Operating Manual

CMGZ 611A/612A/630A/ACV

and

CMGZ6xx with Brake Amplifier

Digital Microprocessor Controlled Tension Controller

Version 1.35 01/2011 ff

Firmware Version: 2.12 and 3.01
Hardware Rev. D
GSD 1.03

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.

Table of Contents

1 Safety Instructions

1.1 Description Conditions

High danger of health injury or loss of life

Danger

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

Risk of damage to machines

Caution

This symbol refers to risk of heavy mechanical damage. This warning has to be followed absolutely.

Note for proper function

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

The Tension Controller has no built-in „Emergency Stop“ function. However it 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.

Some of the wire terminals in the power supply board of the CMGZ6xx.W.ACV and CMGZ6xx.W.B.ACV controllers are under a tension of 85-264 VAC. Mortal danger! Only specially instructed and qualified personnel should handle this controller unit. In any case the power supply must be disconnected from the main supply before opening the housing.

Proper function of the electronic unit is only guaranteed with the recommended application of the components. In case of an 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 operation manual. However, they have to be followed strictly.

Bad earth ground 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 ground 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! Operators handling the processor board must wear a well earthed bracelet in order to discharge static electricity.

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

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

3.1 System Components CMGZ611A

A CMGZ611A tension control system consists of the following components (ref. to fig. 1):

Force sensors

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

Electronic unit CMGZ611A

- 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
- With operation panel for parametrization
- With robust aluminium housing
- Supports connection of external feedback displays
- Interface RS232
- *Interface CAN-Bus, PROFIBUS, DeviceNet*
- *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*

(Variants or options are indicated in italic text)

4 System Description

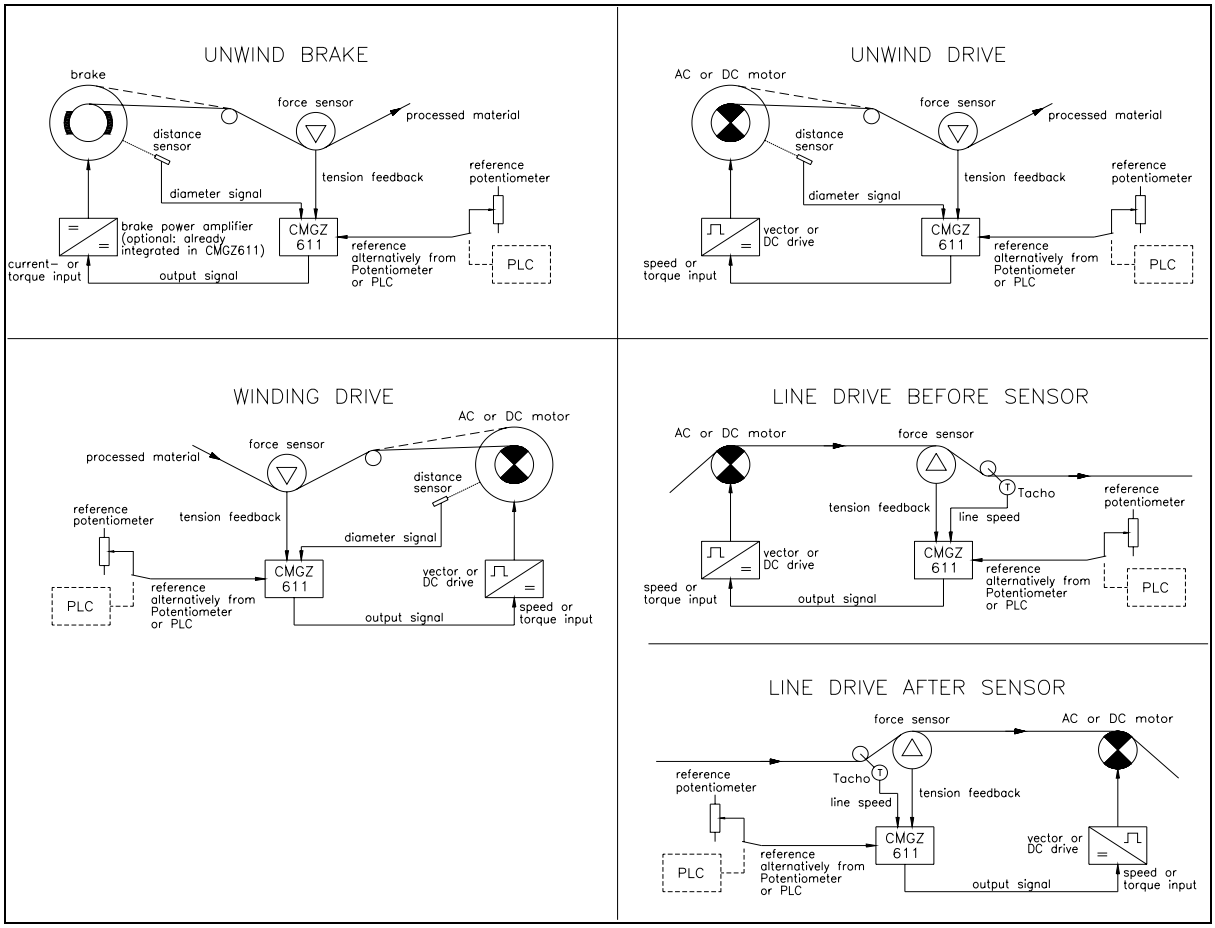

fig. 1: Basic structures of the CMGZ611A configurations C611001e

4.1 Functional Description

The force sensors measure the tension force in the material and transmit the measuring value as a mV signal to the electronic control unit. The electronic control unit amplifies the mV signal and calculates the error to the reference value. If the material tension deviates too much, the brake or the drive will be activated more or 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 CMGZ611A

Common

The electronic unit is mounted in a robust aluminium housing. It contains a microprocessor to handle all calculation and communication processes, a highly accurate sensor power supply and signal amplifiers for up to two measuring points. The electronic unit does not require trimming to maintain its accurate long-time 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 can be paramterized. The parametrization can be done via the keys or the interfaces. All inputs are stored fail-safely in an EEPROM.

Strain gauge amplifier

The strain gauge amplifier generates the highly accurate supply voltages (5VDC, 10VCD or 24VDC) for 1 or 2 force sensors. The force sensors can be wired using a 4 wire or 6 wire circuitry. This allows accurate control of the bridge excitation even with very long cables.
The power supply contains a current-mode control. This allows to detect short circuit or cable breaks automatically and to initiate an error message if required.
A highly accurate differential amplifier rises the mV signal up to 10V. This signal will be fed to the A/D converter. The microprocessor does then all application specific calculations such as offset, gain, low-pass 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 can be 0...10V, ±10V, 0...20mA or 4...20mA, depending on the configuration.
With a diameter sensor or other source, a 0...10V signal proportional to the actual reel diameter can be fed to the controller. For winder applications, 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

As an option there are RS232, PROFIBUS or CAN-Bus interfaces available.

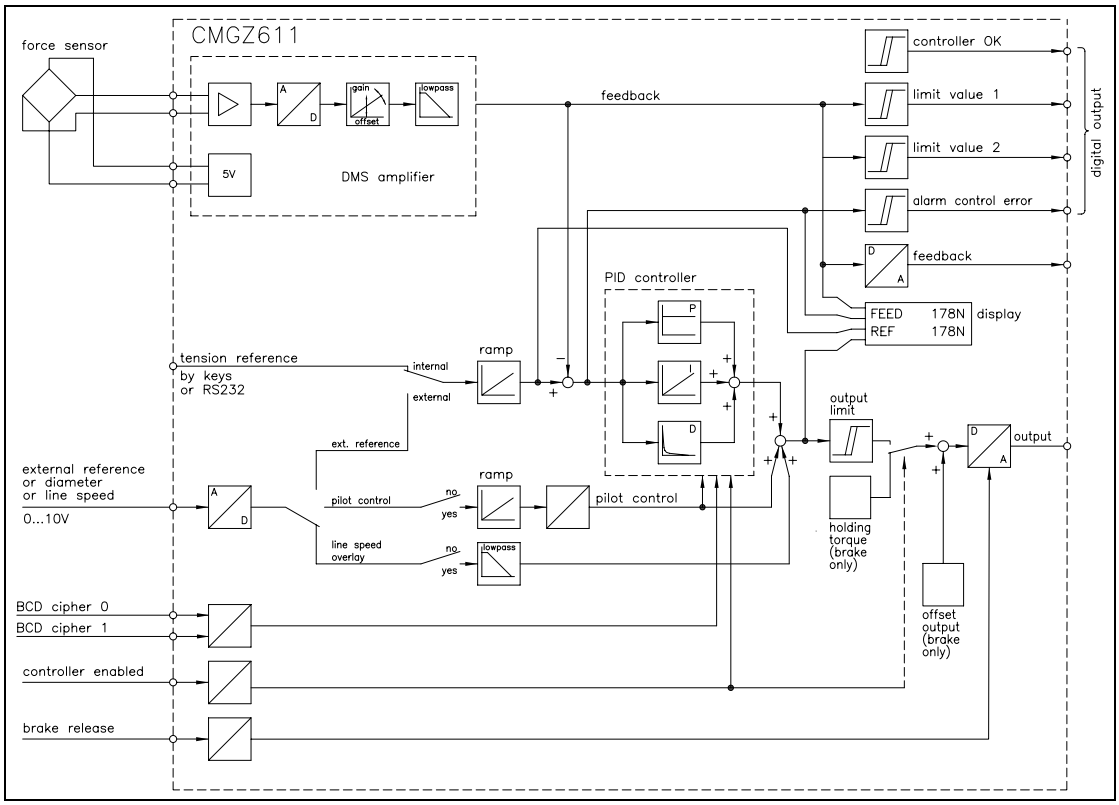

fig. 2: Block diagram of the electronic unit CMGZ611A C611012e

4.4 Electronic Unit CMGZ612A

The electronic unit CMGZ612A differs from the CMGZ611A by the possibility to process two independent control loops with one measuring point each. The strain gauge amplifier and PID controller sections are integrated separately for each measuring point.

4.5 Electronic Unit CMGZ630A

The electronic unit CMGZ630A differs from the CMGZ611A by having a total of two additional analogue inputs for processing external reference value and correction input simultaneously.

4.6 Electronic Unit CMGZ6XX.ACV

The electronic unit CMGZ6XX.ACV includes a separate power supply that supports voltage of 85V up to 264V. It transforms the AC input voltage into DC 24V for the internal system components.

4.7 Power Amplifier and Brake

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 or pneumatic brake can be used.

4.8 Drive and Motor

AC or DC four quadrant drives that are suited to the dynamic requirements and to the motor can be used.

5 Controller Theory

5.1 Tension Control Loops

When manufacturing or 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.

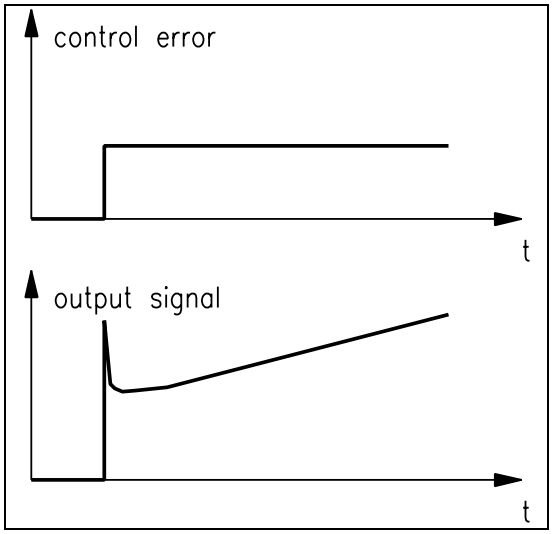

fig 3: Step response of a PID controller
C432003e

„P“ component
A controller with only a proportional component emits 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 characteristic value of a „P“ controller is 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 analogue 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“)
- Perform 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 „9.9 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 „9.10 Additional settings“)
- CMGZ612A: Repeat the steps written above for the second measuring point and the second control loop.

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 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

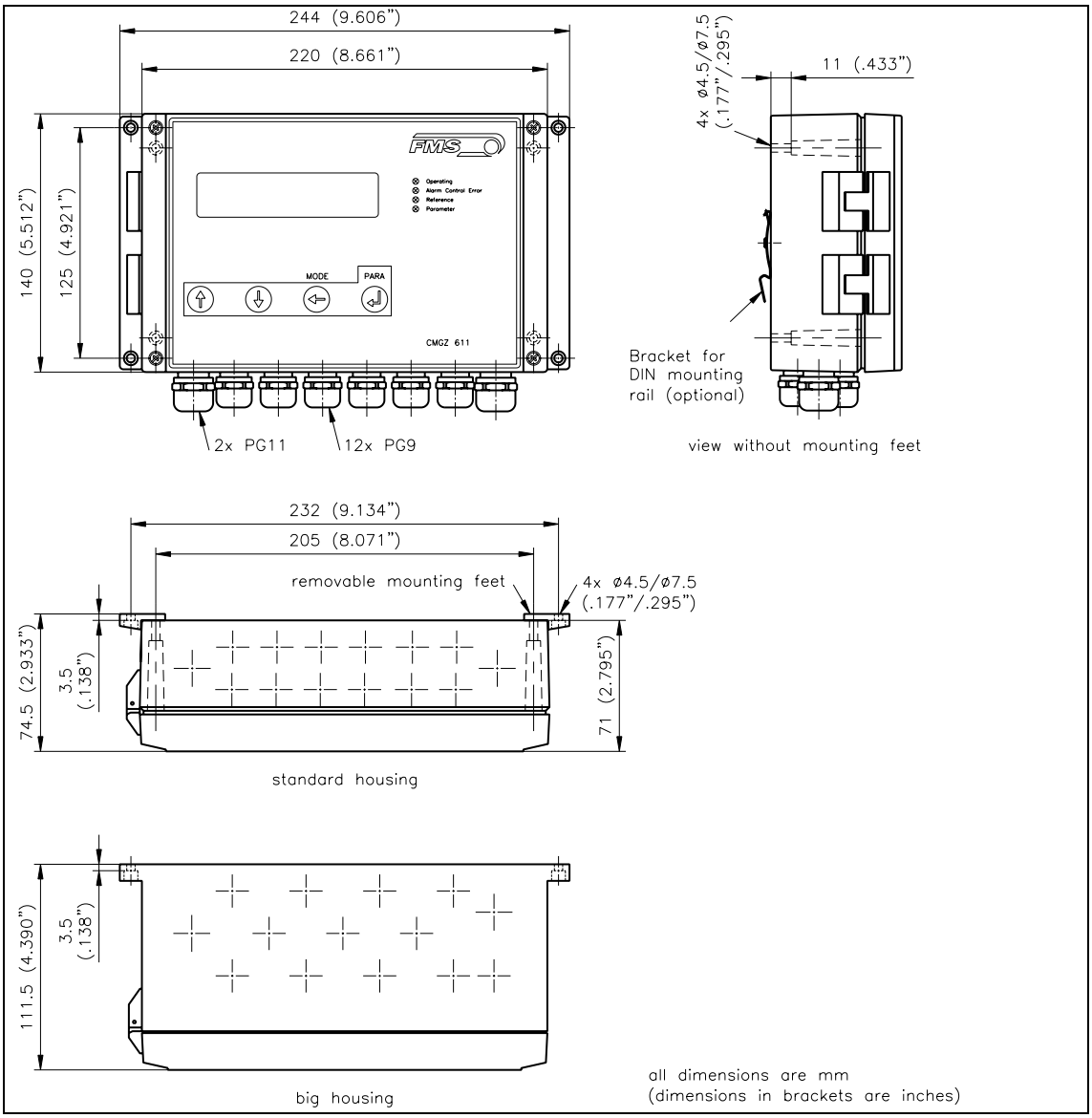

fig. 4: Dimensions C600005e

Type	Housing size
CMGZ611A	standard
CMGZ611A.B	big
CMGZ612A	big
CMGZ630A	standard
CMGZ630A.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 have a good earth connection.

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...12).

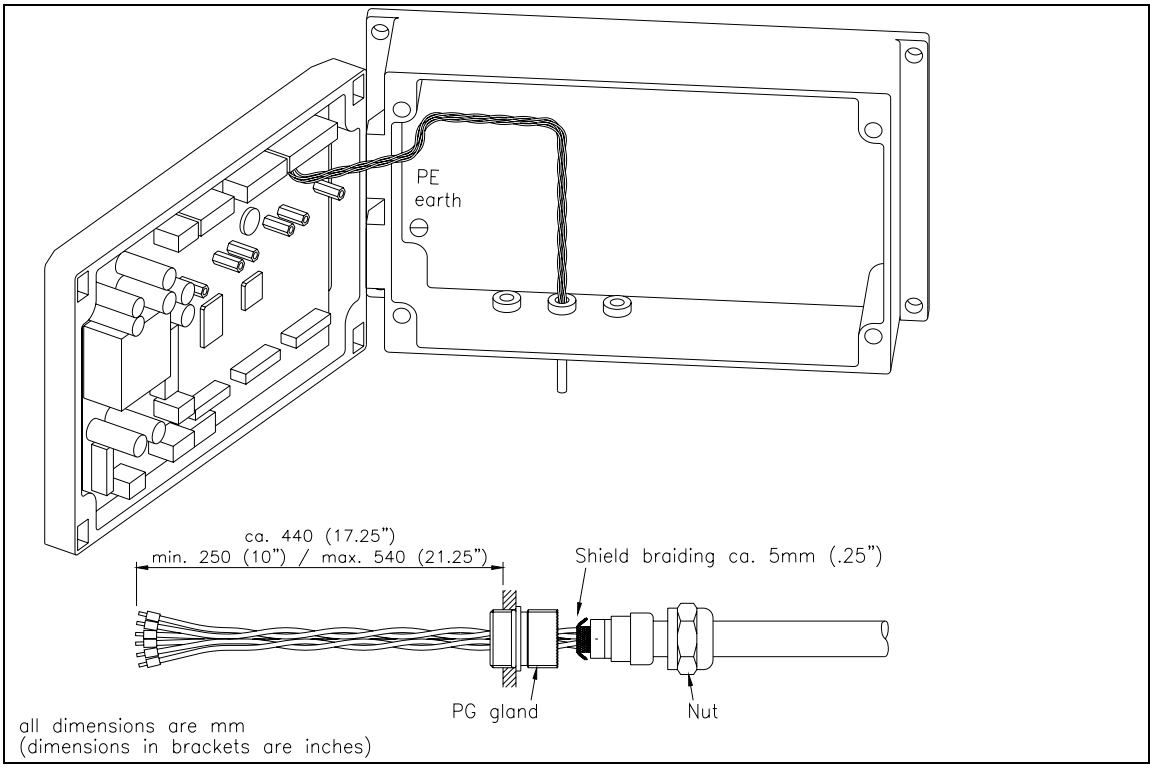

fig. 5: Wiring path inside the housing E600011e

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! Operators handling the processor board must wear a well earthed bracelet in order to discharge static electricity.

Danger

Some of the wire terminals in the power supply board of the CMGZ6xx.W.ACV and CMGZ6xx.W.B.ACV controllers are under a tension of 85-264 VAC. Mortal danger! Only specially instructed and qualified personnel should handle this controller unit. In any case the power supply must be disconnected from the main supply before opening the housing.

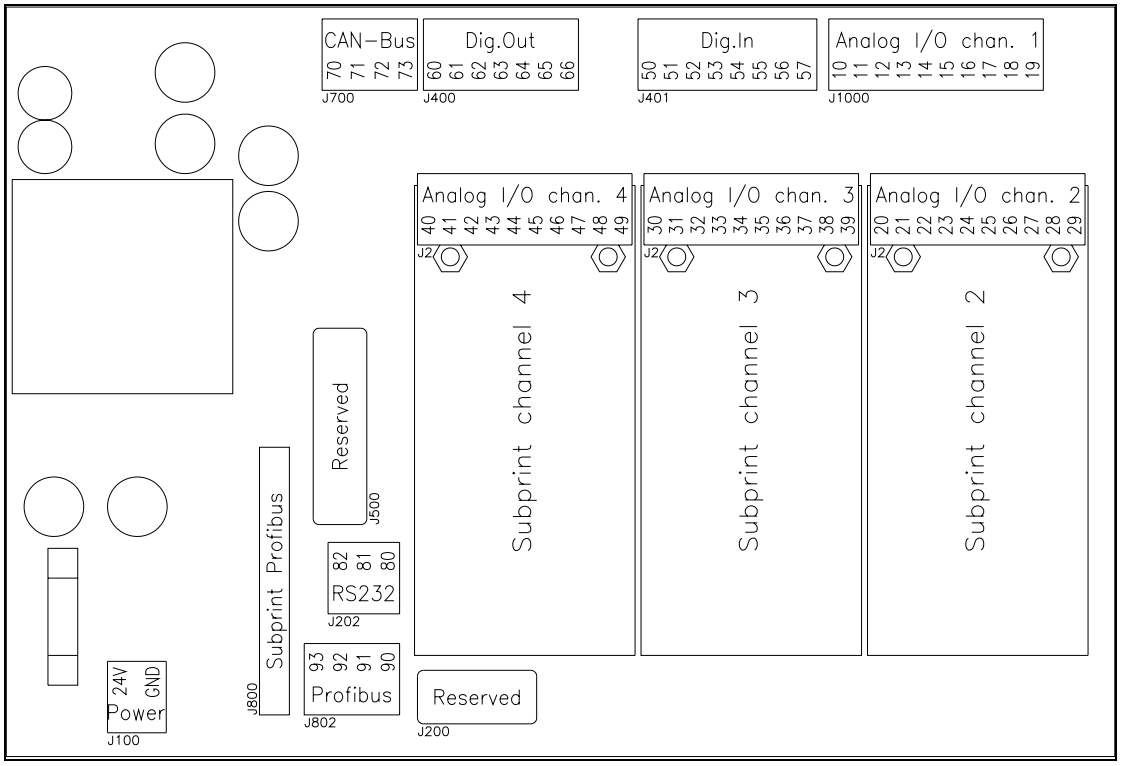

fig. 6: Screw terminal arrangement on the electronic unit E600012e

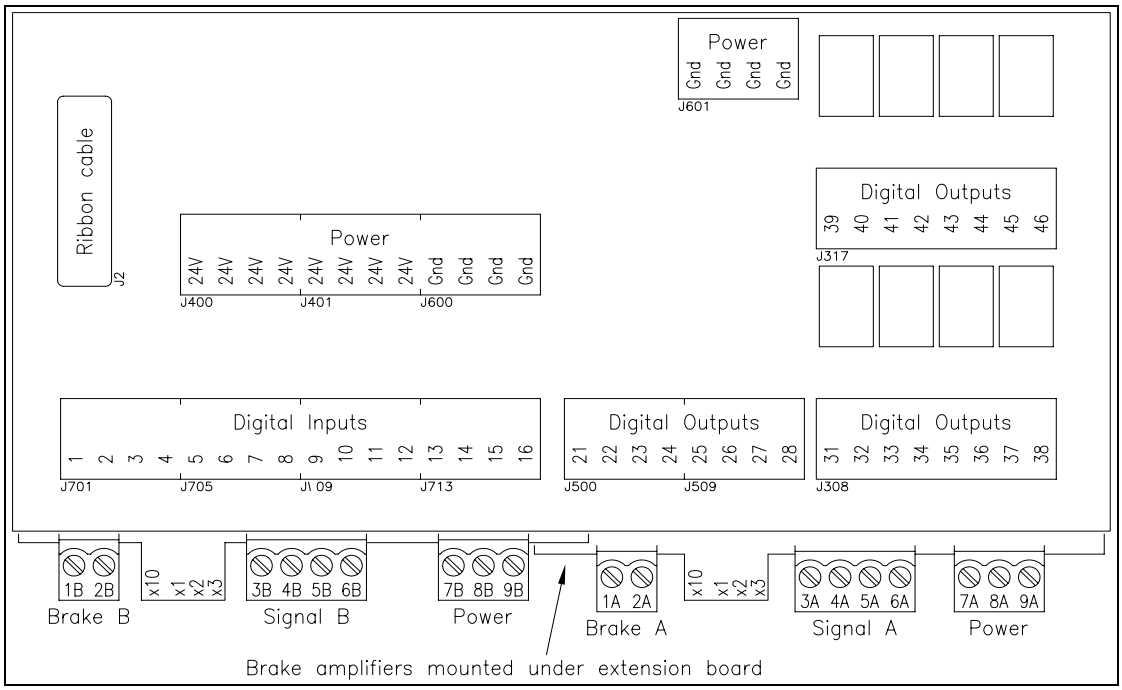

fig. 7: Screw terminal arrangement on the extension board and the brake amplifier

C600016e

8.2 Wiring Diagram CMGZ611A

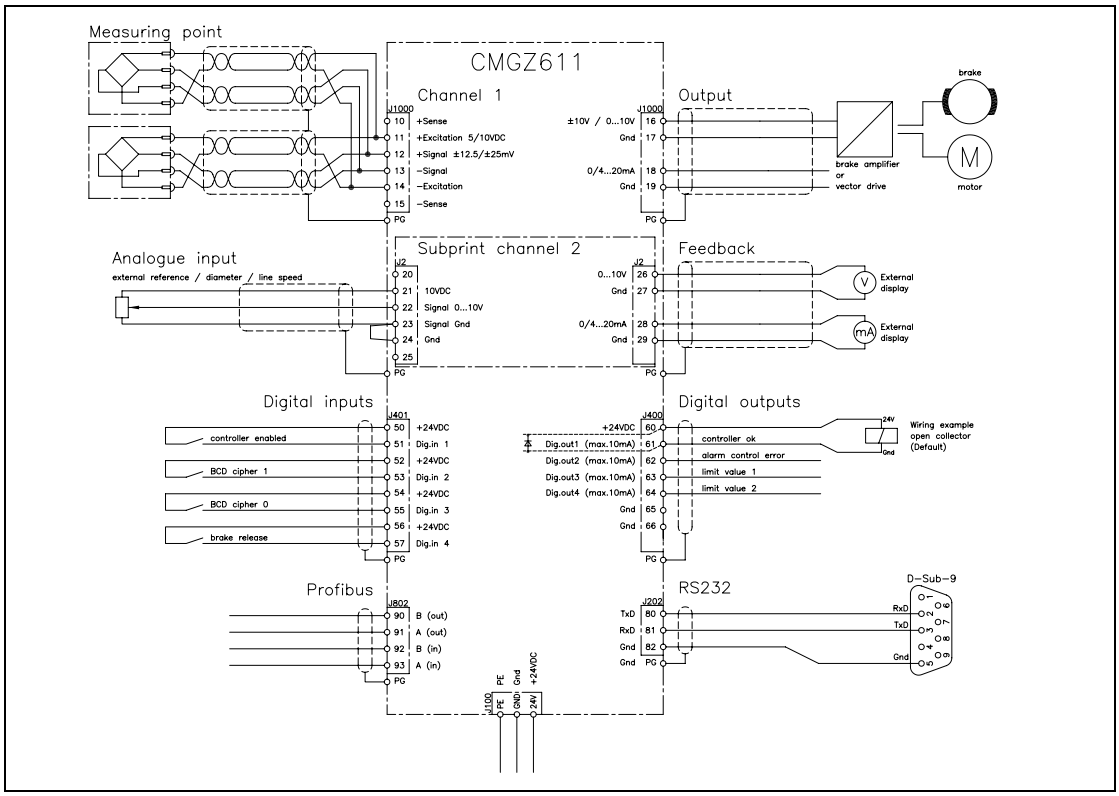

Fig.8: Wiring diagram CMGZ611A C611011e

8.3 Wiring Diagram CMGZ612A

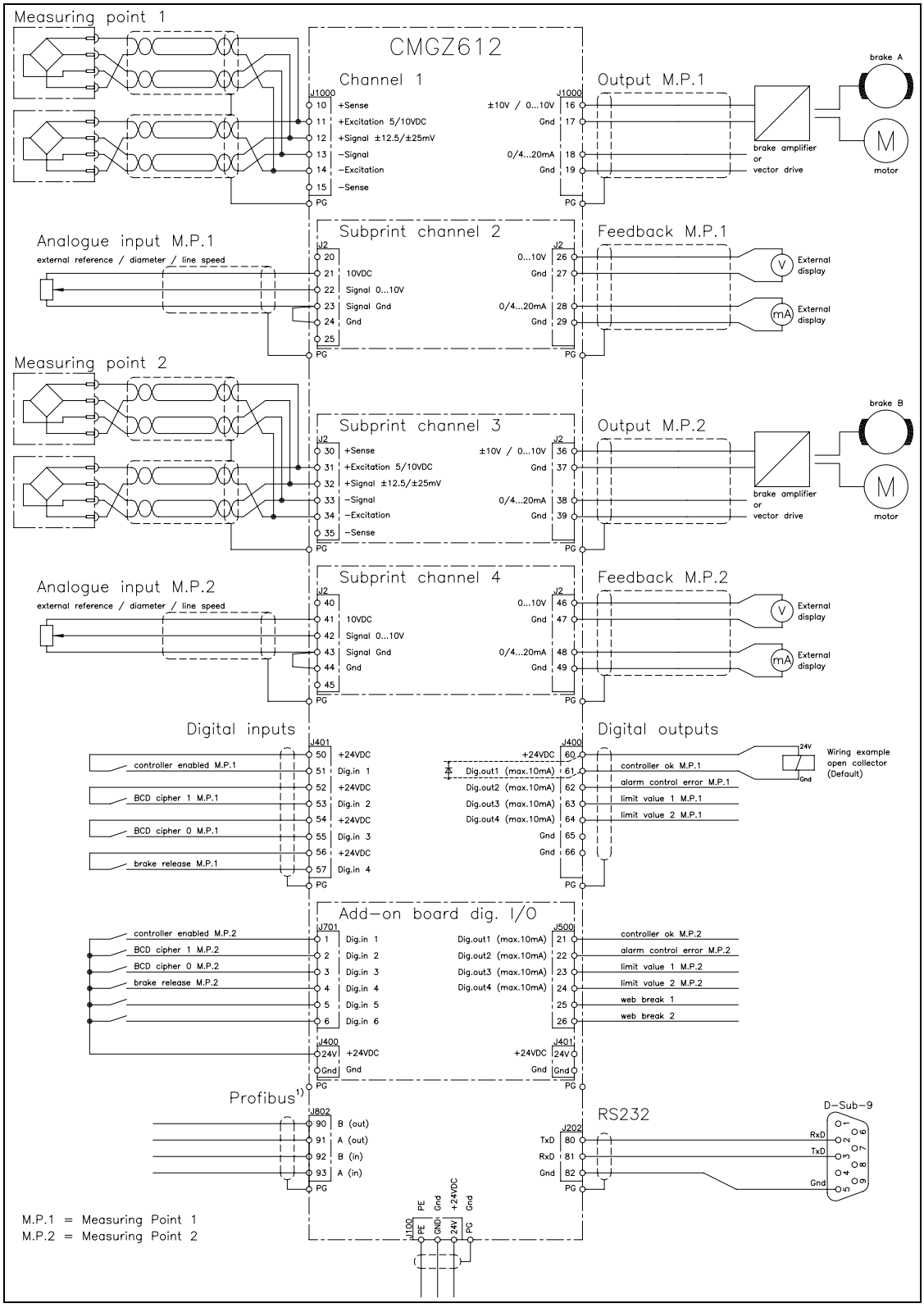

fig. 9: Wiring diagram CMGZ612A C612007e

8.4 Wiring Diagram CMGZ630A

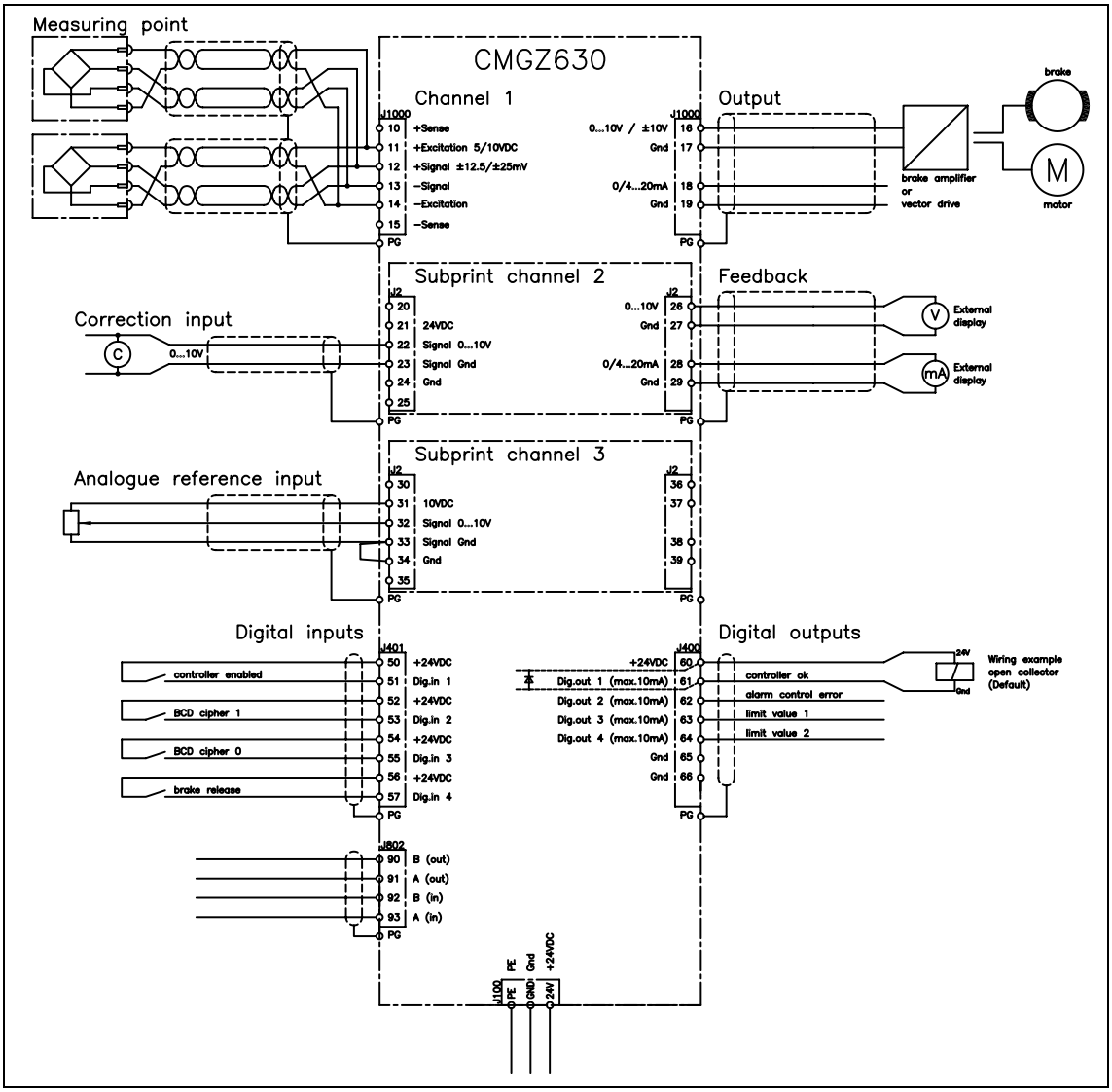

fig. 10: Wiring diagram CMGZ630A C630001e

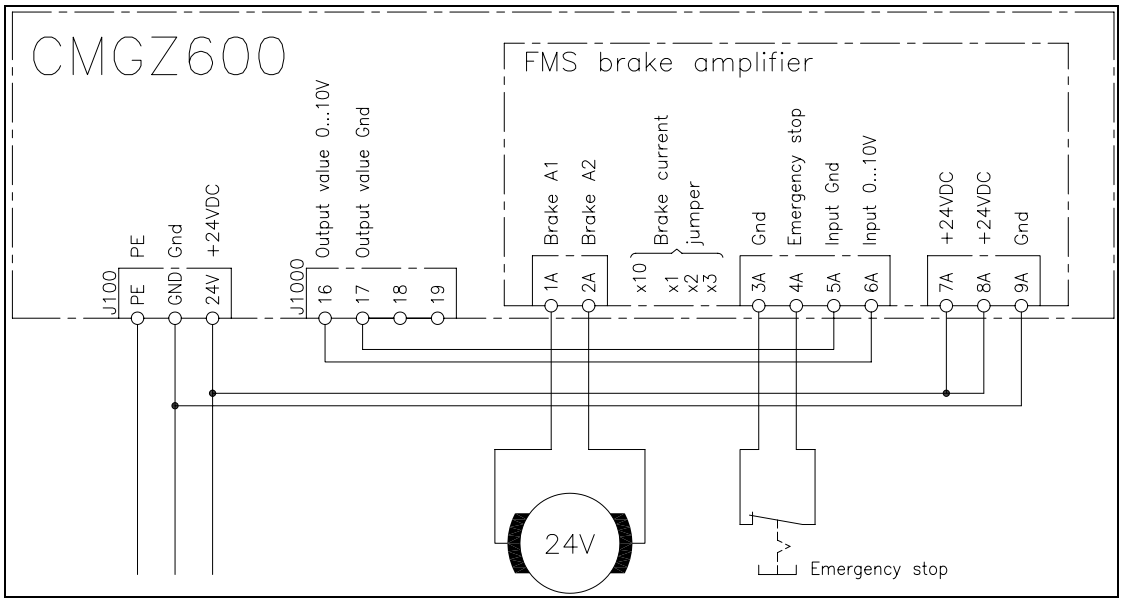

fig. 11: Wiring Diagram integrated brake amplifier CMGZ.B (24V) C600017e
With 24V brake

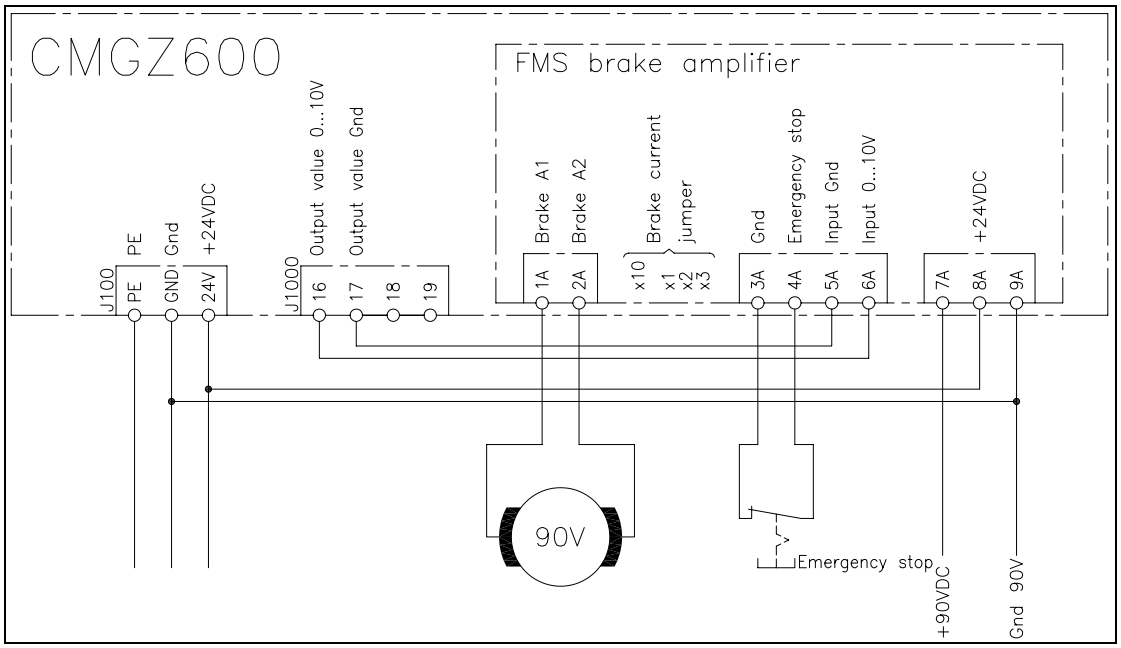

fig. 12: Wiring Diagram integrated brake amplifier CMGZ.B (90V) C600018e
With 90V brake

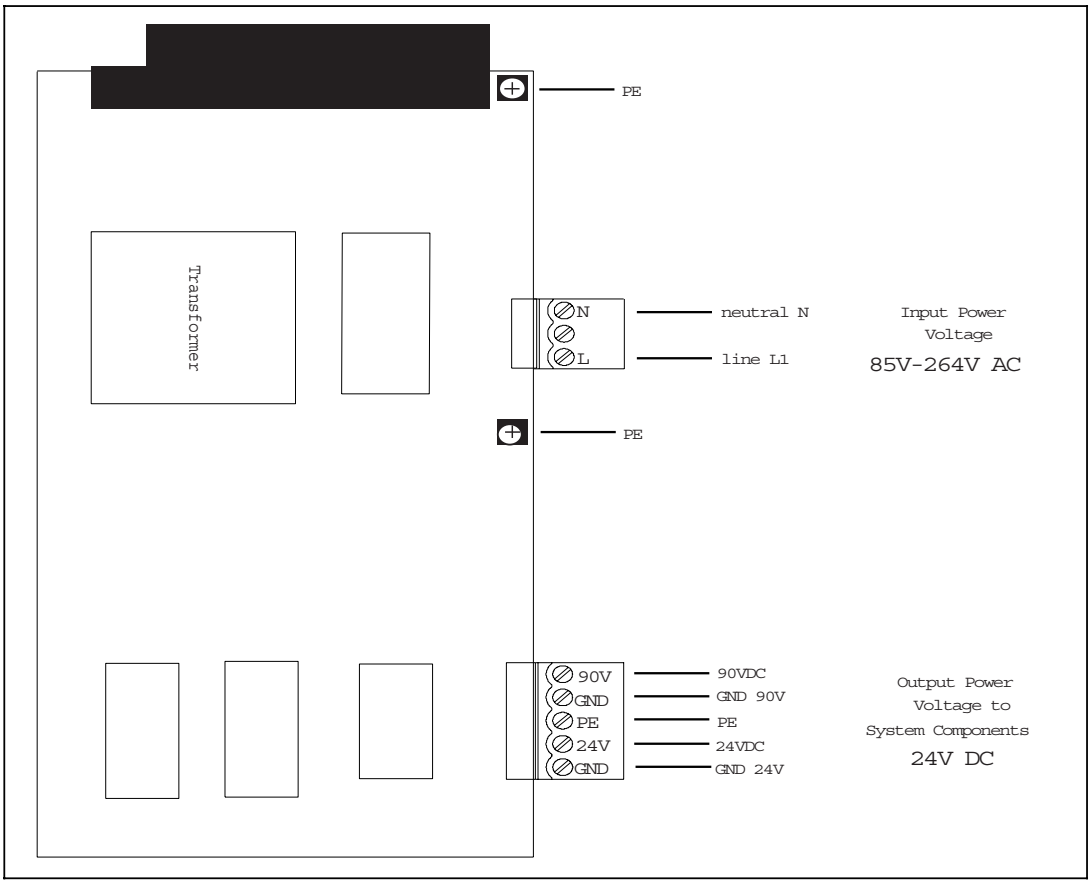

fig. 12a: Wiring CMGZ.6XX.ACV C600008e

If jumper X10 is closed, double of output current is available

Tab.a: X10 = Open

Current 24V Brake	Current 90V Brake	X1	X2	X3
0.125A	0.125A	Open	Open	Open
0.25A	0.25A	Open	Open	Closed
0.5A	0.5A	Open	Closed	Closed
1.0 A	0.9A	Closed	Closed	Closed

Tab.b: X10 = Closed

Current 24V Brake	Current 90V Brake	X1	X2	X3
0. 25A	0. 25A	Open	Open	Open
0.5A	0.5A	Open	Open	Closed
1.0A	0.9A	Open	Closed	Closed
2.0A	-	Closed	Closed	Closed

F3	Power Fuse 24 VDC or 90 VDC
F4	Fuse 24 VDC

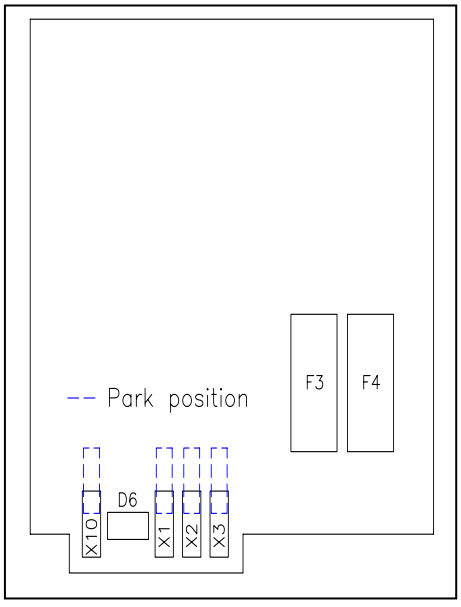

Fig 12b: Brake Amplifier C600024e

8.5 Mounting the Force Sensors

For mounting the force sensors please refer 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 with a 2x2x0.75mm^2 [AWG 18] shielded twisted pair cable. With cable lengths below 15m, a 2x2x0.25 mm^2 [AWG 23] cable is also suitable. This signal cables must be separated from power lines.
The wiring diagrams show how the wiring to the terminals of the electronic unit is done. If two force sensors are used per measuring point, the cables are wired parallel (ref. to wiring diagram). If the wiring is using 6-wire circuit the solder dip-switches must be modified (ref. to „9.2 Configuring the electronic unit“).
Force sensor excitation can be supplied with 5VDC (default), 10VDC or 24VDC (ref. to „9.2 Configuring the electronic unit“).

Note

The force sensor signal has only a few mV and is therefore susceptible to external influences. To increase immunity to interfering use one 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 with the measuring signal. 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.

8.6 Mounting the Brake Amplifier or the Drive Unit

Brake and brake amplifier respectively drive unit and motor will be mounted according to the manufacturer’s guide lines. Due to the wide variety of available types, no further recommendation can be made in this manual. Wiring is done according to the wiring diagram.
If an AC drive unit is used, the energy produced in the motor during the braking process must be dissipated on a resistor.

Danger

The Tension Controller has no built-in „Emergency Stop“ function. However, it can drive brakes with high kinetic energy and drive units with high performance. An “all-out braking” process or complete release may cause heavy damage on man and/or machines. The same applies also for drive units. Therefore, the system designer must adopt protective measures for persons and equipment.

8.7 Mounting the Distance Sensor

If the control loop is operated with pilot control (utilizing 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. The distance signal is fed to the analogue diameter input.
Please make sure that the measuring axis of the distance sensor is exactly radial to the reel (refer to fig. 1 and 13).

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.

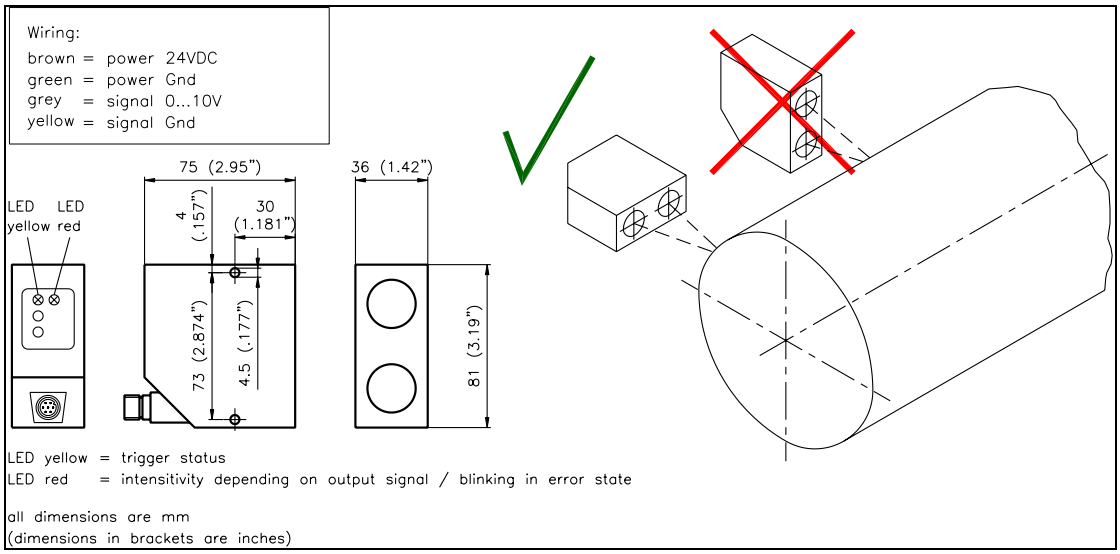

fig. 13: Mounting of the distance sensor CMGZ581924 E411012e

The distance sensor operates with the 3-beam-correction principle. It is widely insensible to secondary light and changes of the surface colour of the detected object. Must avoid mounting the sensor in a „horizontal“ position (for mounting please ref. to fig. 13).
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

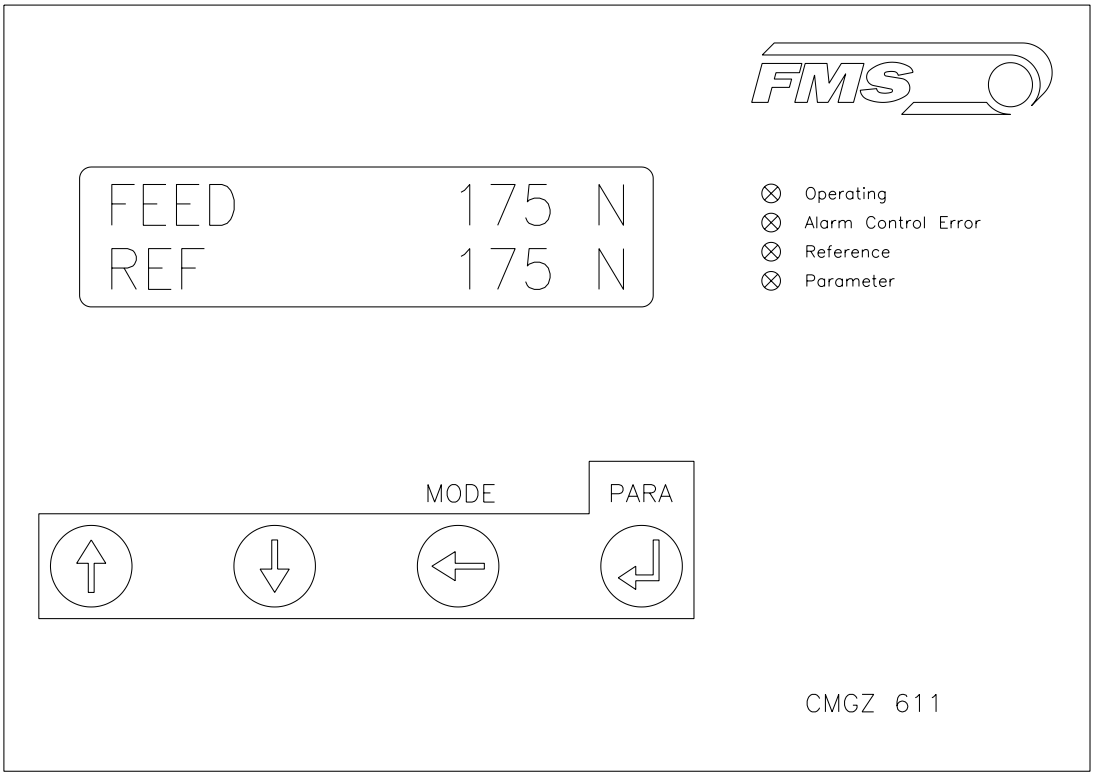

Fig. 14: Operating panel CMGZ611A C611009e

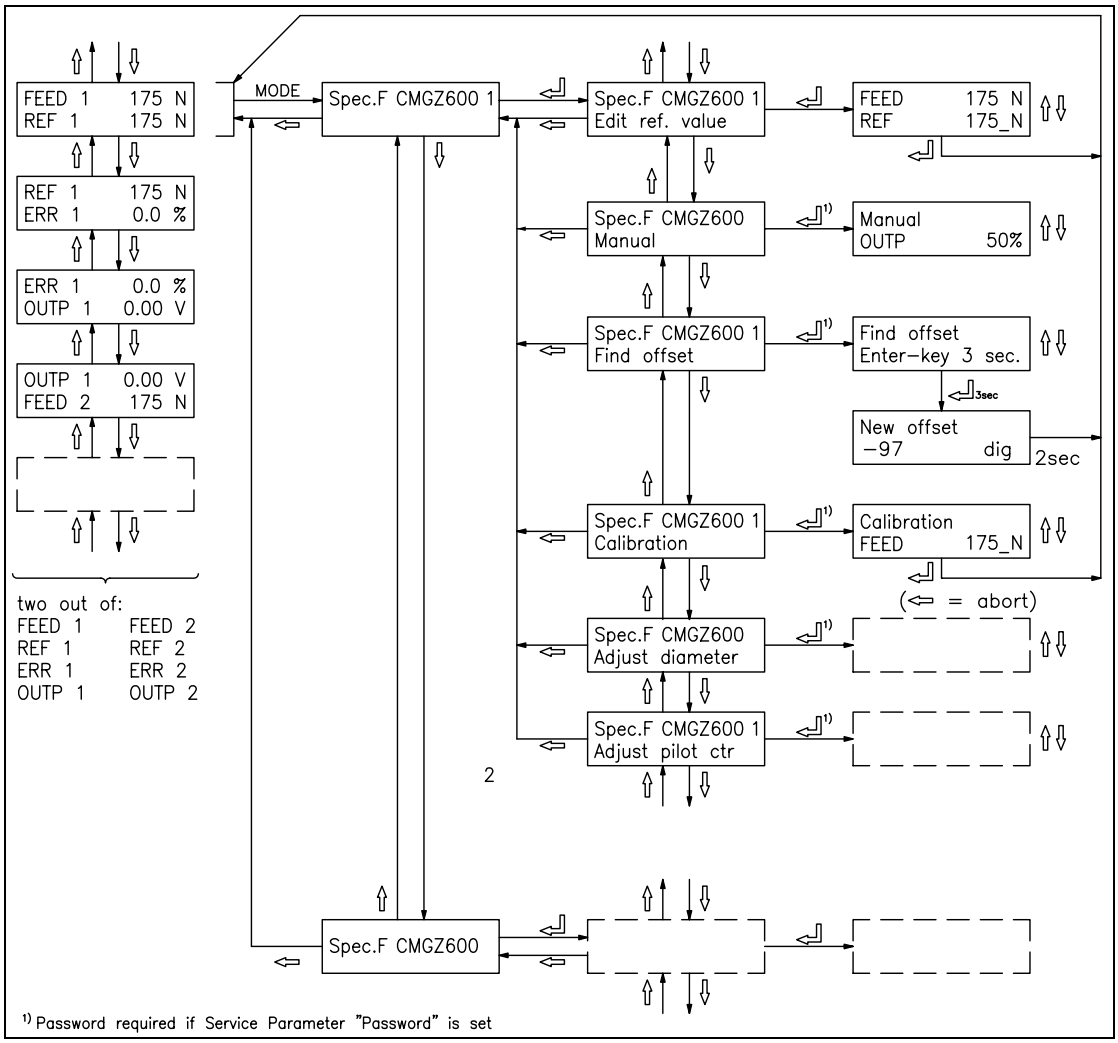

Fig. 15: Main operating menu CMGZ612A C612008e

9.2 Configuring the Electronic Unit

The input channels configuration is as follows:

Input Channel assignment (ref. also to wiring diagram)			
	CMGZ611A	**CMGZ612A**	**CMGZ630A**
Channel 1	Force Sensor	Force Sensor (Module 1)	Force Sensor
Channel 2	External Ref. / Diameter / Line Speed	External Ref. / Diameter / Line Speed (Module 1)	Diameter / Line Speed
Channel 3	–	Force Sensor (Module 2)	External Ref.
Channel 4	–	External Ref. / Diameter / Line Speed (Module 2)	–

Prior to the first calibration, the following settings must be done for each channel (ref. to „14. Parametrization“ and „20. Technical Reference“):

Default channel settings for the analogue outputs			
	CMGZ611A	**CMGZ612A**	**CMGZ630A**
Channel 1	±10V (using a drive) or 0...10V (using a brake)		
Channel 2	0...10V (default)		
Channel 3	–	±10V (using a drive) or 0...10V (using a brake)	–
Channel 4	–	0...10V (default)	–

System parameters	
Language	Desired language on the display

Parameters CMGZ600A	
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
Low-pass feedback	Reset to default = 50.0 Hz
Scale instrument	Which material tension feedback corresponds 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 settings of the dip-switches, jumpers and parameters may cause malfunction in the electronic unit. Parameters setting must be done carefully before putting the device into operation.

9.3 Calibrating the Measuring Amplifier

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

Simulation Method (recommended)
The following instructions refer to a setup and calibration in the installing machine. The material tension is simulated by a weight (fig. 16).

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 required, 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.

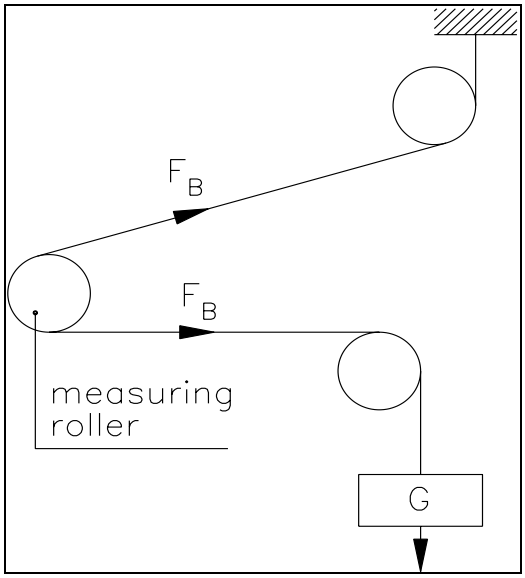

fig. 16: Calibration measuring amplifier
C431011e

Find offset

- Insert material or a rope loosely to the machine.
- Press MODE key. Search and select the module *Spec.F CMGZ600 1* and the special function *Find offset* with the ↑ ↓ ↵ keys (fig. 15).
- Determine the offset by pressing the ↵ key for 3 seconds (fig. 14). 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. 16)
- Press MODE key. Search and select the module *Spec.F CMGZ600 1* and the special function *Calibration* with the ↑ ↓ ↵ keys (fig. 15).
- Set the force referring to the applied weight into the display with the ↑ ↓ keys and confirm with ↵ key (fig. 15). The electronic unit calculates automatically the new gain value. The display will return to the main operating menu.

CMGZ612A
The calibration of the measuring amplifier, as described above, applies to module 1. The same procedure must be followed for module 2. For that purpose use the special functions from module *Spec.F CMGZ600 2* (ref. to fig. 15).

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 according to „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 CMGZ600A“).

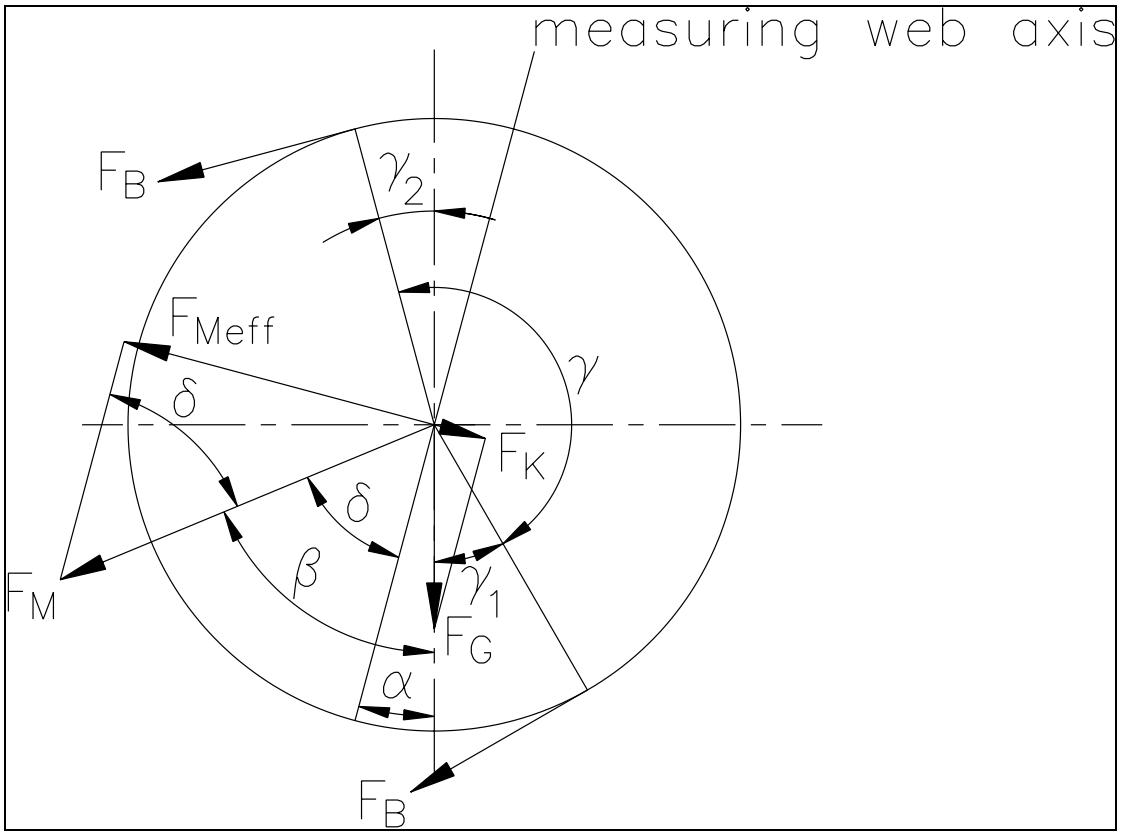

Fig. 17: Force vectors in the FMS force measuring bearing C431012e

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

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		

9.4 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.

9.5 Enter Reference Value

The tension reference value can be inputted via 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. 15). 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* to the required reference value range (refer to „14. Parametrization“)
- Set the value of the voltage source according to the required reference value.

Note

FMS recommends to use a potentiometer of 2.5 kΩ for external reference

Taper function

If the parameter *Reference source* is set to *Taper function*, the taper function is activated. Therefore an external diameter signal is required to calculate the actual reel diameter. For diameter adjustment see 12.4.

9.6 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. 18):

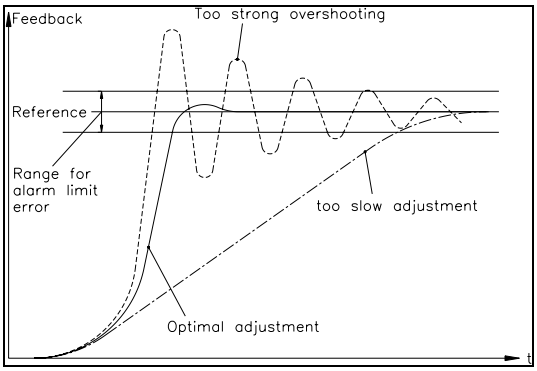

fig. 18: Transient effect of the control system C431013e

- Set parameter *Derivative D* to 0s (only if PID configuration is used)
- Set parameter *Integral I* very high (32.675s)
- Set parameter *Proportional P* very small (for ex. 0.010)
- Enable controller (ref. to „9.8 Automatic Operation“)
- If control loop is not oscillating: Increase *Proportional P*
- 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 setup at a possible re-installation.

Mathematic determination of the control parameters

- If the behaviour of the control loop is known, the control parameters can be calculated by the described mathematic procedure and saved in the parameters *Proportional P1...P4*, *Integral I1...I4* and *Derivative D1...D4*. Only the parameter set that was selected via the BCD inputs is active (ref. 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

Four different P, I, D reference values (P1...P4; I1...I4; D1...D4; Ref1...Ref4) can be saved. This allows an easy and flexible adjustment of the controller to different materials. Only the parameter set that was selected via the BCD inputs is active (ref. to „9.7 Switching the Control Parameters“.) The instructions above is valid for all 4 sets of parameters. But for better understanding, the instruction is written in common form.

Note

A correct setting of the control loop can be time consuming. We recommend to use an oscilloscope to better judge the adjustment of the control parameters and record the behaviour of the feedback value. The oscilloscope shows whether the control loop operates stable and the static error is compensated.

Note

The controller must be adjusted so that the feedback reaches the reference in the shortest possible time but without overshooting. You can see if the feedback overshoots either on the display or on the oscilloscope

9.7 Switching the Control Parameters

Four different P-, I- and D- values (P1...P4; I1...I4; D1...D4), as well as four different tension reference values can be saved. This allows you to adjust the control loop flexibly to different material characteristics. Caution: It is also possible to switch to another set of parameters, if the controller is enabled !
Switching is done with the parameter *“PID set active”* and by using the digital inputs „BCD value 0“ and „BCD value 1“ (ref. to wiring diagram) according to table below

(digital inputs are dominating):

dig. input BCD value 1	**dig. input BCD value 0**	**Binary code**	**BCD code**	**Parameter set**
open	open	0 0	0	Acc. to parameter “PID set active”
open	24VDC	0 1	1	P2 / I2 / D2 / Ref2
24VDC	open	1 0	2	P3 / I3 / D3 / Ref3
24VDC	24VDC	1 1	3	P4 / I4 / D4 / Ref4

9.8 Manual Operation

Press MODE key and select the module *Spec.F CMGZ600* and the special function *MANUAL*. Confirm with the Enter ↵ key. The display will show *MANUAL* in the first row and *OUTPUT* in the second. The value entered into *OUTPUT* acts on the analogue output. The first time this value is 0. The value can be changed using ↑ ↓ keys . The value stays on the analogue output as long as this mode is active.
MANUAL mode can be aborted by pressing the Enter ↵ key. The actual value is stored and will appear next time the mode MANUAL is entered.

9.9 Automatic Operation

State „Controller Disabled“
After power on, the controller is disabled. Its output value is 0V, 0mA or 4mA depending on the 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.
When 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. During this state the roller might turn a short distance in the opposite rolling direction. Afterwards the material tension is increased to the reference value or the pilot control value (depending on parameter *Pilot control*; refer to „14. Parametrization“).
When 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 described in „14.5 Description of the Parameters CMGZ600A“. The new values are taken for the control loop when parameter mode is aborted.

Change of reference value while automatic operation
The reference value can be changed while in automatic operation as described in „9.5 Inputting the Reference Value“.

Disable controller
The controller has to be disabled to terminate the controlling process after stopping the machine. If the enabling instruction was given via the interface, disabling must also be done via interface. After disabling the controller, the output value will immediately be reset to zero. 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 might cause material cracks. Therefore, the controller should be disabled only if the machine is no longer running.

9.10 Additional Settings

PI or PID configuration

The Tension Controller Unit can be operated as a PI or as a PID controller (with unwind brake as PI only). FMS recommends to chose the PI configuration since it is much easier to handle and the controller dynamics are good enough 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 covers higher dynamic than a PI controller. PID controlling is used where the dynamics of a PI controller is not good enough. – The D component increases the tendency for instability compared with a PI controller!

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

Setting of the lowpass filters

The electronic unit contains two lowpass filters that are independently adjustable. They are used to filter noise which would be overlaid to the signals. Signal variations that are faster than the cut-off frequency of the filter will be suppressed. The lower the cut-off frequency is set, the more sluggish the output signal will be.

The lowpass filters are configured by setting the 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 could happen that the feedback value is no longer suitable for control loop applications. You have to pay attention to the cut-off frequency that is set to a suitable value.

Setting of the limit switches

The electronic unit provides two limit switches which can be tapped to 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 the wiring diagram.

Control Error Limitation

The parameter *Error Limit* allows to hold the feedback value within a defined range. In case of high variations of the tension feedback value, extreme peaks of the control output can herewith be avoided (i.e. in rough running reels). Ref. to „14. Parametrization“.

9.11 Special Features of the CMGZ612A

All operating instructions described in sections „9. General Operation“ to „13. Setup of a Line Drive Controller“ apply to module 1 which operates the measuring point 1 and control loop 1. The instructions and settings apply accordingly also to module 2 which operates measuring point 2 and control loop 2.

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 CMGZ600A	
Control mode	*Unwind brake* (default)
Pilot control	For the time being set to *No*
Offset output	Reset to 0%
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	(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“)
Start limit	For the time being set to 0.0
Softstart time	For the time being set to 0.0
Brake time	For the time being set to 0.0
Brake boost	For the time being set to 0.0

Note

CMGZ611A/612A: There is only one additional analogue input for external reference, diameter or line speed signal. You cannot run the controller with external reference and pilot control in 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.

More information about the setup can be found in section „9.5 Inputting the reference value“. After having set the basic the controller configuration, special functions can be added if required by the application. These special functions are described below.

10.2 Entering the Holding Torque

The unwind reel can be held by the brake at standstill while the machine is stopped. If the parameter *Torque in use* is set to *“no”*, the output will show the holding torque but only if the controller is enabled. If the parameter *Torque in use* is set to *“yes”*, the output will show the holding torque also if the controller is disabled.

Parameter *pilot-control* set to “no”:
In the parameter *holding torque Dmax* there is the possibility to enter a holding torque (see chapter 14. “Parametrization”). E.g. this is a possibility to prevent spin.

Parameter *pilot-control* set to “yes”:
Dependent on the diameter a holding torque is displayed which is proportional to the actual diameter. A prerequisite for that is that a diameter signal is available. The holding torque (which is proportional to the diameter) is tuned with the parameters *holding torque*

Dmax and *holding torque Dmin.* While storing the values for *holding torque Dmax* and *holding torque Dmin* the actual diameter signal is simultaneously stored in the background. The stored values are accessible in the service module under *holding torque Dmax U1* and *holding torque Dmin U2.*

10.3 Enter Start Limit

After controlling is enabled, the output is 0V or equal to the holding torque. During the "softstart time" the output will increase linearly towards the maximum (10V) as long as the start limit value is not reached.
The *start limit* value is entered as a percentage of the actual reference value. After the synchronization, when the feedback value reaches the *start limit* value, the PID controller takes over.

10.4 Enter "Softstart" Time

After controlling is enabled, the output is 0V or equal to the holding torque. During the time specified in "softstart time", the output value will increase linearly towards the maximum (10V) as long as the value specified in "start limit" is not reached.
The "softstart time" is defined in seconds. A longer "softstart time" value results in a slower rise time of the output value. A shorter "sofstart time" results in a faster rise time of the output value.

10.5 Enter Brake Time

When the controller is disabled the output value will go to the last output value multiplied by the value specified in the parameter "brake boost" . This value will be kept for the time specified in the parameter "brake time". The "brake time" value is defined in seconds. Did the brake time run out, the output value will be set to 0 or equal to holding torque.

10.6 Enter Brake Boost

When the controller is disabled the output value will go the last output value multiplied by the value specified in the parameter "brake boost". This value will be kept for the time specified in the parameter "brake time". The "brake boost" value is specified in percentage of the output value before the controller is disabled. If the time specified in the parameter "brake time" did run out the output value will be 0 V or equal to the holding torque

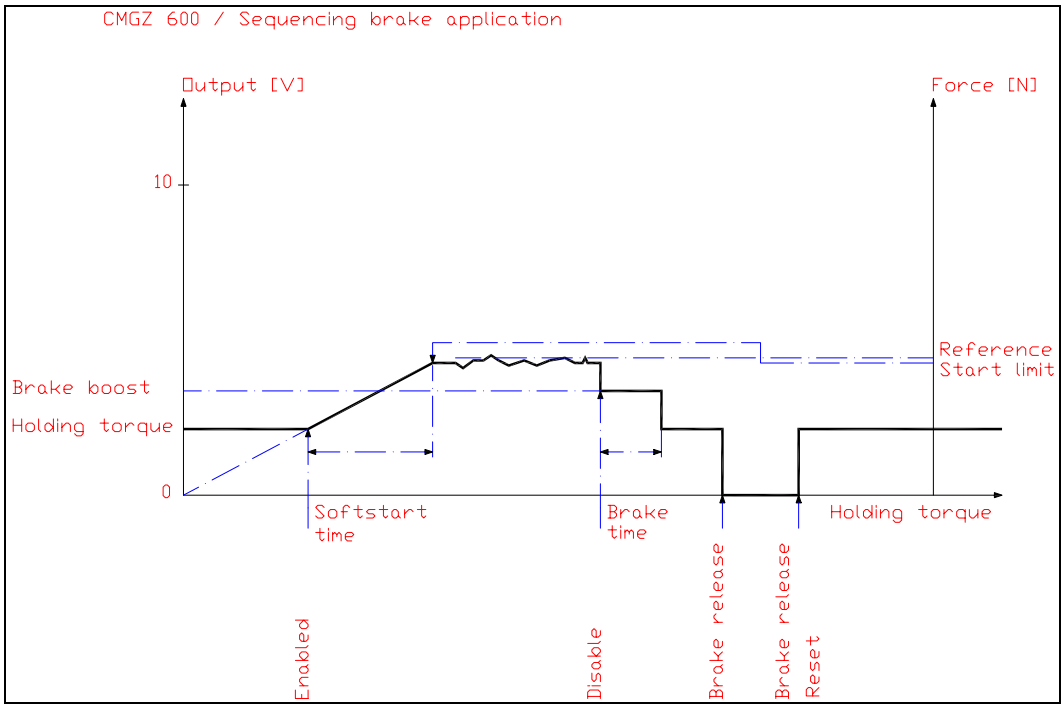

fig. 19: Sequence brake application control C600009e

10.7 Setup of Pilot Control

Pilot control enables the evaluation of the actual reel diameter. This allows the calculation of the brake torque or the drive power appropriate to the given reel diameter (pilot control signal). In addition, the PID control parameters are dynamically adapted to the reel diameter. Thus the controller has only to handle the tension variations. This increases control loop stability.

Note

For winder operations, the pilot control must work in combination with a torque controlled drive. A speed controlled drive does not bring satisfactory results with pilot control. This note doesn't apply if a brake is operated.

Transmission of diameter signal

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

Diameter adjustment

To provide the electronic unit with the actual reel diameter information, distance signal and diameter range must be assigned to each other. This is done the following way:

- Set parameter *Pilot control* to *Yes.*
- Insert reel with a small diameter, so that the distance sensor delivers a small diameter signal, or set PLC diameter signal to a small value.
- In the main operating menu, press the MODE key. Search and select the module *Spec.F CMGZ600 1* and the special function *Adjust diameter* with the ↑ ↓ ↵ keys (fig. 15). Input the actual (small) reel diameter as *Diameter 1* (fig. 20). After confirmation with ↵ key the diameter is saved together with the corresponding voltage signal.

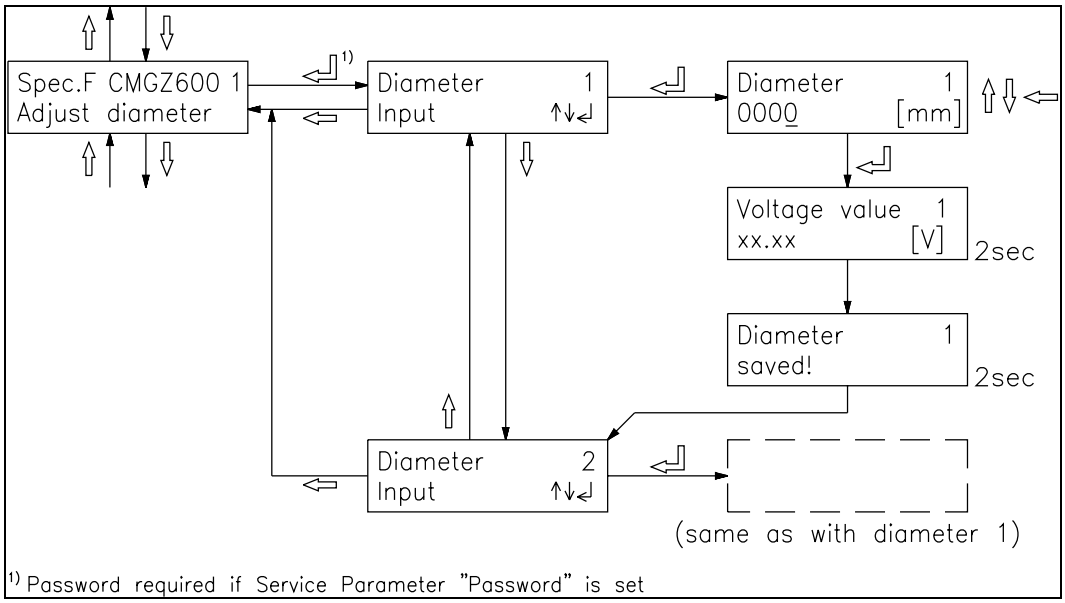

fig. 20: Program flow for special function „Adjust diameter“ C611007e

- Insert a reel with a large diameter, so that the distance sensor delivers a larger diameter signal, or set PLC diameter signal to a larger value.
- Enter the actual (large) reel diameter as *Diameter 2* as written above (fig. 20). After confirmation with ↵ key the diameter is saved together with the referring voltage signal.

Adjustment of pilot control

In order the electronic unit to calculating the pilot control correctly, the torque value has to be assigned to the correspondent diameter:

- Set parameter *Pilot control* to *No.*
- Proceed for a test run. If with a large diameter the control loop runs stable, the actual reference value and, after pressing the ↑ key, the actual output value can be read from the display (fig. 15). 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:

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

  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.
- In the main operating menu, press MODE key. Search and select the module *Spec.F CMGZ600 1* and the special function *Adjust pilot ctr* with the ↑ ↓ ↵ keys (fig. 15). Enter the previously calculated torque value into *%-torque* and confirm with ↵ key (fig. 21). Enter the previously noted reference value [N]. After confirmation with ↵ key the calculated pilot control value is saved together with the actual diameter signal.

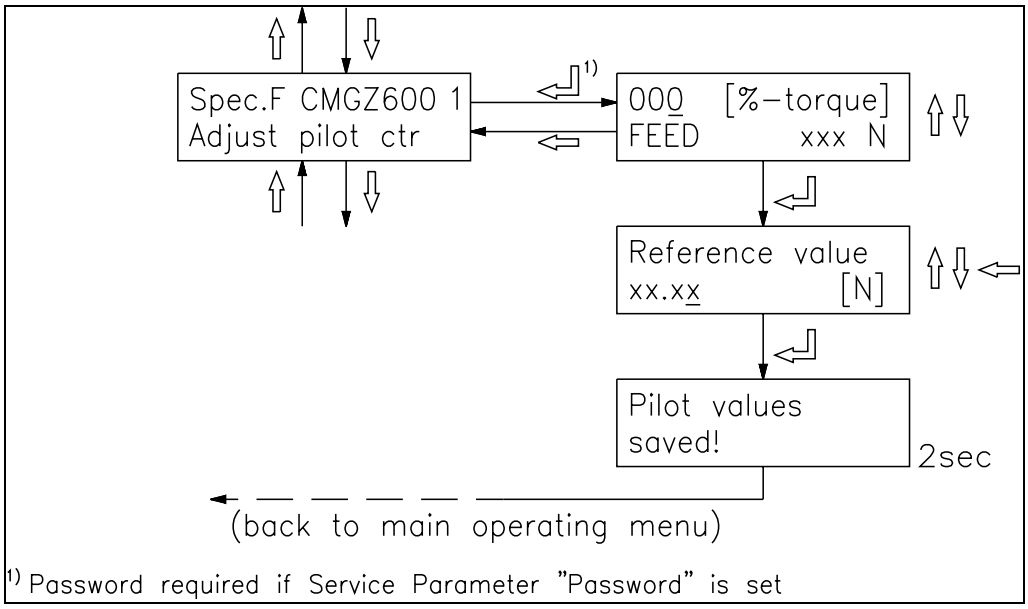

fig. 21: Program flow for special function „Adjust pilot control“ C611008e

Note

The additional analogue input supports only one operation mode at a time. When changing parameters *Reference source, Pilot control* or *Taper function*, the settings of pilot control get lost. If one of these parameters are changed after pilot control was adjusted, the whole pilot control setting procedure must be repeated.

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 CMGZ600A	
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 „9.10 Additional settings“
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	(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

CMGZ611A/612A: There is one additional analogue input available for external reference, diameter or line speed signal. You cannot run the controller with external reference and pilot control at 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 the controlling process very sparing way even if the material has some slack. The controller operates with only a slow initial speed until a certain minimum tension 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 tension variations. This will increase control loop stability.
Setup of pilot control is done as described in section „10.7 Setup of Pilot Control“.

12 Setup of a Winding Drive Controller

12.1 Configuring the Basic Parameters

Following parameters must be set for a winding drive controller according to the used application:

Parameters CMGZ600A	
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 „9.10 Additional settings“
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	(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

CMGZ611A/612A: 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 at 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 Enter reference value“. If the general setup is completed, 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 gently 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 the evaluation of the actual reel diameter and the calculation of the brake torque or drive power adapted to the reel diameter (pilot control signal). In addition, the PID control parameters are dynamically and continuously adapted to the reel diameter. Therefore the controller is only responsible for the tension variations. This will increase control loop stability.
Setup of pilot control is done as indicated in „10.3 Setup of pilot control“.

12.4 Taper Function

If the end of the reel needs winding with less tension than the centre, the taper function can be parametrized. Therefore the corresponding values have to be entered in the parameters *Reference 25%Dia*, *Reference 50%Dia*, *Reference 75%Dia* and *Reference D max*. (ref. fig. 20). The taper function only operates, if the parameter *Reference source* is set to *Taper function*. The controller has to know the actual reel diameter.

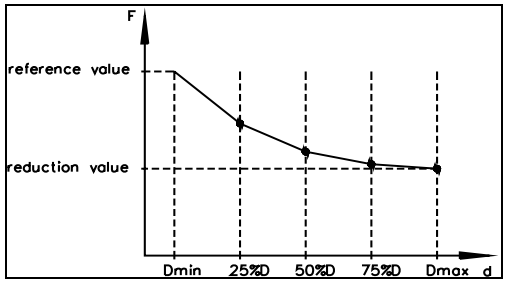

fig. 22: Parametrization of taper function C650011e

Transmission of diameter signal
To transmit the actual reel diameter to the electronic unit, an analogue signal 0...10V (coming e.g. from a external control unit or a distance sensor) is fed to the analogue input (terminals *Signal 0...10V* and *Signal Gnd*; refer to wiring diagram)

Diameter adjustment
To inform the electronic unit about the actual reel diameter, the distance sensor signal has to be assigned to a diameter range:

- Set parameter *Reference source* to *Taper function.*
- Insert reel with small diameter to get a signal according to the small diameter from the distance sensor.
- When in the main operating menu, press `MODE` key. Search and select the module *Spec.F CMGZ600 1* and the special function *Adjust diameter* with the ↑ ↓ ↵ keys (fig. 15). Input the actual (small) reel diameter as *Diameter 1* (fig. 20). After confirmation with ↵ key the diameter is saved together with the referring voltage signal.

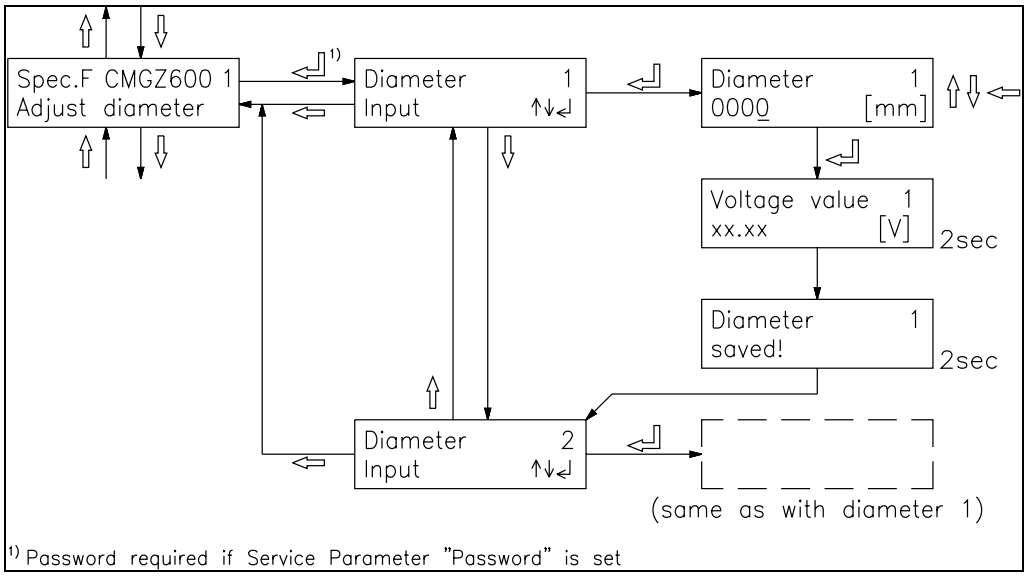

fig. 23: Program flow for special function „Adjust diameter“ C611007e

- Insert reel with large diameter to get a signal according to the large diameter from the distance sensor.
- Input the actual (large) reel diameter as *Diameter 2* as written above (fig. 23). After confirmation with ↵ key the diameter is saved together with the referring voltage signal.
- Store the max. diameter in the parameter *Max. diameter*
- Store the min. diameter in the parameter *Center diameter*

Set up of taper function

- Enter the corresponding values to the parameters *Reference 25%Dia*, reference 50%Dia, *Reference 75%Dia* and *Reference D max*. to get the desired characteristic line (ref. fig. 22).

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 CMGZ600A	
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 „9.10 Additional settings“
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	(Only if reference potentiometer is used)

Note

CMGZ611A/612A: There is one additional analogue input for external reference, diameter or line speed signal. You cannot run the controller with external reference and line speed overlay at 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.

Please continue with section „9.5 Enter reference value“. After the basic setup special functions can be added according to requirements the application. Following these functions are described.

13.2 Setup of Line Speed Overlay

If the controller operates in line speed overlay mode, a line speed signal is used to generate the output value. The controller uses the signals proportional to diameter ration from tachometer roller and drive roller. To this calculated value the percentage quota of the PID controller is overlaid. The sum is the output value. The controller has only to compensate for the tension variations. This will increase control loop stability.

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).

Partitioning of Pilot Control and controller output

- Set parameter *pilot control* to *yes* (ref. “14. Parametrization”)
- Set *Influence of PID* to a suitable value e. g. 10%
- Carry out a test run. Optimize PID control parameters and parameters of *Influence of PID* such that the control works stable under all conditions

14 Parametrization

14.1 Schematic Diagram of Parametrization

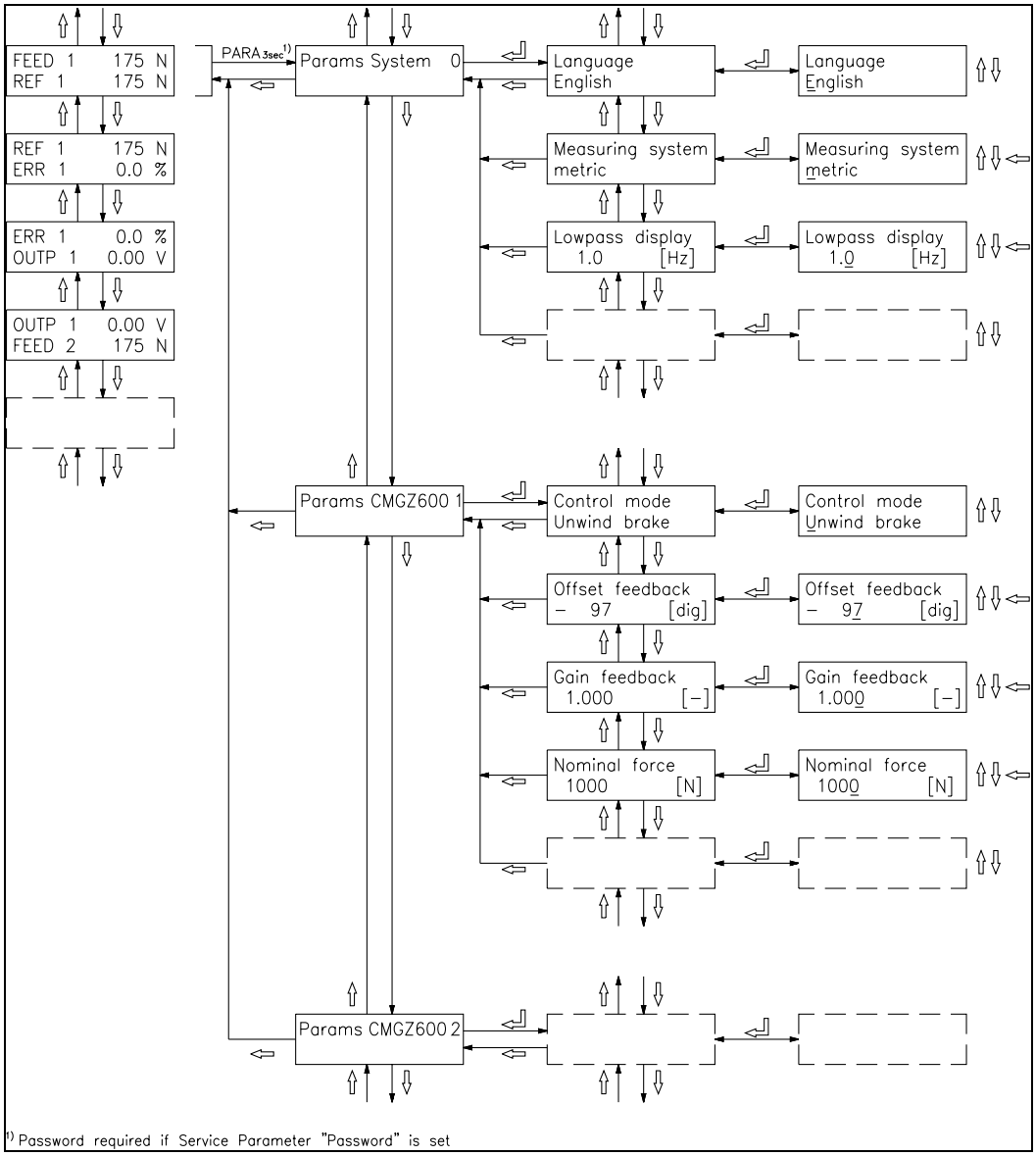

fig. 24: Parametrization CMGZ612A C612003e

The parameters are split into the modules *Params System 0, Params CMGZ600 1* and *Params CMGZ600 2*. The parameter changing mode is activated by pressing the PARA ↵ key for 3 seconds. The required module can then be searched with the ↑ ↓ keys and be selected with the PARA ↵ key (fig. 24). Each module has its own parameter set. The parameters can be changed with the keys as follows:

↵	choose and enter
↑ ↓	switch the selections or increase / decrease numeric values, as well as change the sign
←	change the decimal (when 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		4800, 9600, 19200, 38400			9600

14.3 List of Parameters CMGZ600A

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	b u w l	[Digit]	–8000	8000	0
Gain feedback	b u w l	[-]	0.100	32.675	1.000
Nominal force	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]	0.01	200.00	10.00
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	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
PID set in use	b u w l	[-]	1	4	1
Proportional P1 … 4	b u w l	[-]	0.001	32.675	0.100
Integral I 1 … 4	b u w l	[s]	0.001	32.675	0.100
Derivative D 1 … 4	_ u w l	[s]	0.0000	3.2675	0.0000

[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 entered. The value consists of 4 digits. The position of the decimal point depends on the parameter *Force of sensor*

(List of Parameters CMGZ600 – Continuation)

Parameter	Applies to[1)]	Unit	Min	Max	Default
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
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, Taper function			Internal
Scale ref. input	b u w l	[2)]	[3)]		-
Ref. value 25% D max.	_ _ w _	[%]	1	1000	100
Ref. value 50% D max.	_ _ w _	[%]	1	1000	100
Ref. value 75% D max.	_ _ w _	[%]	1	1000	100
Ref. value D max.	_ _ w _	[%]	1	1000	100
Torque in use?	b _ _ _	Yes, No			No
Holding torque Dmax	b _ _ _	[%Out]	0.0	100.0	0.0
Holding torque Dmin	b _ _ _	[%Out]	0.0	100.0	0.0
Softstart time	b _ _ _	[s]	0.0	100.0	0.0[6)]
Start speed	_ u w _	[%Out]	0.00	100.00	0.00
Start limit	b u w _	[%F_ref]	0.0	100.0	0.0
Brake time	b _ _ _	[s]	0.0	100.0	0.0[6)]
Brake boost	b _ _ _	[%Out)	0	300	0
Tachometer diameter	_ u w l	[4)]	[5)]		100
Center diameter	_ u w l	[4)]	[5)]		100
Max. diameter	_ _ w _	[4)]	[5)]		1000

[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. 21).

Language

Use: This parameter determines language on the display.

Range: English, French, Italian, German

Measuring system

Use: This parameter determines the measuring system that is used. If it is set to *metric*, all force values are in [N, cN, kN]. If it is set to *US standard*, all force values are in [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 identification 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). The other serial interface settings are fixed: 8 data bits, even parity, 1 stop bit („8 e 1“).

Range: 4800, 9600, 19200, 38400 **Default:** 9600

Unit: [Baud]

14.5 Description of the Parameters CMGZ600A

The parameter changing mode is activated by pressing the PARA ↵ key for 3 seconds. The module *Params CMGZ600 1* or *Params CMGZ600 2* can then be found with the ↑ ↓ keys and selected with the PARA ↵ key (ref. also to fig. 21). 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

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: This parameter stores the value determined with special function *Find offset* in [Digit]. It is not necessary to note down this parameter . A new offset adjustment can easily be repeated after the a electronic change. The offset can also be entered manually with the ↑ ↓ ← keys.

Range: –8000 to 8000 **Default:** 0

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

Gain feedback

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: This parameter stores the value determined with the special function *Calibration*. Alternatively you can input a calculated value using the formulas shown in „9.3 Calibrating the measuring amplifier“, if the material tension cannot be simulated.

Range: 0.100 to 32.675 **Default:** 1.000

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

Nominal force

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: This parameter stores the nominal force of the force sensor. It is printed to the type label 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 changes the decimal format of measuring force. It is indicated in the type label 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. For FMS force sensors the standard 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 indicates the number of bearings in measuring roller.

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 contains a lowpass filter to prevent noise overlaying to the feedback signal. This parameter stores the cut off frequency of the filter. The lower the cut off frequency, the more sluggish the feedback signal fed to the PID controller section will be. The filter stabilizes the feedback signal in case of highly fluctuating force values.
This filter is independent from other filters in the unit (e.g. from lowpass display filter).

Range: 0.01 to 200.00 **Default:** 10.00

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 exceeding respectively falling short 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 exceeded or falls below the value (dependent from the setting in parameter *Limit 1 min / max*). The limit switch monitor is inactive, if the value stored here is zero,.

Range: A force value can be entered. 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 to the parameter *Limit 1 min / max* but this parameter controls 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 controls 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

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: This parameter stores the material tension feedback value that generate the maximum signal (10V and 20mA) at the output.

Range: A force value can be entered. 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 can 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 overlaid 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 proportion of the PID controller added to the pilot control or line speed signal.
„10%“ means 10% of the maximum output signal.
If parameter *Output limit* is set below 100% the influence value 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 works as a PI controller in any case.

PID set in use

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: This parameter is functional only if the digital inputs “BCD value 0” respectively “BCD value 1” aren’t activated. (Ref. to 9.7 “Switching the control parameters”).

Range: 1 to 4 **Default:** 1

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

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 adopted in the control loop when leaving the 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	32.675	**Default:**	0.100
Increment:	0.001			**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 correct the output signal to 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 adopted in the control loop when leaving the parameter mode.
There are 4 different I values available (I1...I4). The BCD digital inputs are used for switching (ref. to 9.7 “Switching the control parameters“).

Range:	0.001	to	32.675	**Default:**	0.100
Increment:	0.001			**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 adopted in the control loop when leaving the parameter mode.
There are 4 different D values available (D1...D4). The BCD digital inputs are used for switching (ref. to 9.7 “Switching the control parameters“).

Range:	0.0000	to	3.2675	**Default:**	0
Increment:	0.0001			**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 despite poor machine conditions. The feedback value in the display is not influenced.
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: Faulty brake torques can be compensated, even if the brake is activated without the controller giving a signal to the brake. 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:**	[%]

Output configuration

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: This parameter selects the output signal. With setting „±10V“, the drive unit is able to run and brake both in forward and reverse direction. With the other settings, the drive unit can only run and brake in forward direction.
We recommend the setting „±10V“, if the used drive unit supports this signal mode. However, for a brake unit the other settings are preferred.

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

Position of line drive

Applies to:				Line drive

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

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

Ramp diameter

Applies to:	Unwind brake	Unwind drive	Winding drive	

Use: To prevent disturbances on the controller, the diameter should not change too fast. The diameter signal is therefore led internally to a ramp. The parameter defines the rate of rise of the ramp. 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 prevent disturbances on the controller, the reference value should not change too fast. The reference signal is therefore led internally to a ramp. The parameter defines the rate of rise of the ramp. The length of the ramp defines the settling time from old reference value to the new

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 is entered via keyboard or interface the parameter must be set to *internal*. If the parameter is set to *Taper function*, the taper function is activated. If a 0…10V signal is used the parameter must be set to *extern*. An external diameter signal is required to calculate the actual reel diameter. The start value of the diameter (D min) can also be entered via keyboard or interface.

Range: Internal, External, Taper function **Default:** Internal

Scale ref. input

Applies to:	Unwind brake	Unwind drive	Winding drive	Line drive

Use: This parameter defines what force value corresponds to 10 V on the analogue reference input.

Range: Force values can be entered that 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]

Reference value 25% D/50% D /75% D / D max.

Applies to:			Winding drive	

Use: These four parameter values are used for the taper function. The tension reference value can be set at 25% / 50% / 75% and 100% of the maximum reel diameter (ref. “12.4 taper function”). The taper function relates to the start reference value at minimum diameter. It has to be entered via the operating panel or the interface.

Range:	1	to	1000	**Default:**	100
Increment	1			**Unit:**	[%]

Torque in use?

Applies to:	Unwind brake			

Use: If this parameter is set to *no* and the controller is disabled, the output value will be 0V. When the controller is enabled, the value set under parameter *Holding torque* appears at the output. The controller starts from the holding torque value when enabled.
If this parameter is set to *yes* and the controller is disabled, the output contains a value that corresponds always to the parameter *Holding torque*. The controller always brakes with the holding torque as long as it is disabled. After enabling the controller, it starts from the holding torque and returns to the holding torque if the controller is disabled again.

If the parameter *“Pilot Control”* is set to *no* the holding torque corresponds to the value stored under *“holding torque Dmax”* (there is no diameter signal).

If the parameter *“Pilot Control”* is set to *“yes”* the holding torque corresponds to the torque of the actual diameter value (there is diameter signal).

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

Holding torque Dmax

Applies to:	Unwind brake			

Use: Parameter *Pilot Control* set to “no”:

The controller outputs the actual holding torque of the roller at standstill. The holding torque must be chosen such that the roller stands still but does not tear the material apart when restarted.

If the parameter “*Torque in use”* is set to *“no”* the holding torque will only be at the output if the controller is enabled.

If the parameter “*Torque in use”* is set to *“yes”* the holding torque will already be at the output before the controller is enabled.

“10” means “10%Out”, hence 10% of 10V = 1.0V.

Parameter *Pilot Control* set to “yes”:

The required holding torque for the larger diameter is given to the output. A diameter signal must be applied. The stored value is proportional to the diameter and can be accessed in the service module under the parameter *“Holding torque Dmax U1”*.

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

Holding torque Dmin

Applies to:	Unwind brake			

Use: Parameter *Pilot Control* set to “no”:

At this stage the parameter has no function.

Parameter *Pilot Control* set to “yes”:

The required holding torque for the smaller diameter is given to the output. However, a diameter signal must be applied. The actual diameter signal must be stored. The stored value is proportional to the diameter and can be accessed in the service module under the parameter *“Holding torque Dmin U2”*.

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

Softstart time

Applies to:	Unwind brake			

Use: After controller enable, the output is 0V or equal the holding torque. The output value will increase linearly during the time specified in “softstart time” towards the maximum (10V) as long as the value specified in “start limit” is not reached.

The “softstart time” is defined in seconds. A low value gives a faster increase of the output value. A long “sofstart time” give a slower increase. The value 0.0 will disable this function.

Range:	0.0	bis	100.0	**Default:**	0.0
Increment:	0.1			**Unit:**	[s]

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 up the needed material tension. Due to the inertia of drive unit the web would tear up . Therefore, the controller starts 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* and the operation mode is on unwind drive the output value is negative (for ex. 5% will result in an output signal of –0.5V)

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

Start limit

Applies to:	Unwind brake	Unwind drive	Winding drive	

Use: After controller enable, the output is 0V or equal to the holding torque. The output will increase linearly towards the maximum (10V) as long as the start limit value is not reached.

The start limit value is entered in percent of the actual reference value. If the feedback value is reaching the start limit value, the PID controller will take over after synchronization.

Drives**:** Description and function see *Start speed*
„90“ means 90% of reference value in [N]

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

Brake time

Applies to:	Unwind brake			

Use: When the controller is disabled the output value will go to the value specified under *holding torque* and keep this value during the time specified in the parameter *brake boost*. The *brake time* is defined in seconds and determines how long the *brake boost* is applied to the brake.

Did the brake time go by, the output value will be 0 or equal to holding torque.

The value 0.0 will disable this function.

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

Brake boost

Applies to:	Unwind brake			

Use: When the controller is disabled the output value will go to the last output value multiplied by the value specified in the parameter *brake boost* and keep this value for the time specified in the parameter brake time. The *brake boost* value is specified in percentage of the output value before the controller is disabled. If the time specified in the parameter *brake time* is over , the output value will be 0 or equal to the holding torque

Range: 0 bis 300 **Default:** 0

Increment: 1 **Unit:** [%Out]

Tacho diameter

Applies to:		Unwind drive	Winding drive	Line drive

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

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

Unit: [mm] or [inch] **Default:** 100

Center diameter

Applies to:		Unwind drive	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] **Default:** 100

Max. diameter

Applies to:			Winding drive	

Use: This parameter stores the diameter of the fully winded roller (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] **Default:** 1000

14.6 Service Mode

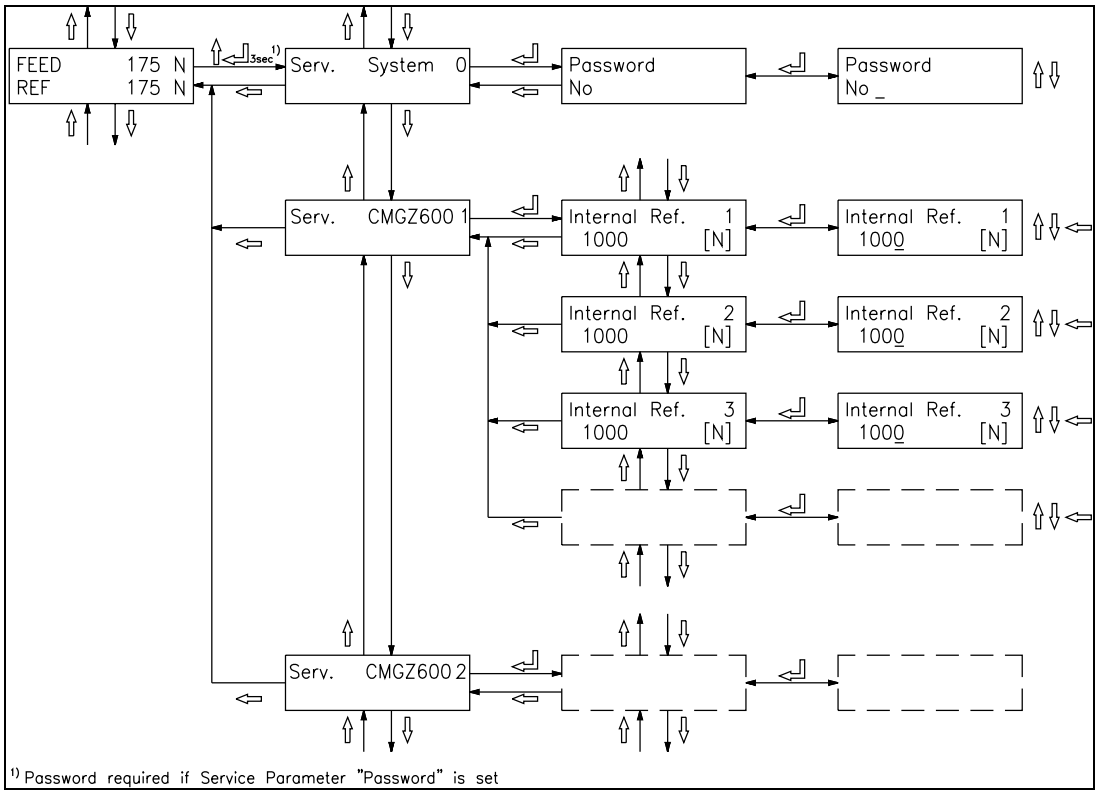

fig. 25: Service Mode Overview C612004e

The service mode uses internally stored values. These values need usually no modification. However, the values simplify the detection of malfunctions. Each function module has its own set of service parameters.

Note

Wrong settings of service mode parameters may result in heavy malfunctions! Therefore, the 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 in the same way as the other parameters.

Password

Use: A password can be set 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. It is entered with special function *Edit ref. value*.
There are 4 different reference values available, depending on the control parameter set that is actually active. The BCD digital inputs are used to switch between the different control parameter sets (ref. to „9.7 Switching the control parameters“).

Range: A force value can be entered. 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 determined with the special function *Adjust diameter*.

Range: A diameter value can be entered. 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 determined by the special function *Adjust diameter*.

Range: 0.00 to 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 determined by the 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 are 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 the 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 the special function *Adjust pilot control*.

Range: A force value can be entered. 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 entered. The value consists of 4 digits.

Unit: [mm] or [inch]

Manual reference

Applies to:	Unwind brake	Unwind drive	Winding drive	

Use: Press MODE key and select the module *Spec.F CMGZ600* and the special function *MANUAL* and confirm with the Enter ↵ key. The display will show *MANUAL* in the first row and *OUTPUT* in the second. The value entered into *OUTPUT* acts on the analogue output. The first time this value is 0. The value can be changed using ↑ ↓ . The value acts on the analogue output only as long as this mode is in use.
Quitting MANUAL mode is done by pressing the Enter ↵ key. The value is stored and will show next time the mode MANUAL is entered.
The analogue output value will return to the value it was before entering MANUAL mode. This can be 0 or what it was before MANUAL mode had been entered e.g. holding torque.

Range: -100 to 100 **Default:** 0

Increment: 1 **Unit:** [%]

Holding torque Dmax U1

Applies to:	Unwind brake			

Use: This parameter stores the first voltage level of the diameter signal. It is stored during the input of *holding torque Dmax.*

Range:	0	to	10.00	**Default:**	0
Increment:	0.01			Unit:	[V]

Holding torque Dmin U2

Applies to:	Unwind brake	Unwind drive	Winding drive	

Use: This parameter stores the second voltage level of the diameter signal. It is stored during the input of *holding torque Dmin.*

Range:	0	to	10.00	**Default:**	0
Increment:	0.01			**Unit:**	[V]

15 Serial Interface (RS232)

(Optional)

16 PROFIBUS Interface Hardware Description

16.1 Wiring the PROFIBUS Data Cable

Wiring the PROFIBUS cables
A standardized PROFIBUS cable type A (STP 2x0.34[2]) [AWG] has to be used. The cables are peeled off as shown in fig. 5 and connected to the terminals according to the wiring diagram.
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. Therefore the plastic mantle has to be fixed only with the PG gland (referring to fig. 5)

Termination
If both cables are connected (Bus in and Bus out), the two termination dip switches must be set in the "off" position.
If only one cable is connected (Bus in), both termination dip switches have to be set in "on" position.

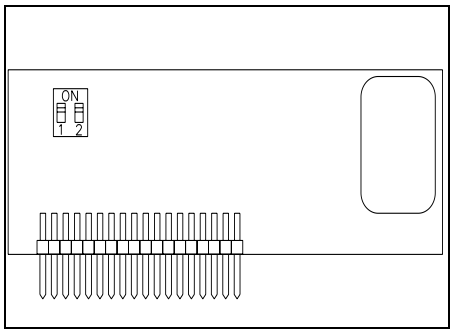

fig. 26: Profibus board E621009

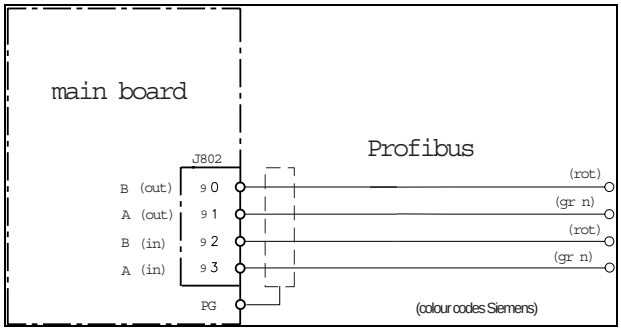

fig. 26A connection Profibus B600030e

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 tension controller off and on, the new address is valid.

17 PROFIBUS Interface Hardware 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 CMGZ611A/612A/630A DP Slave Functional Description

The tension controllers of the CMGZ600A.P-series support a PROFIBUS link which operates according to the PROFIBUS DP protocol 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 normally 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 (gross value)	A/D-value tension controller

The tension controller transmits 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)

Technical Reference

18.1 Additional Setting Elements

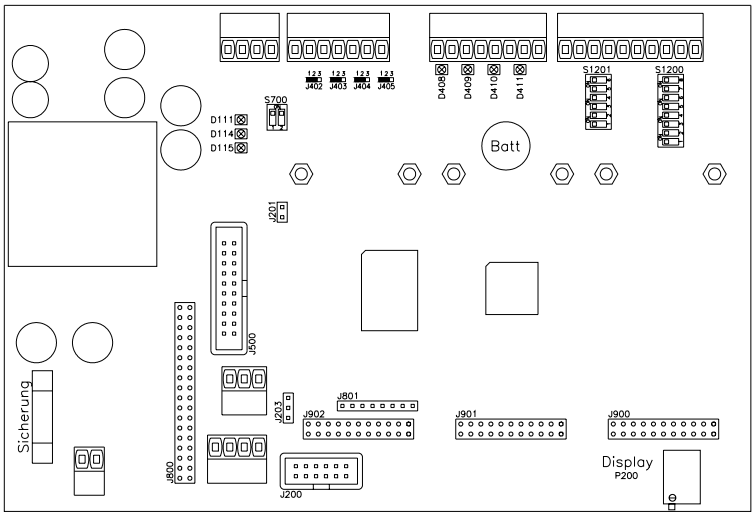

fig. 27 **E600010e**

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)
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
P200	LCD display contrast
S700	CAN Bus termination
S1200	Dip-switch (sensor exitation, sensor signal, 4-wire or 6-wire circuit)
S1201	Dip-switch (sensor exitation, sensor signal, 4-wire or 6-wire circuit)
Battery	Buffer battery for the internal clock
Fuse	Fuse of the power supply, 1A / 250V (fast blow)

18.2 Setting Elements on the Extension Board

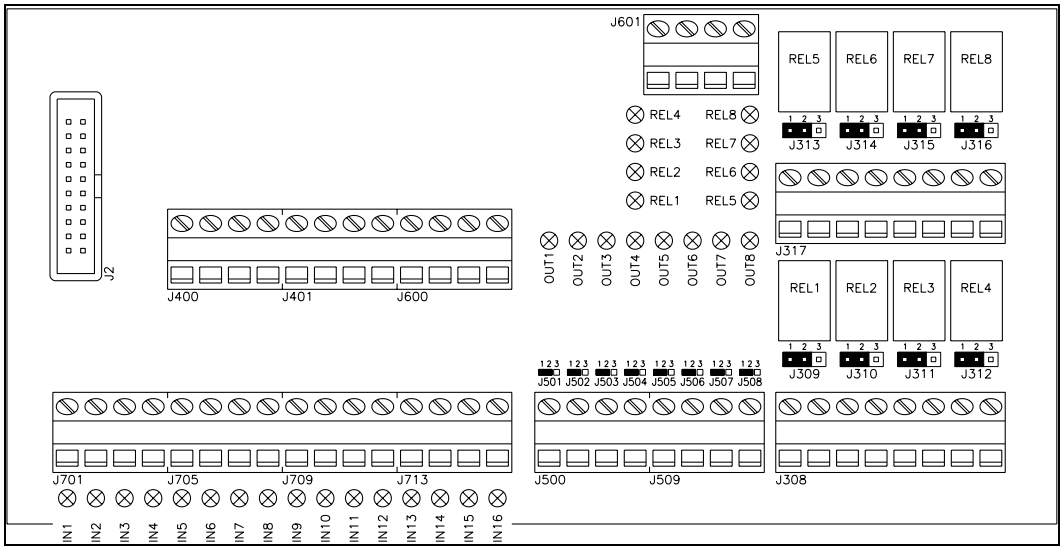

fig. 28 C600002

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**

18.3 Technical Data

Number of measuring points	1 (CMGZ611A / CMGZ630A) 2 (CMGZ612A)
Connection of force sensors	2 parallel wired force sensors of 350Ω for each measuring point
Excitation of force sensors	5VDC (default),10VCD or 24VDC (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 analogue 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)
Analog 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)

19 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.

19.1 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	Offset badly adjusted	Proceed again for offset adjustment of channel n
channel n is > 0 even though material is loose	Current output is set to 4...20mA	Adjust channel parameter *config. output* if a signal 0...20mA is required
Feedback value of channel n is not stable	Cut off frequency of the filters set too high	Adjust cut off frequency (ref. to „9.10 Additional Settings“)
even though material tension	Grounding (PE) not connected	Connect grounding (PE)
doesn’t change	Electrical interference on the cable to the force sensor	Check connection of the shield. Use one twisted pair for +signal and –signal (ref. to „8.5 Mounting the force sensors“)
Feedback value of	Gain badly adjusted	Proceed again for sensor calibration of channel n
channel n does not correspond with the effective material tension	Feedback signal wrong scaled	Set parameter *scale instrument* to an appropriate value
Limit switches do not work	Limit values wrong parametrized	Set parameters to appropriate values (ref. to „9.10 Additional settings“)
Dig. outputs do not work	Wiring error	Check wiring of the dig. outputs (open collector, ref. to wiring diagram)

Error	Cause	Corrective action
`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
	Sub-print of channel n is not detected	Check if sub-prints are seated correctly Contact FMS customer service
`Sub-print missing contact FMS AG`	One or more sub-prints are missing or are not detected	Check if sub-prints are seated correctly 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 „20.1 Additional Setting Elements“)
	Fuse blown	Replace fuse (ref. to „20.1 Additional Setting Elements“)
	Power supply not correct	Check status LED’s of the power supply (D111...D115, ref. to „20.1 Additional Setting Elements“) Check / correct power supply
	Electronic unit defect	Check status LED’s of the power supply (D111...D115, ref. to „20.1 Additional Setting Elements“) Contact FMS customer service
Electronic unit does not answer to interface commands	The interfacesare not supported yet	Contact FMS customer service

19.2 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
Pilot control does not work as expected	Setup of pilot control failed	Repeat setup of pilot control, ref. to „10.7 Setup of pilot control“
Brake doesn’t brake	Fuse blown on brake amplifier	Replace fuse on brake amplifier

19.3 Unwind 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 „10.7 Setup of pilot control“

19.4 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 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 doesn’t work as expected	Setup of pilot control failed	Repeat setup of pilot control, ref. to „10.3 Setup of pilot control“

19.5 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“

FMS Force Measuring Systems AG
Aspstrasse 6
8154 Oberglatt (Switzerland)
Tel. +41 44 852 80 80
Fax +41 44 850 60 06
info@fms-technology.com
www.fms-technology.com

FMS Italy
Via Baranzate 67
I-20026 Novate Milanese
Tel: +39 02 39487035
Fax: +39 02 39487035
fmsit@fms-technology.com

FMS USA, Inc.
2155 Stonington Ave. Suite 119
Hoffman Estates, IL 60169 USA
Tel. +1 847 519 4400
Fax +1 847 519 4401
fmsusa@fms-technology.com

FMS UK
Highfield, Atch Lench Road
Church Lench
Evesham WR11 4UG, Great Britain
Tel. +44 1386 871023
Fax +44 1386 871021
fmsuk@fms-technology.com