machine.
- Press `MODE` key. Search and select the module *Spec.F CMGZ622 1* and the special function *Find offset* with the ↑ ↓ ↵ keys (fig. 12).
- Find offset by pressing the ↵ key for 3 seconds (fig. 12). The electronic unit calculates automatically the new offset value. The display will return to the main operating menu.

Find gain

- Load material or rope with a defined weight (fig. 13)
- Press `MODE` key. Search and select the module *Spec.F CMGZ622 1* and the special function *Calibration* with the ↑ ↓ ↵ keys (fig. 12).
- Set the force referring to the applied weight into the display with the ↑ ↓ keys and confirm with ↵ key (fig. 12). The electronic unit calculates automatically the new gain value. The display will return to the main operating menu.

Repeat the calibration written above with the other measuring range.

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 is done as written under „Simulating method“.
- The Gain value will be calculated by the following formula and then inputted in the parameter *Gain feedback* (refer to „14.5 Description of the parameters CMGZ622“).

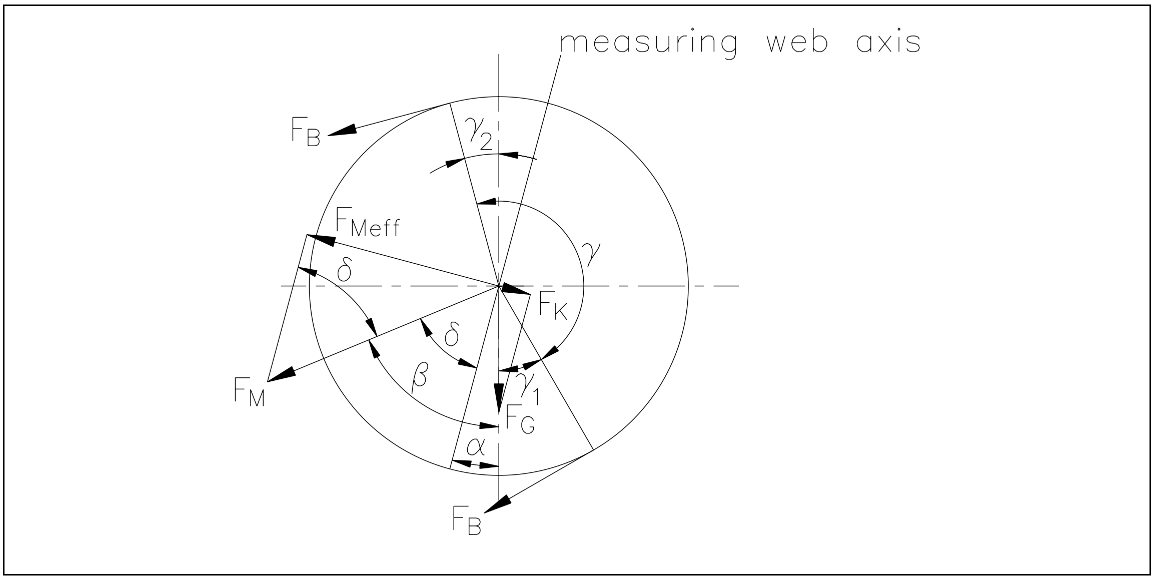

fig. 14: Force vectors in the FMS force measuring bearing C431012e

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

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	wrap angle of material	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		

9.3 Setup the PID Controller

The setup of the PID controller section depends on the operating mode of your application. Thus refer to „10. Setup of an Unwind Brake Controller“ / „11. Setup of an Unwind Drive Controller“ / „12. Setup of a Winding Drive Controller“ / „13. Setup of a Line Drive Controller“. The instructions in the following sections assume you have already done the specific settings for the operating mode of your application.

9.4 Entering the Reference Value

The tension reference value can be inputted by the operating panel or interface, or by the analogue input:

reference input by operating panel or interface

- Set parameter *reference internal / external* to *internal*
- Execute special function *Edit ref. value* (ref. to fig. 12). Input new reference value with ↑ ↓ keys and save it with ↵ key.

reference input by analogue input

- Set parameter *reference internal / external* to *external*
- Apply 0...10V source to the analogue input (ref. to wiring diagram)
- Set parameter *scale ref. input 1* and *scale ref. input 2* to the required reference value range (refer to „14. Parametrization“)
- Set the value of the voltage source according to the required reference value.

9.5 Determination of the control parameters

Experimental determination of the control parameters (recommended)

If the behaviour of the control loop is unknown, tuning is done by means of a systematic approach (fig. 15):

- Set parameter *Derivative D* to 0s (only if PID configuration is used)
- Set parameter *Integral I* very high (100.00s)
- Set parameter *Proportional P* very small (for ex. 1.00)
- Enable controller (ref. to „9.8 Automatic operation“)
- If control loop is not oscillating: Increase *Proportional P*

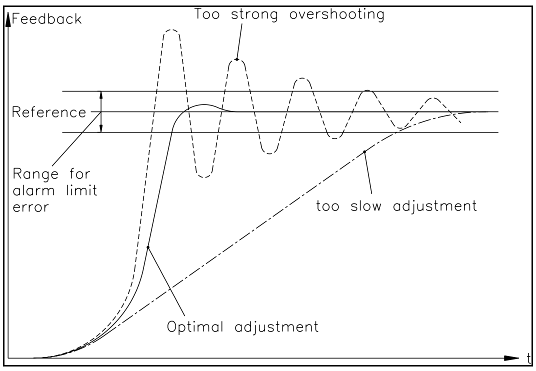

fig. 15: Transient effect of the control system C431013e

- If control loop is oscillating: decrease *Proportional P*
- Repeat this procedure until the control loop is stable and nearly oscillating. The controller can remain enabled; the controller parameters may be changed during automatic operation.
- If the control loop is running stable with the „P“ component, the *Integral I* can be decreased until the steady error disappears.
- If the *Integral I* is too small, the control loop will become unstable again.
- (Only using PID configuration): Increase *Derivative D* carefully until the controller is nearly oscillating.

- If the *Derivative D* is too high, the control loop will become unstable again.
- If the control loop is running stable, the parameters *Proportional P*, *Integral I* and *Derivative D* should be noted for eventually re-setup.

Mathematic determination of the control parameters

- If the behaviour of the control loop is known, the control parameters may be calculated by the known mathematical procedures and saved in the parameters *Proportional P1...P4*, *Integral I1...I4* and *Derivative D1...D4*. (There is only the parameter set active which is chosen by the BCD inputs; refer to „9.7 Switching the control parameters“.)
- If the control loop is oscillating, the control parameters will be fine-tuned as described under „Experimental determination of control parameters“.

Note

There can be saved 4 different P, I, D and reference values (P1...P4; I1...I4; D1...D4; Ref1...Ref4). This allows easy and flexible adjustment of the controller to different materials. The instructions above is valid for all 4 sets of parameters. But for better understanding, the instruction is written in common form. There is a specific parameter set active, depending on Measuring Range and PID switched or not! The reference values and control parameters for both Measuring Ranges must be determinate (refer to „9.7 Switching the control parameters“.)

Note

Correct setting of the control loop can be difficult. To judge the adjustment of the control parameters, an oscilloscope may be helpful to record the behaviour of the feedback value. The oscilloscope shows if the control loop operates stable, and if there is no more static error.

Note

The controller must be adjusted so that the feedback reaches the reference in the shortest possible way but without overshooting. If the feedback overshoots, this is seen on the display or with an oscilloscope.

9.6 Switching the control parameters

There can be saved 4 different P-, I- and D- values (P1...P4; I1...I4; D1...D4), as well as 4 different tension reference values. Due to that, it is possible to adjust the control loop flexibly to different material characteristics. However, switching to another set of parameters is only possible if the controller is disabled.

Switching is done by using the digital inputs „switch range“ and „switch PID“ (ref. to wiring diagram) according to the table below:

Measuring Range	dig. input switch range	dig. input switch PID	Parameter set
Range 1	off (open)	off (open) on (24VDC)	P1 / I1 / D1 / Ref1 P2 / I2 / D2 / Ref2
Range 2	on (24VDC)	off (open) on (24VDC)	P3 / I3 / D3 / Ref3 P4 / I4 / D4 / Ref4

The LED „Range 2“ is on if measuring range 2 is active.

9.7 Automatic operation

State „Controller disabled“

After power on, the controller is disabled. Its output value is 0V, 0mA or 4mA (depending on setting of parameter *Output config*). When operating a brake, the output value is 0V or refers to the parameter *Holding torque* (depending on parameter *Torque in use*).

Enable controller

The controller will be enabled by the digital input „Controller enabled“ or by the interface. This will activate the LED and the digital output „Controller ok“ and the material tension will be adjusted for matching the reference value.

Operating a drive, the controller begins to tighten the material with the speed given by parameter *Start speed* until an initial material tension (parameter *Start limit*) is reached. This can also include a bit of reverse running. Then, the material tension is increased to the reference value or the pilot control value (depending on parameter *Pilot control*; refer to „14. Parametrization“).

Operating a brake, the controller starts from the „Holding torque“ and drives to the reference value or the pilot control value (depending on parameter *Pilot control*; refer to „14. Parametrization“).

Change of control parameters while automatic operation

The control parameters *P1...P4 / I1...I4 / D1...D4, Influence of PI* and *PID-configuration* can be changed while the controller is enabled. Setting is done as written in „14.5 Description of the parameters CMGZ622“. The new values are taken for the control loop when parameter mode is quit.

Change of reference value while automatic operation

The reference value can be changed while automatic operation as written under „9.5 Inputting the reference value“.

Disable controller

To terminate controlling after stopping the machine, the controller has to be disabled. If enabling was done by interface, disabling must be done also by interface. After disabling the controller, the output value will be reset to zero immediately. If a brake is operated and the parameter *Torque in use* is set to *yes*, the output value will be reset to the value stored in parameter *Holding torque*.

Finally the LED and the digital output „Controller ok“ will be cancelled.

☞ **Note**

If the controller is disabled while the material is running, the drive unit will stop immediately. This may cause material crack. Therefore, the controller should be disabled only if the machine is no longer running.

9.8 Additional settings

PI or PID configuration

The Tension Controller can be operated as PI or as PID controller (with unwind brake, PI only). FMS recommends operating as PI controller because this setup is much easier to handle, and the controller dynamics are sufficient for most applications (refer also to „5. Controller theory"):

Characteristics of PI controller	Characteristics of PID controller
+ Easier to adjust than a PID controller + Quite good behaviour + Is very suitable where great inertia moments make the D component ineffective	+ Behaviour is more dynamically than that of a PI controller (PID controller are used where the dynamics of a PI controller is not enough) – The D component causes greater tendency to instable behaviour than using a PI controller!

The parameter *PID-configuration* is set to *PI* or *PID*, depending on required operation mode.

Setting of the lowpass filters

The electronic unit provides 2 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* and *Lowpass feedback* (ref. to „14. Parametrisation").

☞ **Note**

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 electronic unit provides 2 limit switches which can be tapped at the digital outputs. The limit switches are actuated when the feedback value exceeds the stored threshold values. For details see description of parameters *Limit 1 min/max*, *Limit value 1, Limit 2 min/max*, *Limit value 2* (ref. to „14. Parametrization“).
Tapping of the limit switches is done according to wiring diagram.

Control Error Limitation

The parameter *Error Limit* allows to hold the feedback value fed to the controller within a defined range. Thus extreme peaks of the control output value are avoided in case of high variations of the tension feedback value (i.e. with rough running reels). Ref. to „14. Parametrization“.

10 Setup of an Unwind Brake Controller

10.1 Configuring the basic parameters

For an unwind brake controller the following parameters must be set according to your application:

Parameters CMGZ622	
Control mode	*Unwind brake* (default)
Pilot control	For the time being set to *No*
Offset output	Reset to 0%
Current limit	According to the signal level of the brake used
Output configuration	0...10V or according to the brake used
Ramp diameter	Reset to default = 1.0 s
Ramp reference	Reset to default = 1.0 s
Reference source	According to machine configuration (*internal* or *external*)
Scale ref.input 1	(Only if reference potentiometer is used)
Scale ref.input 2	(Only if reference potentiometer is used)
Torque in use	For the time being set to *No*
Holding torque	For the time being set to 0.0, or according to your requirements (refer to „10.2 Inputting the holding torque“)

Note

There is one additional analogue input for external reference, diameter or line speed signal. You cannot run the controller with external reference and pilot control the same time. You must decide which signal you want to process with the controller and then set the parameters *Reference source* and *Pilot control* accordingly.

Now continue with section „9.4 Entering the Reference Value“. If the general setup is done, add the special features below according to your requirements.

10.2 Inputting the holding torque

The unwind reel can be hold by the brake while the machine is stopped. For that purpose the holding torque has to be set in parameter *Holding torque* (ref. to „14. Parametrisation“). This allows avoiding pivoting for example.
If parameter *Torque in use* is set to *No*, the holding torque is output only while the controller is enabled.
If parameter *Torque in use* is set to *Yes*, the holding torque is output also while the controller is disabled.

10.3 Setup of pilot control

The pilot control enables to evaluate the actual reel diameter and to calculate the brake torque or drive power adapted to the reel diameter (pilot control signal). In addition, the PID control parameters are dynamically adapted to the reel diameter continuously. Therefore the controller is only responsible for the material tension variations. This will increase control loop stability.

> ☞ **Note**
>
> Operating a winder, the pilot control is only suitable with a torque controlled drive. Using a speed controlled drive, pilot control won't work as expected. (This notice doesn't apply if a brake is operated.)

Transmission of diameter signal

To transmit the actual reel diameter to the electronic unit, an analog signal 0...10V (from a distance sensor or other source) is fed to the analog input (terminals *Signal 0...10V* and *Signal Gnd*; refer to wiring diagram)

Diameter adjustment

To get the electronic unit knowing the actual reel diameter, the distance signal must be assigned to a diameter range:

- Set parameter *Pilot control* to *Yes.*
- Insert reel with small diameter to get a signal according to the small diameter from the distance sensor, or set PLC diameter signal to a small value.
- When in the main operating menu, press `MODE` key. Search and select the module *Spec.F CMGZ622 1* and the special function *Adjust diameter* with the ↑ ↓ ↵ keys (fig. 12). Input the actual (small) reel diameter as *Diameter 1* (fig. 16). After confirmation with ↵ key the diameter is saved together with the referring voltage signal.

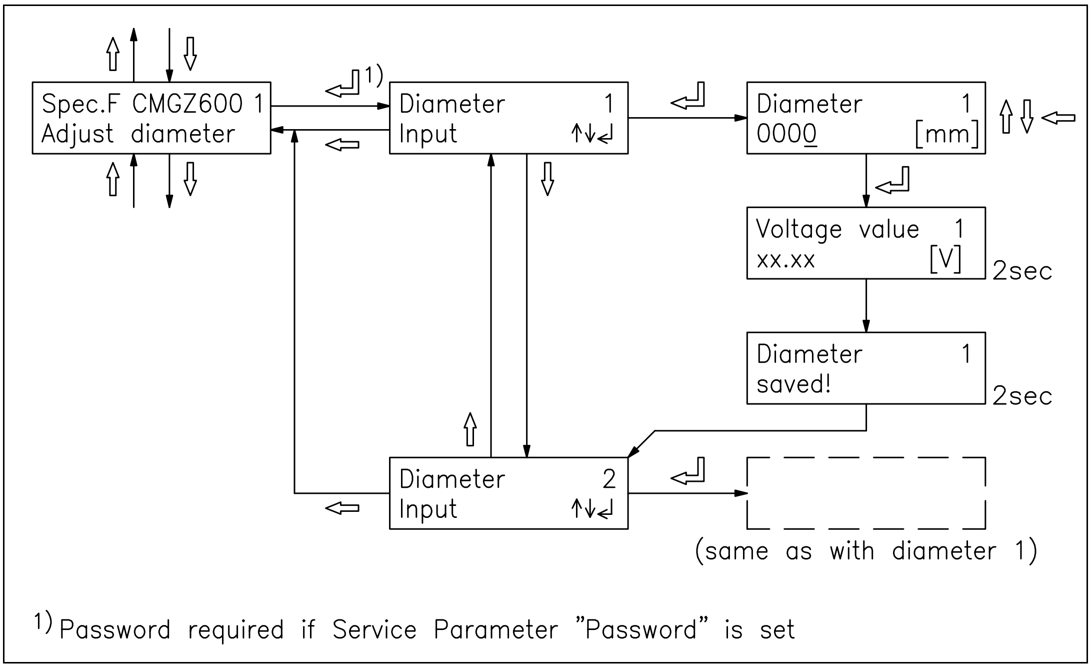

fig. 16: Program flow for special function „Adjust diameter“ C611007e

- Insert reel with large diameter to get a signal according to the large diameter from the distance sensor, or set PLC diameter signal to a large value.
- Input the actual (large) reel diameter as *Diameter 2* as written above (fig. 16). After confirmation with ↵ key the diameter is saved together with the referring voltage signal.

Adjustment of pilot control

To get the electronic unit calculating the pilot control correct, a certain torque has to be assigned to a certain diameter:

- Set parameter *Pilot control* to *No.*
- Proceed for a test run. If the control loop runs stable at a diameter as large as possible, the actual reference value and, after pressing the ↑ key, the actual output value
  can be read from the display (fig. 10). Note these values:

Actual reference value	REF	= ________________	[N, lbs]
Actual output value	OUTPUT	= ________________	[V, mA]

- Terminate test run
- Calculate the required torque value as a percentage of the maximum output signal which is 10V or 20mA:

$$\%\text{-torque} = \frac{\text{actual output}}{\text{max. output}} \cdot 100 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ [\%]$$

  The torque for the pilot control is now determined.
- Set parameter *Pilot control* to *Yes.*
- The reel diameter must be the same as during the test run.
- When in the main operating menu, press `MODE` key. Search and select the module *Spec.F CMGZ622 1* and the special function *Adjust pilot ctr* with the ↑ ↓ ↵ keys (fig. 12). Input the formerly calculated torque value into *%-torque* and confirm with ↵ key (fig. 17). Input the formerly noted reference value [N]. After confirmation with ↵ key the calculated pilot control is saved together with the actual diameter signal.

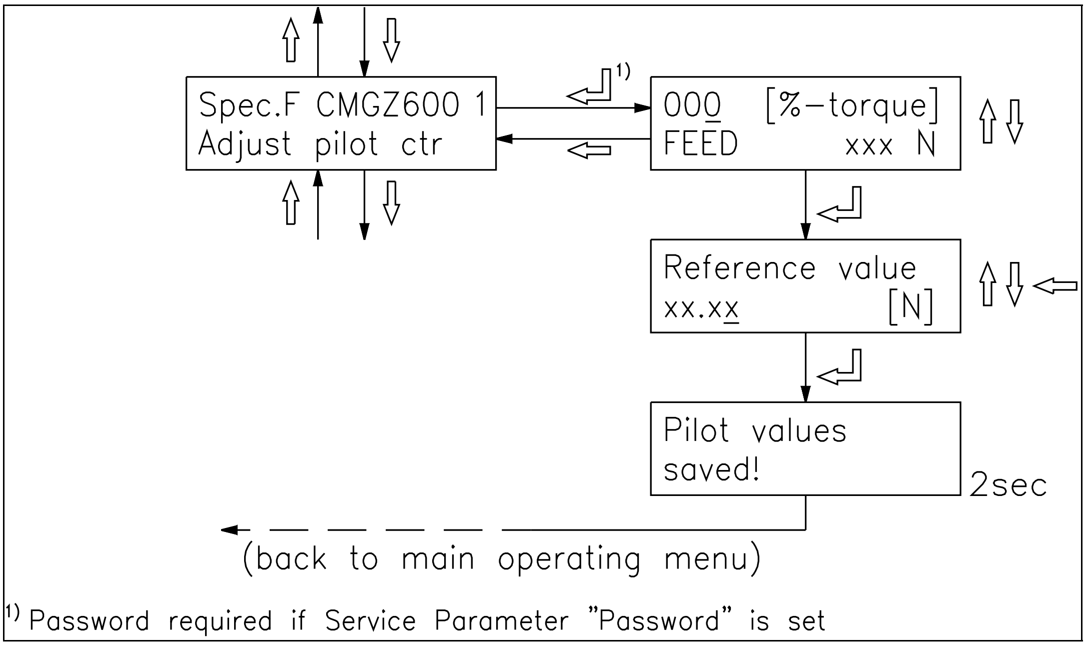

fig. 17: Program flow for special function „Adjust pilot control“ C611008e

Note

The additional analog input can only be operated in one mode at a time. When changing parameter *Reference source*, *Pilot control* or *Taper function*, the adjustment of pilot control is lost! If one of these parameters are changed after pilot control already being adjusted, you have to proceed again for adjustment of pilot control!

Partition the output into pilot control signal and PID output signal

- Set parameter *Influence of PID* to an appropriate value, for ex. „50%“
- Proceed for a test run. Adjust PID control parameters and parameter *Influence of PID* until the control loop will run stable under all conditions.

11 Setup of an Unwind Drive Controller

11.1 Configuring the basic parameters

For an unwind drive controller the following parameters must be set according to your application:

Parameters CMGZ622	
Control mode	*Unwind drive*
Pilot control	For the time being set to *No*
PID configuration	For the time being set to *PI*; if *PID* is required, refer to „9.9 Additional settings“
Output limit	According to the signal level of the drive used
Output configuration	±10V or according to the drive used
Ramp diameter	Reset to default = 1.0 s
Ramp reference	Reset to default = 1.0 s
Reference source	According to machine configuration (*internal* or *external*)
Scale ref.input 1	(Only if reference potentiometer is used)
Scale ref.input 2	(Only if reference potentiometer is used)
Start speed	For the time being set to 0.00
Start limit	For the time being set to 0.0

Note

There is one additional analog input for external reference, diameter or line speed signal. You cannot run the controller with external reference and pilot control the same time. You must decide which signal you want to process with the controller and then set the parameters *Reference source* and *Pilot control* accordingly.

Now continue with section „9.5 Inputting the reference value“. If the general setup is done, add the special features below according to your requirements.

11.2 Automatic Start Function

With the integrated automatic start function, it is possible to start very carefully even if the material has some slack, because the controller operates with only a small start speed until a certain minimum tension value is reached. After reaching the minimum tension, controlling will be fully activated.
To enable automatic start function, the parameters *Start speed* and *Limit speed* are set to appropriate values (ref. to „14. Parametrization“).

11.3 Setup of pilot control

The pilot control enables to evaluate the actual reel diameter and to calculate the brake torque or drive power adapted to the reel diameter (pilot control signal). In addition, the PID control parameters are dynamically adapted to the reel diameter continuously. Therefore the controller is only responsible for the material tension variations. This will increase control loop stability.
Setup of pilot control is done as written under „10.3 Setup of pilot control“.

12 Setup of a Winding Drive Controller

12.1 Configuring the basic parameters

For a winding drive controller the following parameters must be set according to your application:

Parameters CMGZ622	
Control mode	*Winding drive*
Pilot control	For the time being set to *No*
PID configuration	For the time being set to *PI*; if *PID* is required, refer to „9.9 Additional settings“
Output limit	According to the signal level of the drive used
Output configuration	±10V or according to the drive used
Ramp diameter	Reset to default = 1.0 s
Ramp reference	Reset to default = 1.0 s
Reference source	According to machine configuration (*internal* or *external*)
Scale ref.input 1	(Only if reference potentiometer is used)
Scale ref.input 2	(Only if reference potentiometer is used)
Tension reduction	For the time being set to *No*
Start speed	For the time being set to 0.00
Start limit	For the time being set to 0.0

Note

There is one additional analogue input for external reference, diameter or line speed signal. You cannot run the controller with external reference and pilot control the same time. You must decide which signal you want to process with the controller and then set the parameters *Reference source* and *Pilot control* accordingly.

Now continue with section „9.5 Inputting the reference value“. If the general setup is done, add the special features below according to your requirements.

12.2 Automatic Start Function

With the integrated automatic start function, it is possible to start very carefully even if the material has some slack, because the controller operates with only a small start speed until a certain minimum tension value is reached. After reaching the minimum tension, controlling will be fully activated.
To enable automatic start function, the parameters *Start speed* and *Limit speed* are set to appropriate values (ref. to „14. Parametrization“).

12.3 Setup of pilot control

The pilot control enables to evaluate the actual reel diameter and to calculate the brake torque or drive power adapted to the reel diameter (pilot control signal). In addition, the PID control parameters are dynamically adapted to the reel diameter continuously. Therefore the controller is only responsible for the material tension variations. This will increase control loop stability.
Setup of pilot control is done as written under „10.3 Setup of pilot control“.

12.4 Taper Function

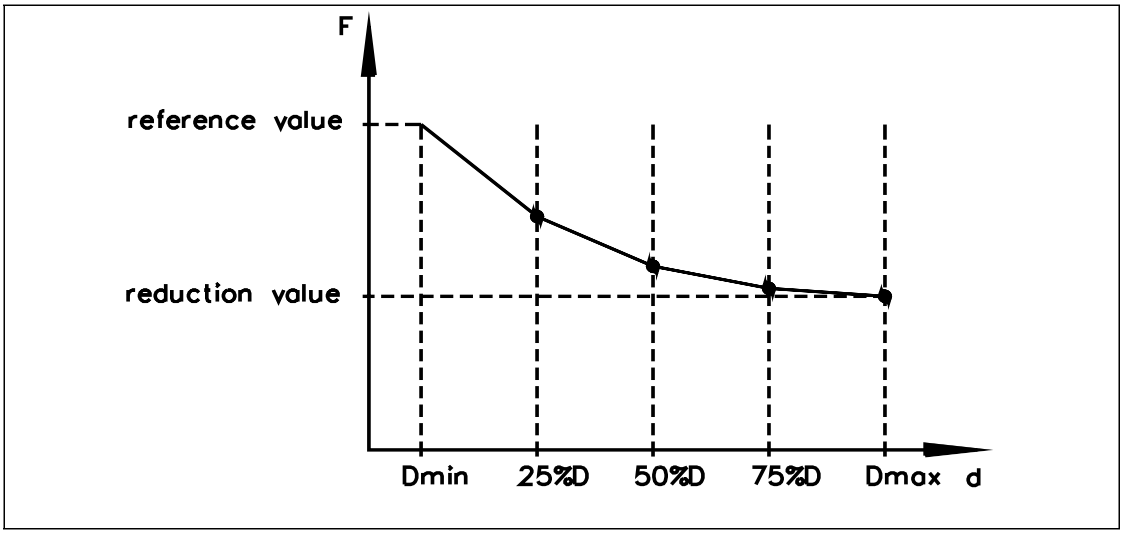

fig. 18: Characteristic curve of the taper function C433007e

If the end of the reel should be wound smoother than the centre of the reel, a taper function can be parametrized. The characteristic curve can be chosen as a linear, square or square root function (fig. 18). But the taper function is only active if the pilot control is also active, that means the controller must know the actual reel diameter.

(to be developed – ask FMS customer service)

13 Setup of a Line Drive Controller

13.1 Configuring the basic parameters

For a line drive controller the following parameters must be set according to your application:

Parameters CMGZ622	
Control mode	*Line drive*
Line speed overlay	For the time being set to *No*
PID configuration	For the time being set to *PI*; if *PID* is required, refer to „9.9 Additional settings“
Output limit	According to the signal level of the drive used
Output configuration	±10V or according to the drive used
Position of line drive	According to machine configuration (before or after sensor)
Ramp reference	Reset to default = 1.0 s
Reference source	According to machine configuration (*internal* or *external*)
Scale ref.input 1	(Only if reference potentiometer is used)
Scale ref.input 2	(Only if reference potentiometer is used)

☞ **Note**

There is one additional analog input for external reference, diameter or line speed signal. You cannot run the controller with external reference and line speed overlay the same time. You must decide which signal you want to process with the controller and then set the parameters *Reference source* and *Line speed overlay* accordingly.

Now continue with section „9.5 Inputting the reference value“. If the general setup is done, add the special features below according to your requirements.

13.2 Setup of line speed overlay

If the controller is operated with line speed overlay, a line speed signal is used to build the output value. The controller uses the signal depending on the diameter proportion between tachometer roller and drive roller. The hereby calculated value is taken and the percentage quota of the PID controller is overplayed. The sum will be the output value. Therefore the controller is only responsible for the material tension variations. This will increase control loop stability.
The parameters for line speed overlay may be calculated. But often the referring values of the machine are unknown. Therefore the experimental setup of line speed overlay is listed below:

Transmission of the line speed signal
To transmit the actual line speed to the electronic unit, an analogue signal 0...10V (from a tachometer generator or other source) is fed to the analogue input (refer to wiring diagram).

Parametrization of the tachometer roller

For the controller knowing the actual line speed, the line speed signal has to be set in relation to the diameter and speed of the tachometer roller:

- Set line speed signal on the master computer or on a drive already setup to a certain value, for ex. 5V. Note that value:

  U_{Line} = _________________ [V]

- Set tachometer to the running drive roller and read the rotation speed.
  Note that value:

  n_{Tacho} = _________________ [rpm]

- Reset line speed signal to 0, so that the drive roller will stop.
- Measure the diameter of the drive roller and input it into parameter *Tachometer diameter*.
- Calculate number of rotations per volt using the following formula:
-

$$P_1 = \frac{n_{Tacho}}{U_{Line}}$$ = _________________ [rpm/V]

- Store the P_1 value in parameter *Tachometer voltage*.

Parametrization of the drive roller

For the controller being able to drive the drive roller correctly, the output signal has to be set in relation to the diameter and speed of the drive roller:

- Drive the drive unit with a certain output value, for ex. 5V. Note that value:

  U_{Output} = _________________ [V]

- Set tachometer to the running drive roller and read the rotation speed.
  Note that value:

  n_{Drive} = _________________ [rpm]

- Reset the output signal to 0, so that the drive roller will stop.
- Measure the diameter of the drive roller and input it into parameter *Center diameter*.
- Calculate number of rotations per volt using the following formula:

$$P_2 = \frac{n_{Drive}}{U_{Output}}$$ = _________________ [rpm/V]

- Store the P_2 value in parameter *Controlled drive*.

Partition the output into line speed overlay signal and PID output signal

- Set parameter *Line speed overlay* to *Yes* (ref. to „14. Parametrization“)
- Set parameter *Influence of PID* to an appropriate value, for ex. „10%“
- Proceed for a test run. Adjust PID control parameters and parameter *Influence of PID* until the control loop will run stable under all conditions.

14 Parametrization

14.1 Schematic Diagram of Parametrization

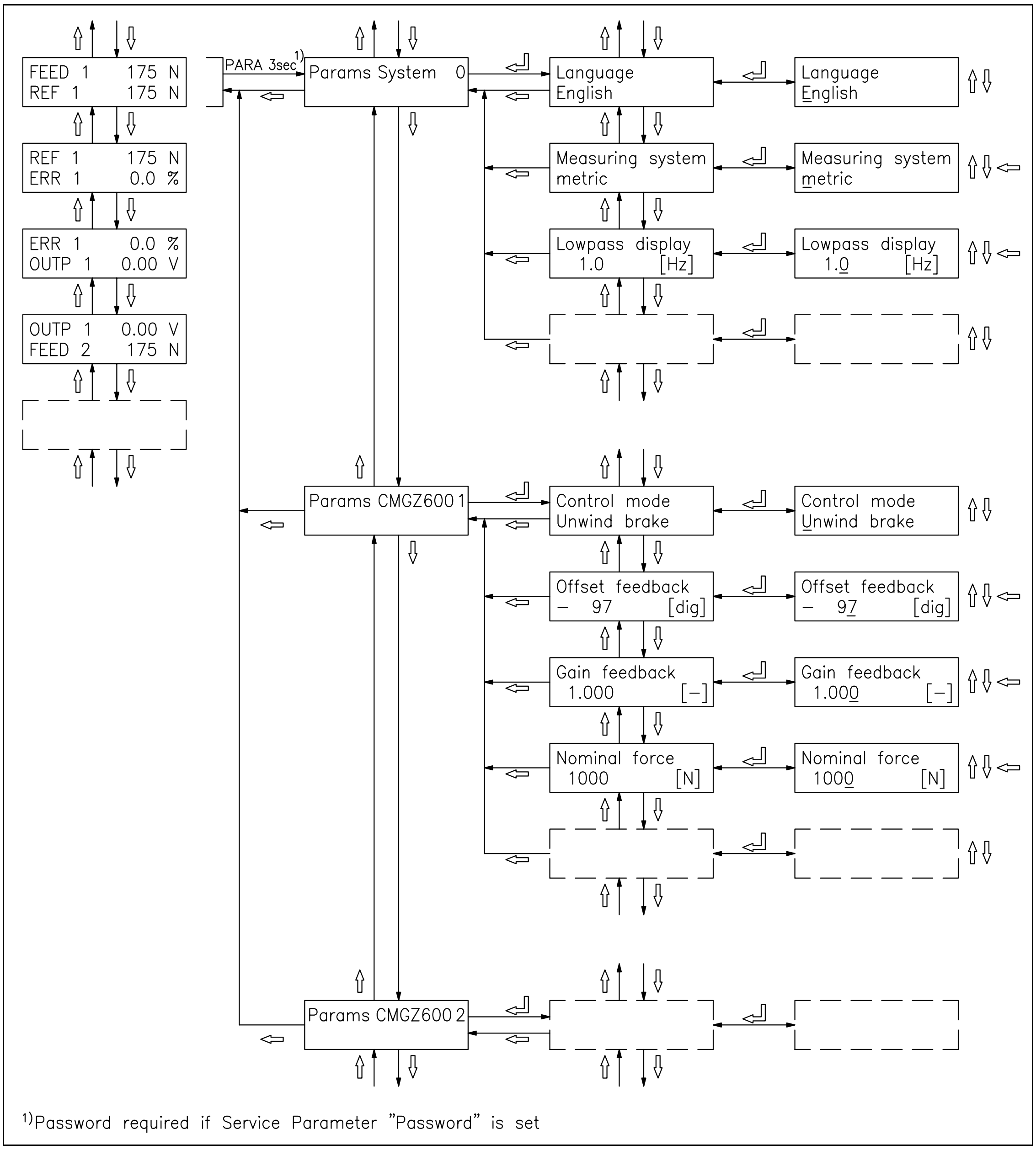

fig. 19: Parametrization CMGZ612 C612003e

The parameters are split into the modules *Params System 0* and *Params CMGZ622 1*. The parameter changing mode is activated by pressing the PARA ↵ key for 3 seconds. The required module is then searched with the ↑ ↓ keys and selected with the PARA ↵ key (fig. 19). Each module has its own parameter set. Generally, the parameters are settable using the keys as follows:

- ↵ choose and enter
- ↑ ↓ switch the selections or increase / decrease numeric values, as well as change the sign
- ← change the decimal (while inputting a numeric value) or abort setting

14.2 List of System Parameters

Parameter	Unit	Min	Max	Default
Language	English, French, Italian, German			
Measuring System	Metric, US standard			Metric
Lowpass display	[Hz]	0.1	10.0	1.0
Identifier	[-]	0	255	0
Baud rate	2400, 4800, 9600, 19200			9600

14.3 List of Parameters CMGZ622

Parameter	Applies to[1]	Unit	Min	Max	Default
Control mode	b u w l	Unwind brake, Unwind drive, Winding drive, Line drive			Unwind brake
Offset feedback 1	b u w l	[Digit]	–8000	8000	0
Offset feedback2	b u w l	[Digit]	–8000	8000	0
Gain feedback 1	b u w l	[-]	0.100	9.000	1.000
Gain feedback 2	b u w l	[-]	0.100	9.000	1.000
Nominal force 1	b u w l	[N, kN, cN]	1	9999	1000
Nominal force 2	b u w l	[N, kN, cN]	1	9999	1000
Unit of sensor	b u w l	N, kN, cN			N
Sensitivity	b u w l	[mV/V]	0.1	3.0	1.8
1 or 2 force sensors	b u w l	[-]	1	2	1
Lowpass feedback	b u w l	[Hz]	0.1	200.0	50.0
Limit 1 min/max	b u w l	Min, Max			Max
Limit value 1	b u w l	[2]	[3]		0
Limit 2 min/max	b u w l	Min, Max			Min
Limit value 2	b u w l	[2]	[3]		-
Config. instrument	b u w l	0...20mA, 4...20mA			0...20mA
Scale instrument 1	b u w l	[2]	[3]		-
Scale instrument 2	b u w l	[2]	[3]		-
Pilot control	b u w _	No, Yes			No
Line speed overlay	_ _ _ l	No, Yes			No
Influence of PID	b u w l	[%]	0.1	100.0	100.0
PID configuration	_ u w l	PI, PID			PI
Proportional P1	b u w l	[-]	0.01	100.00	1.00
Integral I1	b u w l	[s]	0.01	100.00	1.00
Derivative D1	_ u w l	[s]	0.001	10.000	0.010

1) Code refers to: **b** = unwind **b**rake / **u** = **u**nwind drive / **w** = **w**inding drive / **l** = **l**ine drive
2) [N, cN, kN] if measuring system = metric / [lb, clb, klb] if measuring system = US standard
3) A force value can be input. The value consists of 4 digits. The position of the decimal point depends on the
parameter *Force of senso*

r
(List of Parameters CMGZ600 – Continuation)

Parameter	Applies to[1]	Unit	Min	Max	Default
Proportional P2	b u w l	[-]	0.01	100.00	1.00
Integral I2	b u w l	[s]	0.01	100.00	1.00
Derivative D2	_ u w l	[s]	0.001	10.000	0.010
Proportional P3	b u w l	[-]	0.01	100.00	1.00
Integral I3	b u w l	[s]	0.01	100.00	1.00
Derivative D3	_ u w l	[s]	0.001	10.000	0.010
Proportional P4	b u w l	[-]	0.01	100.00	1.00
Integral I4	b u w l	[s]	0.01	100.00	1.00
Derivative D4	_ u w l	[s]	0.001	10.000	0.010
Error limit	b u w l	[%]	1.0	100.0	100.0
Alarm control error	b u w l	[%]	0.1	100.0	10.0
Offset output	b _ _ _	[%]	0.0	50.0	0.0
Current limit	b _ _ _	[%]	10.0	100.0	100.0
Output limit	_ u w l	[%]	10.0	100.0	100.0
Output config.	b u w l	0...10V, ±10V, 0...20mA, 4...20mA			±10V
Pos. line drive	_ _ _ l	After sensor, Before sensor			After
Ramp diameter	b u w _	[s]	0.1	60.0	1.0
Ramp reference	b u w l	[s]	0.1	20.0	1.0
Reference source	b u w l	Internal, External			Internal
Scale ref. input 1	b u w l	2)	3)		-
Scale ref. input 2	b u w l	2)	3)		-
Torque in use?	b _ _ _	Yes, No			No
Holding torque	b _ _ _	[%Out]	0.0	100.0	0.0
Taper function	_ _ w _	No, Linear, Square, Root			No
Reduction factor	_ _ w _	[-]	0.000	1.000	0.000
Start speed	_ u w _	[%Out]	0.00	100.00	0.00
Start limit	_ u w _	[%F_ref]	0.0	100.0	0.0

Parameter	Applies to[1)]	Unit	Min	Max	Default
Tacho voltage	_ _ _ l	[rpm/V]	1	1000	100
Controlled drive	_ _ _ l	[rpm/V]	10	1000	300
Tacho diameter	_ _ _ l	4)	5)		-
Center diameter	_ _ w l	4)	5)		-
Max. diameter	_ _ w _	4)	5)		-

1) Code refers to: **b** = unwind **b**rake / **u** = **u**nwind drive / **w** = **w**inding drive / **l** = **l**ine drive
2) [N, cN, kN] if measuring system = metric / [lb, clb, klb] if measuring system = US standard
3) A force value can be input. The value consists of 4 digits. The position of the decimal point depends on the parameter *Force of sensor*
4) [mm] if measuring system = metric / [inch] if measuring system = US standard
5) A diameter value can be input. The value consists of 4 digits.

14.4 Description of the System Parameters

The parameter changing mode is activated by pressing the PARA ↵ key for 3 seconds. By pressing the PARA ↵ key again, the system parameters are selected (ref. also to fig. 19).

Language

Use:	This parameter stores the display language.		
Range:	English, French, Italian, German		

Measuring system

Use:	This parameter indicates the measuring system to be used. If it is set to *metric*, all force values are shown as [N, cN, kN]. If it is set to *US standard*, all force values are shown as [lb, clb, klb].		
Range:	Metric, US standard	**Default:**	Metric

Lowpass display

Use:	The electronic unit 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 display will be much more stable in the case of high fluctuations of the force value. The lowpass display filter is independent to the other filters.		
Range:	0.1 to 10.0	**Default:**	1.0
Increment:	0.1	**Unit:**	[Hz]

Identifier

Use:	This parameter stores the ident number of the device when linked to PROFIBUS, CAN-Bus resp. DeviceNet.		
Range:	0 to 255	**Default:**	0
Increment:	1 **Unit:**	[-]	

Baud rate

Use:	This parameter stores the speed of the serial interface (RS232).		
Range:	2400, 4800, 9600, 19200	**Default:**	9600
		Unit:	[Baud]
Note:	The other serial interface settings are fixed: 8 data bits, even parity, 1 stop bit („8 e 1“).		

14.5 Description of the Parameters CMGZ622

The parameter changing mode is activated by pressing the PARA ↵ key for 3 seconds. The module *Params CMGZ622 1* is then searched with the ↑ ↓ keys and selected with the PARA ↵ key (ref. also to fig. 19). Each measuring point has its own module with a parameter set. Parameters not applying to the selected control mode are not shown in the display.

Control mode

Applies to:

Unwind brake	Unwind drive	Winding drive	Line drive

Use: This parameter defines the type of actuator which is supported by this parameter set.

Range: Unwind brake, Unwind drive, Winding drive, Line drive **Default:** Unwind brake

Offset feedback 1

Applies to:

Unwind brake	Unwind drive	Winding drive	Line drive

Use: This parameter stores the value in [Digit] determined with special function *Find offset* while the digital input „switch range“ was OFF (measuring range 1). 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 manually with the ↑ ↓ ← keys.

Range: –8000 to 8000 **Default:** 0

Increment: 1 **Unit:** [Digit]

Offset feedback 2

Applies to:

Unwind brake	Unwind drive	Winding drive	Line drive

Use: This parameter stores the value in [Digit] determined with special function *Find offset* while the digital input „switch range“ was ON (measuring range 2). 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 manually with the ↑ ↓ ← keys.

Range: –8000 to 8000 **Default:** 0

Increment: 1 **Unit:** [Digit]

Gain feedback 1

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: This parameter stores the value wasdetermined with special function *Calibration* while the digital input „switch range“ was OFF (measuring range 1). Alternatively you can input a value calculated using the formulas written under „9.3 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 feedback 2

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: This parameter stores the value wasdetermined with special function *Calibration* while the digital input „switch range“ was ON (measuring range 2). Alternatively you can input a value calculated using the formulas written under „9.3 Calibrating the measuring amplifier“, if the material tension cannot be simulated.

Range: 0.100 to 9.000 **Default:** 1.000

Increment: 0.001 **Unit:** [-]

Nominal Force 1

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: This parameter stores the nominal force of the low range of the double range force sensor. It is printed to the nameplate of the force sensor.

Range: 1 to 9999 **Default:** 1000

Increment: 1 **Unit:** [N, kN, cN]

Nominal Force 2

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: This parameter stores the nominal force of the high range of the double range force sensor. It is printed to the nameplate of the force sensor.

Range: 1 to 9999 **Default:** 1000

Increment: 1 **Unit:** [N, kN, cN]

Unit of sensor

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: This parameter stores the measuring unit of the force sensor. It is printed to the nameplate of the sensor.

Range: N, kN, cN **Default:** N

Sensitivity

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: This parameter stores the sensitivity of the force sensor, that means how much signal per volt excitation the sensor will give when loaded with nominal force. Standard for FMS force sensors is 1.8mV/V.

Range: 0.1 to 5.0 **Default:** 1.8

Increment: 0.1 **Unit:** [mV/V]

1 or 2 sensors

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: This parameter stores wether the measuring roller is beared by one or two force sensors.

Range: 1 to 2 **Default:** 1

Increment: 1 **Unit:** [-]

Lowpass feedback

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: The electronic unit provides a lowpass filter to prevent noise which is added to the feedback signal. This parameter stores the cut off frequency. The lower the cut off frequency, the more sluggish the feedback signal fed to the PID controller section will be. Due to this filter, the feedback signal will be much more stable in the case of high fluctuations of the force value.
The lowpass output filter is independent to the other filters.

Range: 0.1 to 200.0 **Default:** 50.0

Increment: 0.1 **Unit:** [Hz]

Limit 1 min / max

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: The digital output „Limit value 1“ can be set as a min or a max limit switch. That means, the digital output will be activated when passing over respectively passing under the value set under parameter *Limit value 1*.

Range: Min, Max **Default:** Max

Limit value 1

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: The digital output „Limit value 1“ will be activated if the threshold value stored in this parameter is passed over respectively passed under (according to setting in parameter *Limit 1 min / max*). If the value stored here is zero, limit switch monitoring is inactive.

Range: A force value can be input. The value consists of 4 digits. The position of the decimal point depends on the parameter *Force of sensor*.

Default: 0

Unit: [N, kN, cN] or [lb, klb, clb]

Limit 2 min / max

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: Identical with *Limit 1 min / max* but this parameter acts to the digital output „limit value 2“.

Range: Min, Max **Default:** Min

Limit value 2

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: Identical with *Limit value 1* but this parameter acts to the digital output „limit value 2“.

Configuration instrument

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: This parameter configures the current output signal.

Range: 0...20mA, 4...20mA **Default:** 0...20mA

Scale instrument 1

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: This parameter stores which material tension feedback value will give the maximum signal (10V and 20mA) at the output if measuring range 1 is used (digital input „switch range“ = OFF).

Range: A force value can be input. The value consists of 4 digits. The position of the decimal point depends on the parameter *Force of sensor*.

Default: -

Unit: [N, kN, cN] or [lb, klb, clb]

Scale instrument 2

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: This parameter stores which material tension feedback value will give the maximum signal (10V and 20mA) at the output if measuring range 2 is used (digital input „switch range“ = ON).

Range: A force value can be input. The value consists of 4 digits. The position of the decimal point depends on the parameter *Force of sensor*.

Default: -

Unit: [N, kN, cN] or [lb, klb, clb]

Pilot control

Applies to:	Unwind brake	Unwind drive	Winding drive	

Use: With this parameter, the pilot control will be turned on and off. That means, that the utilization of the reel diameter signal will be activated or de-activated. Refer to „10.3 Setup of pilot control“

Range: No, Yes **Default:** No

Line speed overlay

Applies to:				Line drive

Use: If this parameter is set to *Yes*, the actual line speed signal is overlayed to the PID controller output. This will increase controller dynamics significantly. Refer to „13.2 Setup of line speed overlay“

Range: No, Yes **Default:** No

Influence of PID

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: If pilot control or line speed overlay is activated, this parameter defines the percentage participation of the PID controller which will be added to the pilot control or line speed signal.
„10%“ means 10% of the maximum output signal.
If parameter *Output limit* is set to less than 100% the influence value stored here should be adjusted accordingly.
If pilot control or line speed overlay is not activated, the effective influence of PID is 100%, regardless of this parameter.

Range: 0.1 to 100 **Default:** 100.0

Increment: 0.1 **Unit:** [%]

PID-configuration

Applies to:		Unwind drive	Winding drive	Line drive

Use: This parameter determines if the controller is operated as a PI or as a PID controller. If it is operated as a PI controller, the parameters *Derivative D1...D4* are ineffective.

Range: PI, PID **Default:** PI

Notice: If parameter *control mode* is set to *unwind brake*, the controller acts as a PI controller in any case.

Proportional P1 / P2 / P3 / P4

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: The P value determines the behaviour of the „P“ component of the controller. If the value stored here is 1.00 the P controller will produce an output signal of 0.5V or 0.5mA at a control error of 100N.
This parameter can be changed while the controller is enabled. The new value is taken for the control loop when quit parameter mode.
There are 4 different P values available (P1...P4). The BCD digital inputs are used for switching (ref. to „9.7 Switching the control parameters“).

Range: 0.01to 100.00 **Default:** 1.00

Increment: 0.01 **Unit:** [-]

Integral I1 / I2 / I3 / I4

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: The I value determines the behaviour of the „I“ component of the controller. If the value stored here is 1.00 the I controller will produce an output signal changement of 1V/s or 1mA/s at a control error of 100N.
This parameter can be changed while the controller is enabled. The new value is taken for the control loop when quit parameter mode.
There are 4 different P values available (P1...P4). The BCD digital inputs are used for switching (ref. to „9.7 Switching the control parameters“).

Range: 0.01to 100.00 **Default:** 1.00

Increment: 0.01 **Unit:** [s]

Derivative D1 / D2 / D3 / D4

Applies to:		Unwind drive	Winding drive	Line drive

Use: The D value determines the behaviour of the „D“ component of the controller.
This parameter can be changed while the controller is enabled. The new value is taken for the control loop when quit parameter mode.
There are 4 different P values available (P1...P4). The BCD digital inputs are used for switching (ref. to „9.7 Switching the control parameters“).

Range:	0.001	to	10.000	**Default:**	0.010
Increment:	0.001			**Unit:**	[s]

Error limit

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: This parameter allows to hold the feedback value fed to the controller within a defined range. Feedback values exceeding this range are limited to the range. Thus extreme peaks of the control output value are avoided in case of high variations of the tension feedback value (i.e. with rough running reels). This allows to set the PID parameters more sensitive even in case of poor machine conditions. The feedback value in the display is not modified with this parameter.
The percentage refers to the tension reference value. For example a setting of *80%* with a reference value of 100N limits the feedback value to ±80N max.
If the parameter is set to *100%* the function is disabled.

Range:	1.0	to	100.0	**Default:**	100.0
Increment:	0.1			**Unit:**	[%]

Alarm control error

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: The digital output „Alarm control error“ and the LED „Alarm control error“ will be activated if the control error exceeds the tolerance set in this parameter.

Range:	0.1	to	100.0	**Default:**	10.0
Increment:	0.1			**Unit:**	[%]

Offset output

Applies to:	Unwind brake			

Use: If the brake is activated although the controller gives no signal to the brake, the faulty brake torque can be compensated here. The value stored here is active only if the controller is enabled.
„10%“ means 10% of the maximum current value (refer to parameter *Current limit*).

Range:	0.1 to	50.0	**Default:**	0.0
Increment:	0.1		**Unit:**	[%]

Current limit

Applies to:	Unwind brake			

Use: This parameter defines the range for the output signal. „80%“ refers to „±8V“ or „0...8V“ or „0...16mA“ or „4...16.8mA“, depending on parameter *Output config*. Due to that, a current limitation for the brake power can be realized indirectly.
For the CMGZ.B with integrated brake amplifier (optional) this parameter must be set according to the maximum current of the brake used. „100%“ refers to a maximum current of 2.0A; „87.5%“ refers to 1.75A max; „40%“ refers to 0.8A max, and so on.

Range:	10.0to	100.0	**Default:**	100.0
Increment:	0.1		**Unit:**	[%]

Output limit

Applies to:		Unwind drive	Winding drive	Line drive

Use: This parameter defines the range for the output signal. „80%“ refers to „±8V“ or „0...8V“ or „0...16mA“ or „4...16.8mA“, depending on parameter *Output configuration*.

Range:	0.1 to	100.0	**Default:**	100.0
Increment:	0.1		**Unit:**	[%]

Output configuration

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: With this parameter, you can choose the output signal. With setting „±10V“, the drive unit can run and brake both in forward and reverse direction. With the other settings, the drive unit can only run and brake in forward direction.
FMS recommends setting to „±10V“ if the used drive unit supports this signal. However, for a brake the other settings are preferred.

Range: ±10V, 0...10V, 0...20mA, 4...20mA **Default:** ±10V

Note: The setting of this parameter must match with the jumper of the analogue output (ref. to „19.2 Jumper for the analogue inputs / outputs“).

Position of line drive

Applies to:				Line drive

Use: The output value of the controller depends on the line drive being mounted before or after the force sensors (ref. to fig. 1). Depending on the position, the polarity of the output value is different.

Range: After sensor, Before sensor **Default:** After sensor

Ramp diameter

Applies to:	Unwind brake	Unwind drive	Winding drive	

Use: To optimize the controller against disturbances, the diameter should not change too fast. For this, the diameter signal is led internally to a ramp. Its rate of rise is defined using this parameter. The length of the ramp defines the time the diameter will take for a change of 1mm.

Range: 0.1 to 60.0 **Default:** 1.0

Increment: 0.1 **Unit:** [s]

Ramp reference

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: To optimize the controller against disturbances, the reference value should not change too fast. For this, the reference value signal is led internally to a ramp. Its rate of rise is defined using this parameter. The length of the ramp defines the settling time the reference will take to set to the new value.

Range: 0.1 to 20.0 **Default:** 1.0

Increment: 0.1 **Unit:** [s]

Reference source

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: If the reference value will be set using the operating panel or the interface, this parameter has to be set to *internal*. If the reference value will be set using a 0...10V signal led to the analog input, this parameter has to be set to *external*.

Range: Internal, External **Default:** Internal

Scale ref. input 1

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: This parameter defines which force value is assigned to a 10 V signal on the analog reference input if measuring range 1 is used (digital input „switch range“ = OFF).

Range: A force value can be input. The value consists of 4 digits. The position of the decimal point depends on the parameter *Force of sensor.*

Default: -

Unit: [N, kN, cN] or [lb, klb, clb]

Scale ref. input 2

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: This parameter defines which force value is assigned to a 10 V signal on the analog reference input if measuring range 2 is used (digital input „switch range“ = ON).

Range: A force value can be input. The value consists of 4 digits. The position of the decimal point depends on the parameter *Force of sensor.*

Default: -

Unit: [N, kN, cN] or [lb, klb, clb]

Torque in use?

Applies to:	Unwind brake			

Use: If this parameter is set to *no*, the output value will be 0V while the controller is disabled. When enabling the controller, the value set under parameter *holding torque* will be output. So, the controller starts from the holding torque value when enabling it.
If this parameter is set to *yes*, the output value will be as defined in parameter *Holding torque* constantly while the controller is disabled. So, the controller brakes all the time constantly with the holding torque while disabled. When enabling the controller, it starts from the holding torque and returns to the holding torque if the controller is disabled again.

Range: Yes, No **Default:** No

Holding torque

Applies to:	Unwind brake			

Use: This parameter defines the holding torque that is active during machine stopped. It has to be set in a way that the reel is hold during stop, but no material breakage can appear during start up.
If parameter *Torque in use* is set to *No* the holding torque will be output only when the controller is getting enabled.
If parameter *Torque in use* is set to *Yes* the holding torque is already output even the controller is disabled.
„10“ means „10%Out“, that is 10% of 10V = 1.0V.

Range: 0.0 to 100.0 **Default:** 0.0
Increment: 0.1 **Unit:** [%Out]

Taper function

Applies to:			Winding drive	

Use: This parameter defines the shape of the characteristic curve for the taper function (ref. to „12.4 Taper function“)
(To be developed – ask FMS customer service)

Range: No, Linear, Square, Root **Default:** No

Reduction factor

Applies to:			Winding drive	

Use: This parameter stores the reduction factor for the tension reduction. It corresponds to the relation from reduced tension (at Dmax) to normal tension (at Dmin) and is calculated using the following formula:

$$\text{Reduction factor} = \frac{\text{reduced tension at Dmax [N]}}{\text{normal tension at Dmin [N]}}$$

(To be developed – ask FMS customer service)

Range: 0.000 to 1.000 **Default:** 0.000
Increment: 0.001 **Unit:** [-]

Start speed

Applies to:		Unwind drive	Winding drive	

Use: If the material is hanging loosely during enabling the controller, the controller would rewind the material with maximum speed to build the needed material tension. The drive unit then cannot brake fast enough, and cracking of the material can be the result. Therefore, the controller runs with a low speed stored in parameter *Start speed* until an initial material tension stored in parameter *Start limit* is reached.
„10“ refers to 10% of the maximum output value, depending on parameter *Output configuration*.
If the parameter *Output configuration* is set to *±10V*, the value stored here is output with negative sign (for ex. 5% will result in an output signal of –0.5V)

Range:	0.00to	100.00	**Default:**	0.00
Increment:	0.01		**Unit:**	[%Out]

Start limit

Applies to:		Unwind drive	Winding drive	

Use: Description and function see *Start speed*.
„10“ refers to 10% of the reference value [N].

Range:	0.0 to	100.0	**Default:**	0.0
Increment:	0.1		**Unit:**	[%F_ref]

Tacho voltage

Applies to:				Line drive

Use: This parameter stores the number of rotations which will generate 1V tension on the tacho generator. The value is used to calculate the line speed overlay function.

Range:	1 to	1000	**Default:**	100
Increment:	1		**Unit:**	[rpm/V]

Controlled drive

Applies to:				Line drive

Use: This parameter stores the number of rotations of the drive roller if it is driven by a speed signal of 1V. The value is used to calculate the line speed overlay function.

Range:	10 to	1000	**Default:**	300
Increment:	1		**Unit:**	[rpm/V]

Tacho diameter

Applies to:

			Line drive

Use: This parameter stores the diameter of the tacho roller. It is used for the line speed overlay function.

Range: A diameter value can be input. The value consists of 4 digits.

Unit: [mm] or [inch]

Center diameter

Applies to:

		Winding drive	Line drive

Use: This parameter stores the diameter of the drive roller. It is used for the line speed overlay function and for the taper function.

Range: A diameter value can be input. The value consists of 4 digits.

Unit: [mm] or [inch]

Max. diameter

Applies to:

		Winding drive	

Use: This parameter stores the diameter of the fully winded reel (Dmax). It is used for the taper function.

Range: A diameter value can be input. The value consists of 4 digits.

Unit: [mm] or [inch]

14.6 Service Mode

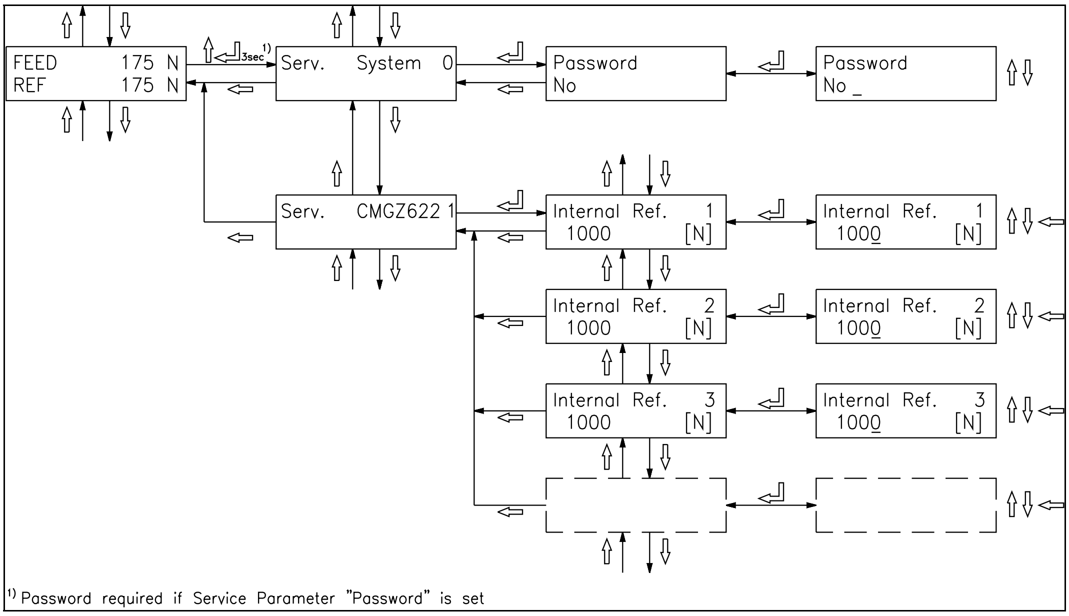

fig. 20: Service Mode Overview C622007e

The service mode contains internally used values. These need usually no modification. However, they could be helpful while trouble shooting. Each function module has its own set of service parameters.

> **Note**
> Bad setting of the service mode parameters may result in heavy malfunctions! Therefore, these settings should be made by specially trained personnel only!

The service mode is activated by pressing the ↑ and ↵ keys for 3 seconds. Generally the service mode parameters can be modified the same way as the other parameters.

Password			
Use:	This parameter defines if a password is required to access the parameters and several special functions. This allows enhanced security against modifications. The password is „3231“.		
Range:	No, Yes	**Default:**	No

Internal reference 1 / 2 / 3 / 4

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: This parameter stores the internal reference value given with special function *Edit ref. value*.
There are 4 different reference values available, depending on the control parameter set which is active. The BCD digital inputs are used for switching (ref. to „9.7 Switching the control parameters“).

Range: A force value can be input. The value consists of 4 digits. The position of the decimal point depends on the parameter *Force of sensor*.

Unit: [N, kN, cN] or [lb, klb, clb]

Cal. dia. val 1

Applies to:	Unwind brake	Unwind drive	Winding drive	

Use: This parameter stores the first diameter value given with special function *Adjust diameter*.

Range: A diameter value can be input. The value consists of 4 digits.

Unit: [mm] or [inch]

Cal. dia. signal 1

Applies to:	Unwind brake	Unwind drive	Winding drive	

Use: This parameter stores the first voltage value given with special function *Adjust diameter*.

Range:	0.00to	10.00	**Default:**	0.00
Increment:	0.01		**Unit:**	[V]

Cal. dia. val 2

Applies to:	Unwind brake	Unwind drive	Winding drive	

Use: This parameter stores the second diameter value given with special function *Adjust diameter*. Description and function otherwise identical with *Cal.dia.val 1*.

Cal. dia. signal 2

Applies to:	Unwind brake	Unwind drive	Winding drive	

Use: This parameter stores the second voltage value given with special function *Adjust diameter*. Description and function otherwise identical with *Cal.dia.signal 1*.

Pilot output

Applies to:	Unwind brake	Unwind drive	Winding drive	

Use: This parameter stores the required torque as a percentage of the maximum output value. The value is determined with special function *Adjust pilot control*.

Range:	0 to 100	**Default:**	0
Increment:	1	**Unit:**	[%]

Pilot reference

Applies to:	Unwind brake	Unwind drive	Winding drive	

Use: This parameter stores the reference value corresponding to the parameter *Pilot output*. The value is determined with special function *Adjust pilot control*.

Range: A force value can be input. The value consists of 4 digits. The position of the decimal point depends on the parameter *Force of sensor*.

Unit: [N, kN, cN] or [lb, klb, clb]

Pilot diameter

Applies to:	Unwind brake	Unwind drive	Winding drive	

Use: This parameter stores the diameter at which the adjustment of pilot control was done. The value is determined with special function *Adjust pilot control*.

Range: A diameter value can be input. The value consists of 4 digits.

Unit: [mm] or [inch]

15 Serial Interface (RS232)

(Optional)

16 PROFIBUS Hardware Interface Description

16.1 Wiring of the PROFIBUS Data Cable

Wiring of the PROFIBUS cables

The standardized PROFIBUS cable type A (STP 2x0.34^2) [AWG] has to be used for the PROFIBUS data cable. The cables are bared referring to fig. 6 and connected to the terminals according to the wiring diagramm.

The shield is connected with the bracket to the shoulder inside the housing.

Caution

The shield of the PROFIBUS cable is only grounded if the bracket inside the housing clamps directly to the shield If the bracked clamps to the plastic mantle, no grounding is done! Therefore the plastic mantle has to be fixed only with the PG gland (referring to fig. 6)

Termination

If both cables are connected (Bus in and Bus out), if has to be ensured that the two termination dip switches are in off position.

If only one cable is connected (Bus in), both termination dip switches have to be set in on position.

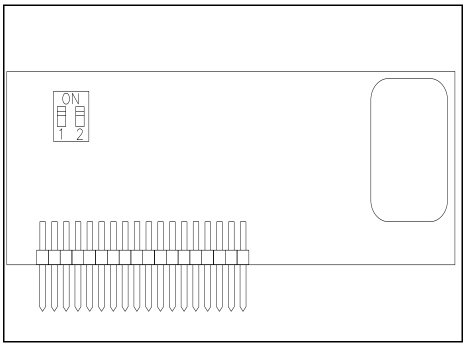

fig. 23: Profibus board E621009

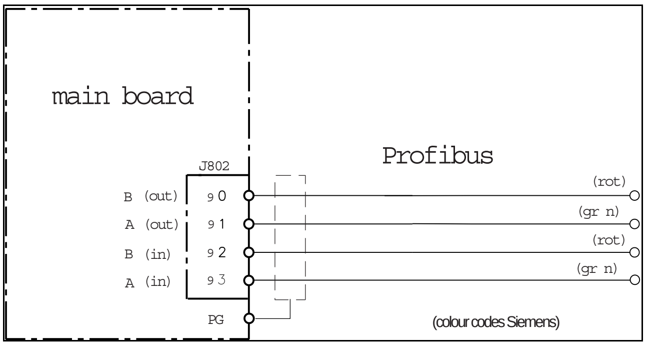

fig. 23A connection Profibus B600030e

Note

The PROFIBUS network has to be terminated properly. Otherwise the installation cannot be set into operation. It has to be ensured that only the last device of the PROFIBUS chain is terminated.

16.2 Setting the PROFIBUS Address

The tension controller requires a unique PROFIBUS address which indicates it definitely in the whole PROFIBUS network. Therefore no other PROFIBUS device in the network may use the same address. The address has to be between 2...125.

The PROFIBUS address is set with the system parameter *Identifier*. (See 14.4 Description of the system parameters). After switching the measuring amplifier off and on, the new address is valid.

17 PROFIBUS Interface Description

17.1 GSD File

The PROFIBUS DP Master has to know which devices are connected to the PROFIBUS network. For this purpose the GSD file is required. The GSD file for the CMGZ600A-series tension controller can be taken fron the following internet address:
http://www.fms-technology.com/gsd
The GSD file can also be supplied on a floppy disk on request. In this case please contact FMS customer service.

Read in the GSD file into the PROFIBUS DP Master
How to read in the GSD file into the control system (DP Master) is depending on the used control system. For further information, refer to the documentation of the control system.

Note
The GSD-file version must match with the firmware version of the tension controller. Otherwise there may be problems while setup. Version numbers of firmware and GSD file are printed to the cover page of this operating manual.

17.2 CMGZ622A DP Slave Functional Description

The tension controllers of the CMGZ600A.P-series supports a PROFIBUS link which operates according to the PROFIBUS DP protocoll according to EN 50170. Hereby the tension controller operates as DP slave and the control system as DP Master. Several parameters have to be set and met by the control system.

17.3 Initial Parameters

Initial parameters are sent from the control system to the tension controller once while initialization. They are nomally set to a fixed value for a machine with the programming tool of the control system.
The first bytes of the parameter telegram are specified in the EN 50170 standard. an user segment of 4 bytes is defined manufacturer-specific for the tension controller

Byte	Use	Value	Meaning
0	initial parameter	0	(not used)
1		0	(not used)
2		0	(not used)
3		0	(not used)

17.4 Configuration

The configuration defines how many process data (byte and word) are sent during the cyclic communication from the control system to the tension controller and from the tension controller to the control system.
To ensure maximum flexibility using the tension controller, there are different modules supplied. in a single tension controller only one module can be set active at a time.

Module 1: Basic telegram
4 bytes (2 word) are transmitted from the control system to the tension controller and also 4 bytes (2 word) from the tension controller to the control system in each data cycle.

	Byte 0	Byte 1	Byte 2	Byte 3
request telegram (master → slave)	function code	channel number	empty	empty
response telegram (slave → master)	function code or error FFh	channel number	data (high byte)	data (low byte) or error code

Modul 2: Reserved

Modul 3: Basic telegram and 4 word operation value (CMGZ611A, CMGZ630A)
The tension controller responses with 4 bytes of the basic telegram and the 4 words (feedback, reference, control error, output).

	Byte 0	Byte 1	Byte 2	Byte 3
request telegram (master → slave)	function code	channel number	empty	empty
response telegram (slave → master)	function code	channel number	data (high byte)	data (low byte) or error code

Word 0	Word 1	Word 2	Word 3
Feedback (HB)/(LB)	Reference (HB)/(LB)	Controller Error (HB)/(LB)	Output (HB)/(LB)

Modul 4: Reserved

17.5 Function Code

Master → Slave

Function Values

Value	Meaning	Remarks
01h	Feedback	feedback tension controller
02h	Reference	reference tension controller
03h	Controller Error	controller error tension controller
04h	Output	output tension controller
07h	A/D-value brutto	A/D-value tension controller

The tension controller transmitt the response with the response telegram

17.6 Error Code

Master → Slave

Byte 0	Byte 3	Meaning
FFh	01h	invalid function code
FFh	02h	invalid channel number

18 Interface CAN-Bus

(Optional)

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19 Technical Reference

19.1 Additional Setting Elements

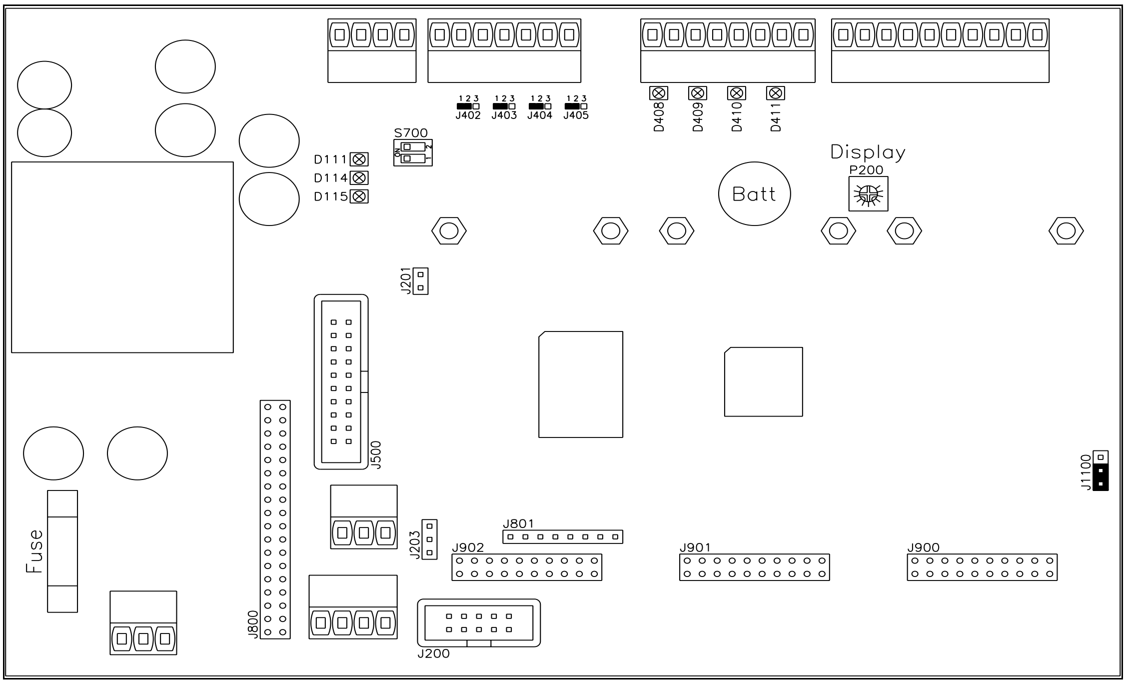

fig. 21 E600004e

Element	Function
D111	Status LED power supply: VCC ok
D114	Status LED power supply: +15VDC ok
D115	Status LED power supply: –15VDC ok
D408	Status LED dig. input 1
D409	Status LED dig. input 2
D410	Status LED dig. input 3
D411	Status LED dig. input 4
J200	(Reserved)
J201	(Reserved)
J203	(Reserved)
J402...405	Solder bridges for dig. output 1...4 (open collector)
J500	Add-on board for dig. I/O
J800	Socket subprint PROFIBUS
J801	(Reserved)
J900	Socket subprint channel 2
J901	Socket subprint channel 3
J902	Socket subprint channel 4
J1100	Configuration analog output channel 1
P200	LCD display contrast
S700	CAN Bus termination
Battery	Buffer battery for the internal clock
Fuse	Fuse of the power supply, 1A / 250V (fast blow)

19.2 Setting Elements on the Extension Board

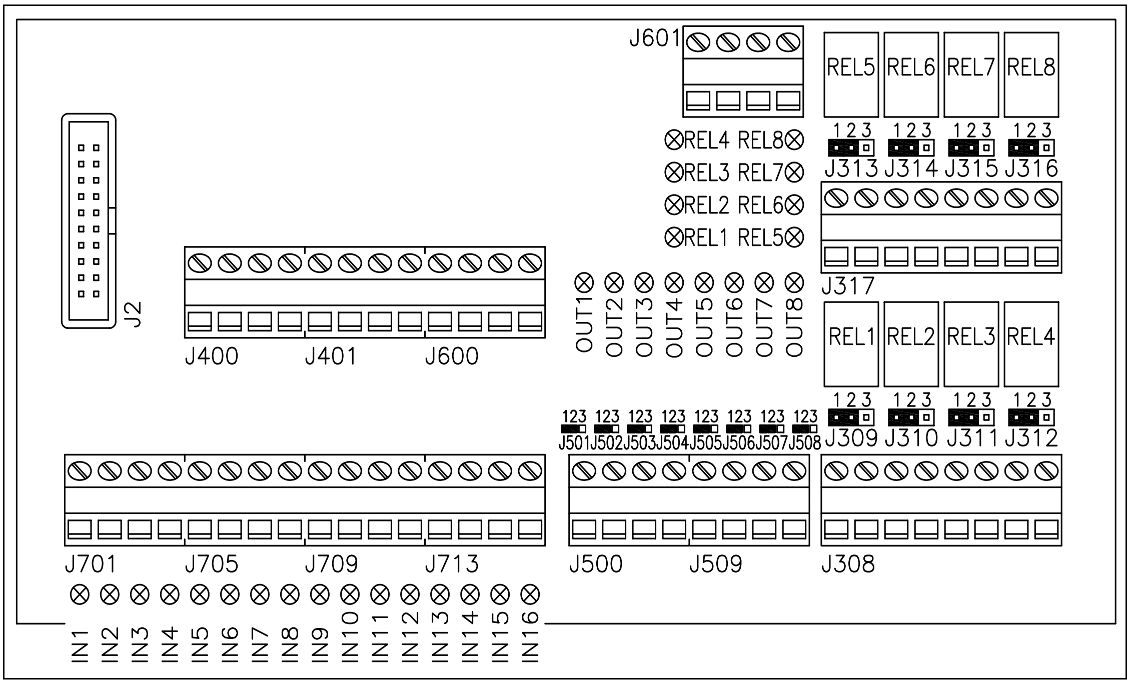

fig. 22 C600002

Element	Function
IN1...16	Status LED dig. input 1...16
OUT1...8	Status LED dig. output 1...8 (open collector)
REL1...8	Status LED and relay dig. output 9...16
J308 / J317	Terminal for dig. output 9...16 (relay)
J309...316	Jumper for dig. output 9...16 (relay)
J400 / 401	8 x Terminal +24VDC
J500 / J509	Terminal for dig. output 1...8 (open collector)
J501...508	Solder bridges for dig. output 1...8 (open collector)
J600 / 601	8 x Terminal Gnd
J701...713	Terminal for dig. input 1...16
J2	Ribbon cable to processor board

Setting of the relay contacts (jumper)

Jumper	Relay operates as „make contact“ (Default)	Relay operates as „break contact“
J309...316	1-2	2-3

19.3 Jumper for the Analogue Inputs / Outputs

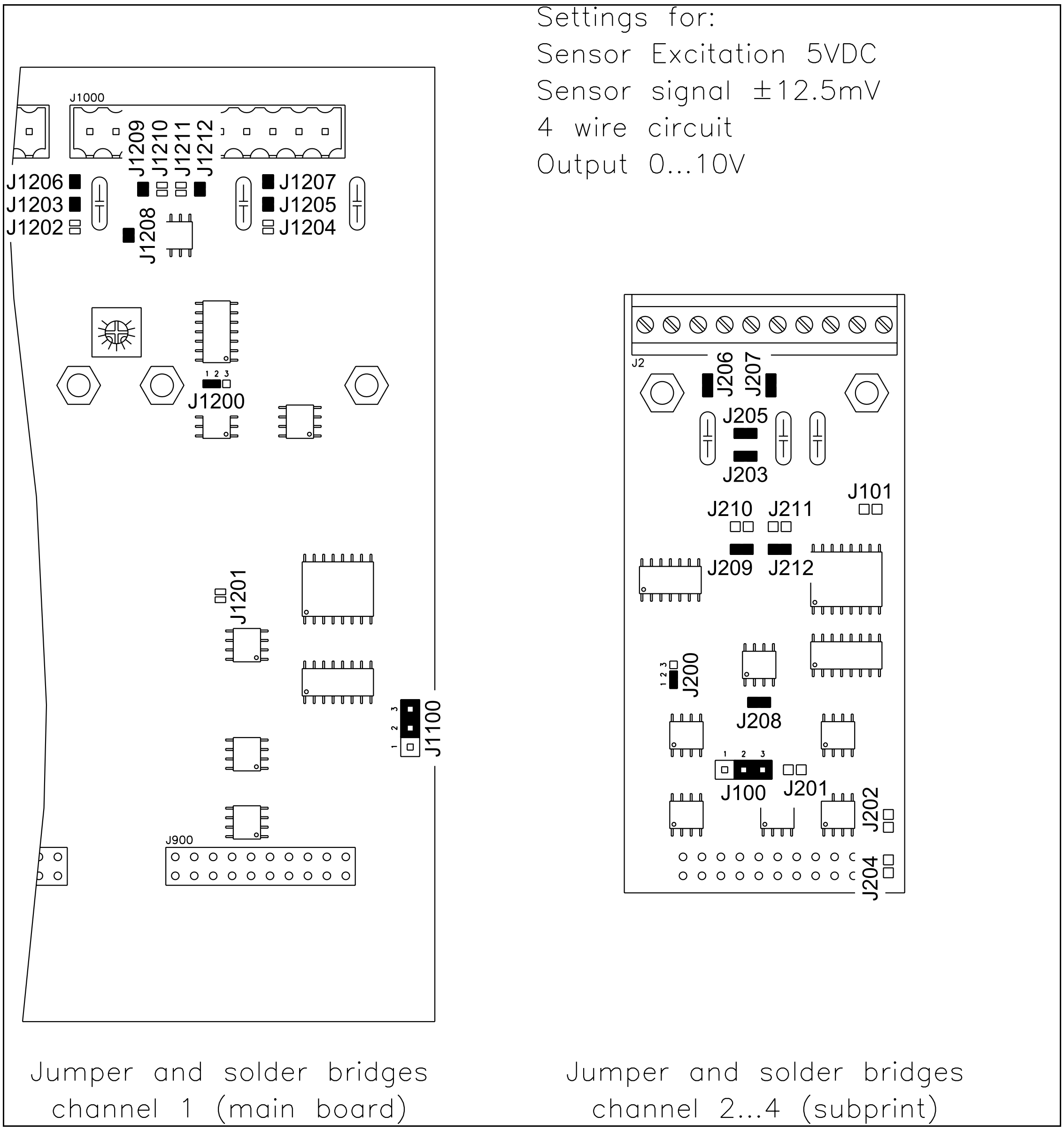

fig. 23: The jumpers and solder bridges show the settings for processing an FMS force sensor signal. E600005e

Caution

Wrong setting of the jumpers and solder bridges may cause malfunction of the electronic unit or the total system! Setting of the solder bridges and jumpers must be checked carefully prior to power on! Setting of the solder bridges should be carried out by trained personnel only!

Note

On the subprint, the solder bridges which are closed by default are made with small printed bridges. When opening the solder bridges the first time these printed bridges must be cut. Otherwise malfunction can be the result!

Setting the analog output (jumper)

Channel 1 (main board)	Channel 2...4 (subprint)	Analog output 0...10V (default)	Analog output ±10V
J1100	J100	2-3	1-2

Setting the sensor excitation (solder bridges)

Channel 1 (main board)	Channel 2...4 (subprint)	Sensor excitation		
		5VDC (default)	10VDC	24VDC
J1200	J200	**1-2**	**2-3**	**2-3**
J1201	J201	open	**closed**	**closed**
J1202	J202	open	open	**closed**
J1203	J203	**closed**	**closed**	open
J1204	J204	open	open	**closed**
J1205	J205	**closed**	**closed**	open

Setting the sensor signal (solder bridges)

Channel 1 (main board)	Channel 2...4 (subprint)	Sensor signal ±12.5 or ±25mV (default)		Sensor signal 0...10V
J1201	J201	open[1)]	**closed**[1)]	**closed**
J1208	J208	**closed**		open
J1209	J209	**closed**		open
J1210	J210	open		**closed**
J1211	J211	open		**closed**
J1212	J212	**closed**		open

[1)] Depending on sensor excitation, see above

Setting to 4 wire or 6 wire circuit (solder bridges)

Channel 1 (main board)	Channel 2...4 (subprint)	4 wire circuit (default)	6 wire circuit
J1206	J206	**closed**	open
J1207	J207	**closed**	open

Note

The jumpers and solder bridges are normally factory set and need no customization.

19.4 Technical Data

Number of measuring points	1
Connection of force sensors	2 parallel wired double range force sensors of 2 x 350Ω for each measuring point
Excitation of force sensors	5VDC (default) or 10VDC (with automatic current control)
Input signal voltage	0...9mV (max. 12.5mV) or 0...18mV (max. 25mV) (depending on force sensor excitation) 0...10V for analog reference input
Resolution A/D converter	±8192 Digit (14 Bit)
Measuring error	<0.05% FS
Cycle time	2ms
Operation	4 keys, 4 LED's, LCD display 2x16 characters (8mm height)
Analogue output channel 1...4	0...10V (default) / ±10V and 0...20mA (default) / 4...20mA (12 Bit)
Digital output 1...4	Open collector, max. 10mA, galvanically isolated, with recovery diode
Digital input 1...4	24VDC, galvanically isolated (signal must be on for min. 100ms)
Interface RS232	Optional
Interface PROFIBUS	PROFIBUS DP (EN50170), optional
Interface CAN-Bus	Optional
Interface DeviceNet	Optional
Power supply	24VDC (18...36VDC) / 10W (max. 1A)
Temperature range	0...45°C (32...113°F)
Weight	1.5kg (3.35lbs)

20 Trouble Shooting

If the electronic unit detects an error, a digital output is activated. In addition, the error state can be read by the interface.

20.1 General Trouble shooting

Error	Cause	Corrective action
„Alarm control error“ is displayed	The control error has exceeded the tolerance band set in parameter *Alarm limit error*	Enlarge parameter *Alarm limit error* or adjust PID control parameters more accurate and restart controlling (enable controller again)
Required parameters don’t show up	Parameter *Control mode* set wrong	Make parameter *Control mode* matching with your application
Display shows `not determinable`	A function can’t be performed at that time (i.e. wiring error)	Check wiring, parametrization and overall system shape
Feedback value of channel n is > 0 even though material is loose	Offset badly adjusted	Proceed again for offset adjustment of channel n
	Current output is set to 4...20mA	Adjust channel parameter *config. output* if a signal 0...20mA is required
	If current output shows 10...12mA: Jumper for tension output is set wrong	Set jumper for tension output of channel n to 0...10V
Feedback value of channel n is < 0 even though material is loose	Jumper for tension output is set wrong	Set jumper for tension output of channel n to 0...10V
Feedback value of channel n is not stable even though material tension doesn’t change	Cut off frequency of the filters set too high	Adjust cut off frequency (ref. to „9.9 Additional Settings“)
	Grounding (PE) not connected	Connect grounding (PE)
	Electrical interference on the cable to the force sensor	Check connection of the shield. Use one twisted pair for +signal and –signal (ref. to „8.3 Mounting the force sensors“)
Feedback value of channel n does not correspond with the	Gain badly adjusted	Proceed again for sensor calibration of channel n
	Feedback signal wrong scaled	Set parameter *scale instrument* to an appropriate value

Error	Cause	Corrective action
effective material tension	Sensor excitation set wrong	Check solder bridges for sensor excitation of channel n (ref. to „19.3 Jumper for the Analog Inputs / Outputs“)
	Sensor signal level set wrong	Check solder bridges for sensor signal of channel n (ref. to „19.3 Jumper for the Analog Inputs / Outputs“)
	If using 6 wire circuit: Solder bridges set wrong	Check solder bridges for 6 wire circuit of channel n (ref. to „19.3 Jumper for the Analog Inputs / Outputs“)
Limit switches do not work	Limit values wrong parametrized	Set parameters to appropriate values (ref. to „9.9 Additional settings“)
Dig. outputs do not work	Wiring error	Check wiring of the dig. outputs (open collector, ref. to wiring diagram)
`C.n Overcurrent`	Excitation of channel n detects overcurrent (short circuit)	Check force sensors and wiring of channel n
`C.n Cable break`	Excitation of channel n detects cable break	Check force sensors and wiring of channel n
`C.n HW error`	Hardware of channel n defect	Contact FMS customer service
	Subprint of channel n is not detected	Check if subprints are seated correctly (ref. to „19.1 Additional Setting Elements“) Contact FMS customer service
`Subprint missing contact FMS AG`	One or more subprints are missing or are not detected	Check if subprints are seated correctly (ref. to „19.1 Additional Setting Elements“) Contact FMS customer service
`System Error contact FMS AG`	Electronic unit defect	Contact FMS customer service
No message on the display	Display contrast setting is bad	Set display potentiometer P200 correctly (ref. to „19.1 Additional Setting Elements“)
	Fuse blown	Replace fuse (ref. to „19.1 Additional Setting Elements“)
	Power supply not correct	Check status LED’s of the power supply (D111...D115, ref. to „19.1 Additional Setting Elements“) Check / correct power supply

Error	Cause	Corrective action
	Electronic unit defect	Check status LED's of the power supply (D111...D115, ref. to „19.1 Additional Setting Elements“) Contact FMS customer service
Electronic unit does not answer to interface commands	The interfacesare not supported yet	Contact FMS customer service

20.2 Unwind Brake Trouble shooting

Error	Cause	Corrective action
Brake gives maximum torque („full braking“)	Controller is enabled, but material is not tight	Tighten the material carefully to build-up a material tension
	Using pilot control, the diameter signal gives „0“; diameter sensor defect	Check diameter sensor and wiring; replace if needed
Brake releases very slow and with great delay	Parameter *current limit* too high	Set parameter *current limit* correct depending on the brake used
Pilot control does not work as expected	Setup of pilot control failed	Repeat setup of pilot control, ref. to „10.3 Setup of pilot control“
Brake doesn't brake	Fuse blown on brake amplifier	Replace fuse on brake amplifier

20.3 Unwind Drive Trouble shooting

Error	Cause	Corrective action
Roller does stay when enabling the controller; ev. material cracking	Parameter *Start limit* set too high	Decrease parameter *Start limit*
Roller rewinds fast when enabling the controller; ev. material cracking	Parameter *Start limit* set too low	Increase parameter *Start limit*
	Parameter *Start speed* set too high	Decrease parameter *Start speed*
Roller unwinds much too fast when enabling the controller	Using pilot control: The diameter signal gives „0“; diameter sensor defect	Check diameter sensor and wiring; replace if needed
Pilot control does not work as expected	Setup of pilot control failed	Repeat setup of pilot control, ref. to „10.3 Setup of pilot control“

20.4 Winding Drive Trouble shooting

Error	Cause	Corrective action
Roller does stay or winds too slow when enabling the controller	Parameter *Start speed* set too low	Increase parameter *Start speed*
	Parameter *Start limit* set too high	Decrease parameter *Start limit*
Roller winds fast when enabling the controller; ev. material cracking	Parameter *Start limit* set too low	Increase parameter *Start limit*
	Parameter *Start speed* set too high	Decrease parameter *Start speed*
Roller winds much too fast when enabling the controller	Using pilot control: The diameter signal gives „0“; diameter sensor defect	Check diameter sensor and wiring; replace if needed
Pilot control does not work as expected	Setup of pilot control failed	Repeat setup of pilot control, ref. to „10.3 Setup of pilot control“

20.5 Line Drive Trouble shooting

Error	Cause	Corrective action
Roller does stay when enabling the controller; ev. material cracking	Using line speed overlay: The line speed signal gives „0“; tacho generator defect	Check tacho generator and wiring; replace if needed
Roller rewinds fast when enabling the controller; ev. material cracking	Parameter *Pos. line drive* set wrong	Change parameter *Pos. line drive*
Line speed overlay does not work as expected	Setup of Line speed overlay failed	Repeat setup of Line speed overlay, ref. to „13.2 Setup of Line speed overlay“

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