Operating Manual CMGZ100

Analog Tension Controller

Version 2.01 04/02 fg

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

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

1 Safety instructions

Caution

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

Caution

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

Danger

The Tension Controller can operate drives or brakes with high performance. It has no built-in emergency stop function. To provide safety of man and machine in case of malfunction, the person responsible for system design has to establish specific safety procedures such as emergency stop ciruits, etc.

Caution

Improper handling may damage the fragile electronic equipment! Don’t use rough tools as screwdrivers or pliers! Touch earthed metal part to discharge static electricity before touching the electronic unit!

Caution

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

Danger

Make sure the Tension Controller operates in the correct direction! If the Tension Controller operates the wrong way, the drive tends to run immediately with maximum speed, causing damage (i.e. material cracking) or personal injury! Check the Tension Controller behaviour by measuring the output value before power on the drive!

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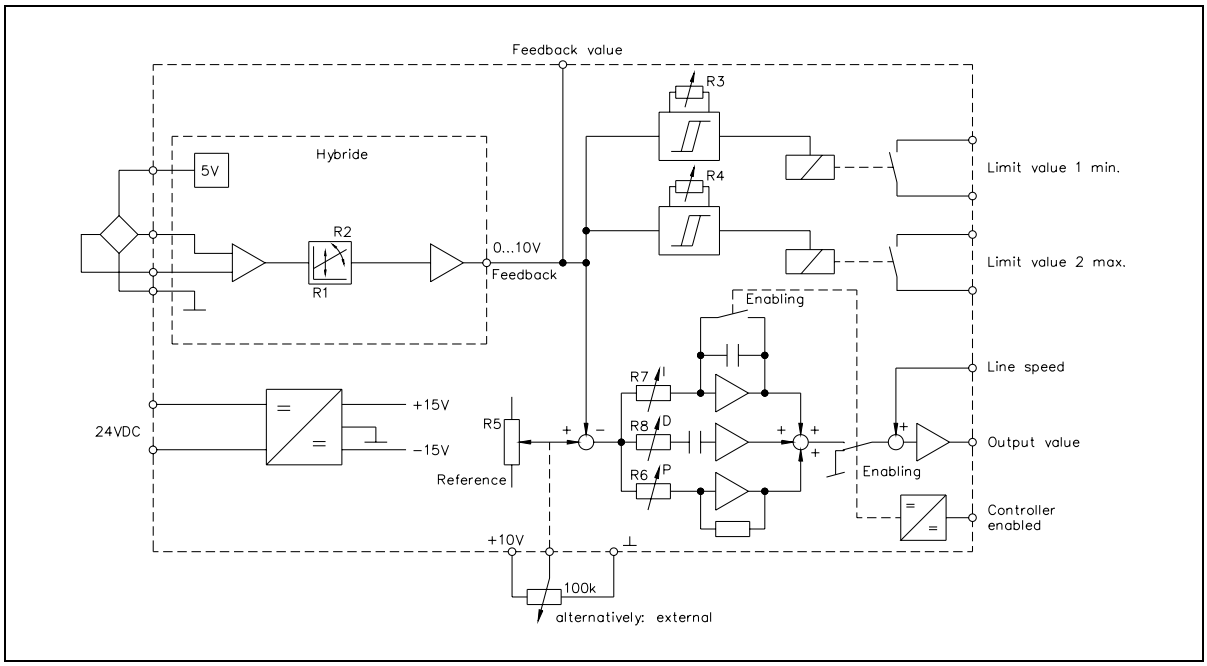
2 System Description

2.1 Block diagram

The block diagram shows the strain gauge amplifier, the PID controller, the limit switches, the overlay of the line speed and the power supply.



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2.2 Function

The CMGZ100 combines a strain gauge amplifier with a PID controller and is suitable for controlling the material tension in machinges for finishing paper, plastic foils, aluminium foils, metal sheets, wires and most other continuously processed materials.
The amplifier is based on reliable components from the FMS range and provides offset and gain adjustment as well as an adjustable low-pass filter.
The Tension Controller provides independently adjustable Proportional, Integral and Derivative control blocks, and can be released over a digital input that is operated with 24VDC or AC.
The Tension Controller also has also a minimum and a maximum limit switch with relay outputs.
The pcb is built to European standard size with DIN41612 F connector.

2.3 Strain gauge amplifier

The strain gauge amplifier is based on a hybrid module that provides the stable excitation voltage (5V) for max. 2 sensors with 350Ω. It amplifies the mV signal to 10V. Offset and gain are adjusted with the front-mounted 10-turn potentiometers. The 10V signal is the feedback signal for the Tension Controller.

2.4 PID-Controller

The controller part calculates Proportional, Integral and Derivative values based on the difference between reference and feedback.
The coefficients are independently adjustable over a wide range with potentiometers R6, R1 and R8..
The tension reference can be set using the internal potentiometer R5 or by changing jumper X20 to X21 and using an external 100kΩ potentiometer.

2.5 Controller release

The CMGZ100 Tension Controller can be released over a digital input (12-30V AC or DC). As long as there is no signal the Tension Controller is locked and the output is zero. When the voltage is applied the Tension Controller starts operating and the output signal goes from zero to the required value that is needed for the desired tension.

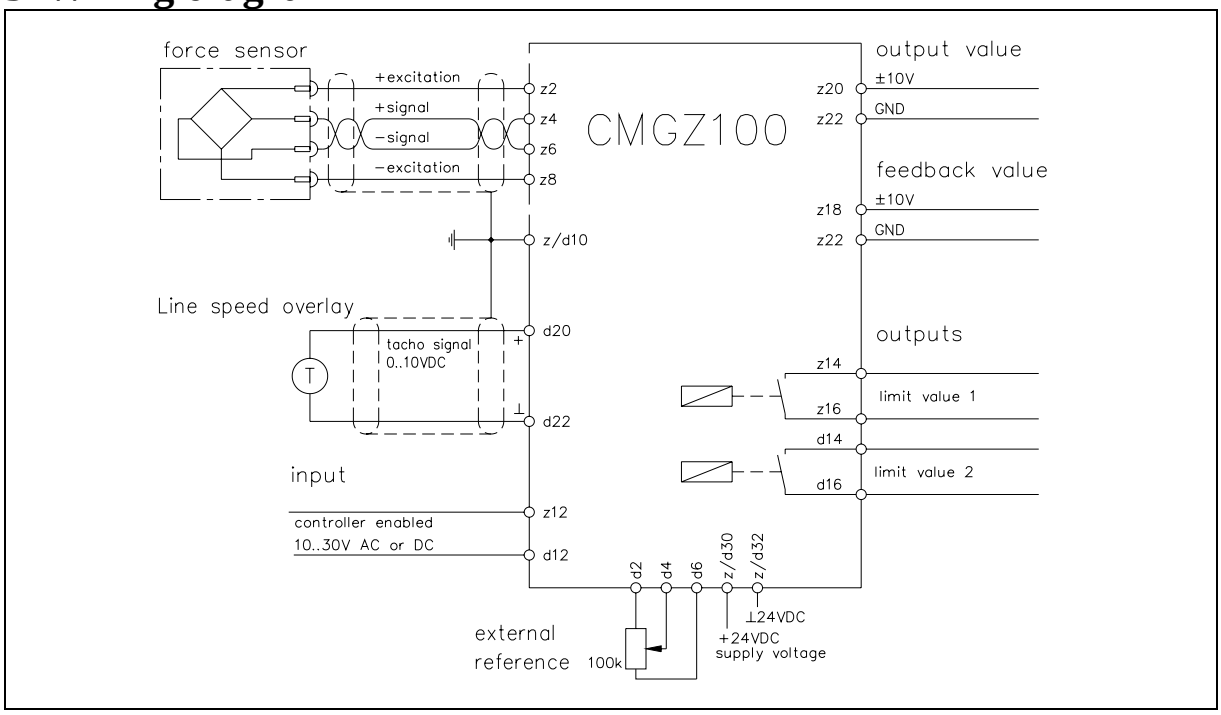
2.6 Limit switches

The CMGZ100 provides a minimum switch (GW1) and a maximum switch (GW2). If the threshold is overrun the appropriate front-mounted LED lights up and a relay switches on (24V, 0.5A). The thresholds are being set with front-mounted 10-turn potentiometers R3 ad R4.
The threshold value can be measured at pin X4 and X5.
The relay outputs are available on the connerctor at z14/z16 and d14/d16.

2.7 Overlaid line speed

If the Tension Controller is used in a line drive application the dynamic can be increased by using an available line speed signal, which is fed to the Tension Controller. The tension control loop then is only responsible for the correction of this signal. By setting jumper X24 to X25 the part of this overlaid controller signal can be adjusted.

3 Wiring diagram



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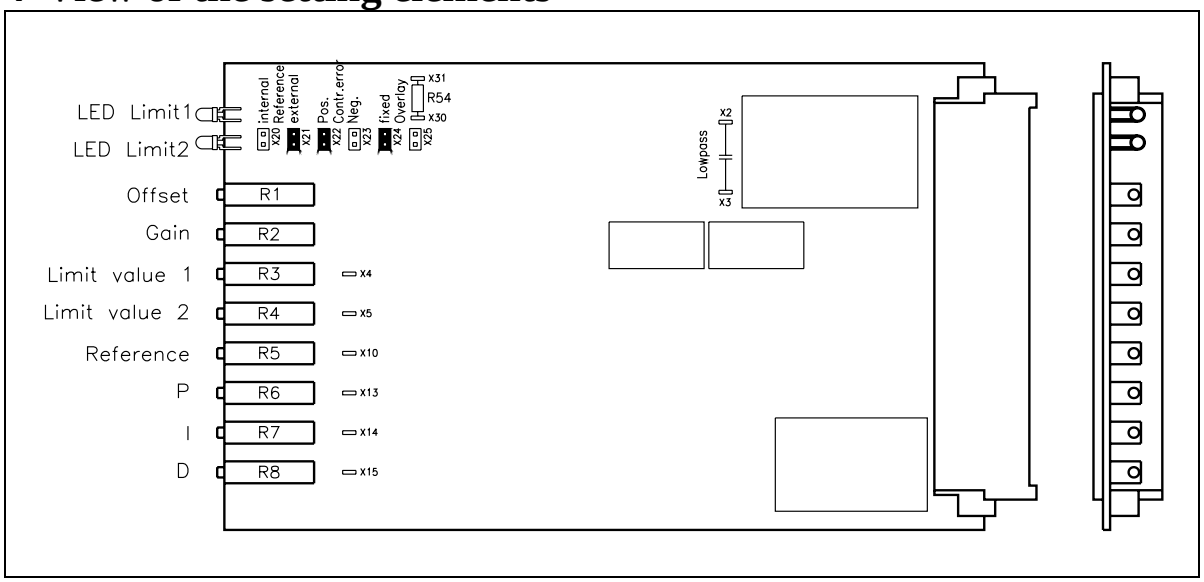
The force sensors are connected using 2x2x0.75mm^2 [AWG 18] shielded twisted pair cable. (With cable length below 15m, 2x2x0.25mm^2 [AWG 23] is also suitable.)
The shield must be connected only to the Tension Controller side to aviod earth loops.

4 View of the setting elements



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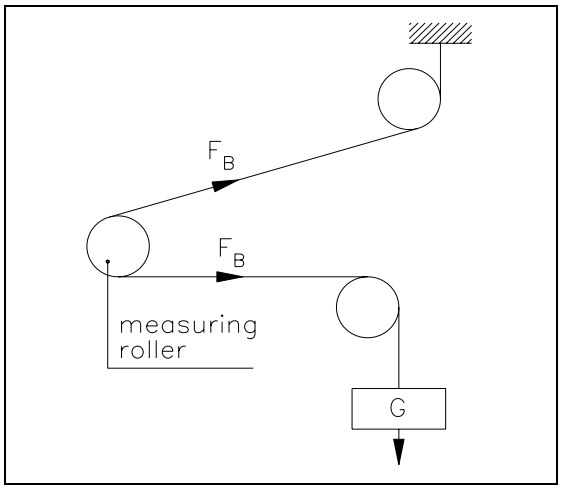
5 Operating the strain gauge amplifier

5.1 Calibrating the strain gauge amplifier

- Connect first sensor.
- Test if feedback signal (z18) is positive when sensor is loaded. If signal is negative, change z4 and z6.
- Connect second sensor
- Test if feedback signal (z18) is positive when sensor is loaded. If signal is negative, change z4 and z6 of second sensor.
- Insert material loosely into machine.
- Adjust feedback signal (z18) to zero with potentiometerR1 (Offset).
- Load material with known weight as shown in the sketch beside.
- Adjust feedback (z18) to required voltage at the loaded weight with R2 (Gain).



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5.2 Lowpass filter

The Tension Controller provides a first-order lowpass filter to eliminate noise coming from unbalanced rollers, oscillations of the band material or similar.
The adjustment of the cutoff frequency is done by means of a non-polarized capacitor using the following table:

Setting the cutoff-frequency
The corresponding capacitor is chosen with the following formula or table:

$C = \frac{10}{F}$ C: Capacity in Mikrofarad, F: Cutoff-frequency (3dB-Point)

Frequency in Hertz	Capacitor in Mikrofarad
1	10
2	5
5	2
10	1
20	0,5
50	0,2
100	0,1
200	0,05
500	0,02
1000	0,01

Table: Cutoff frequency of lowpass filter.
The filter is acting on the feedback signal.

The capacitor has to be soldered to pins X2 and X3.

Use non-polarized capacitors because positive and negative voltages can occur at this point.

5.3 Setting the limit switches

The two limit switches are adjusted with built in potentiometers.
The minimum limit is adjusted with R3. The corresponding voltage can be measured at pin X4.
The maximum limit is adjusted with R4. The corresponding voltage can be measured at pin X5.
The voltages are compared with the tension feedback signal (z18).

6 Operating the PID controller

6.1 Setting of the basic controller behaviour

Depending on this setting, a feedback signal that is greater than the reference (negative error) creates a positive output signal (Jumper X22, pos) or a negative output signal (Jumper X23, neg). The setting required depends whether the application is a winder or unwinder or in the case of a line drive whether the controlled drive is before or after the tension measuring roller.

Danger: Make sure the Tension Controller operates in the correct direction! If the Tension Controller operates the wrong way, the drive tends to run immediately with maximum speed, causing damage (i.e. material cracking) or personal injury! Check the Tension Controller behaviour by measuring the output value before power on the drive!

6.2 Overlaying the line speed

In the case of a line drive if there is a 10V-signal available that is proportional to the line speed one can improve the dynamics of the Tension Controller. Feed that signal to terminals d20/d22. The Tension Controller uses this signal as predictive output signal and adds the calculated tension control output signal.
The tension control loop then only has to correct the synchronisation errors. Jumper X24 has to be set to X25. Resistor R54 (pins X30 and 31) determines the percentage of the control output. R54 is chosen 10kΩ as standard giving 10%. The resistor value (in kΩ) gives the percentage.

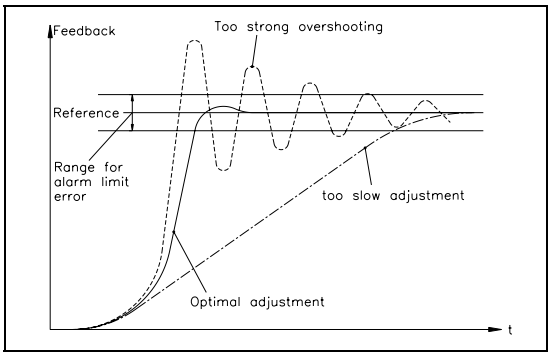
With no line speed the Jumper has to be in position X24 to give exact 100%.

6.3 Internal/external tension reference

To use the internal potentiometer for the tension reference set Jumper X20. To use an external 100kΩ potentiometer set jumper to X21. Connect external potentiometer to d2/d4/d6

6.4 Determining the control Parameters

- Connect control release to z12/d12
- Check the operating direction of the Tension Controller without power on the drive. To do this the sensors can be loaded with a force near the reference and the output signal can be checked with a voltmeter at z20. The Tension Controller must be released for this check.
- Turn potentiometer R6/R7/R8 anticlockwise
- Release controller
- Turn potentiometer R6 (Proportional) clockwise until drive starts to oscillate. Turn back a little.
- Turn potentiometer R7 (Integral) to the right until drive starts to oscillate. Turn back a little.
- If required for satisfying control results turn potentiometer R8 (Derivative) clockwise until drive starts to oscillate. Turn back a little.
- If a scope is used the following sketch might be helpful



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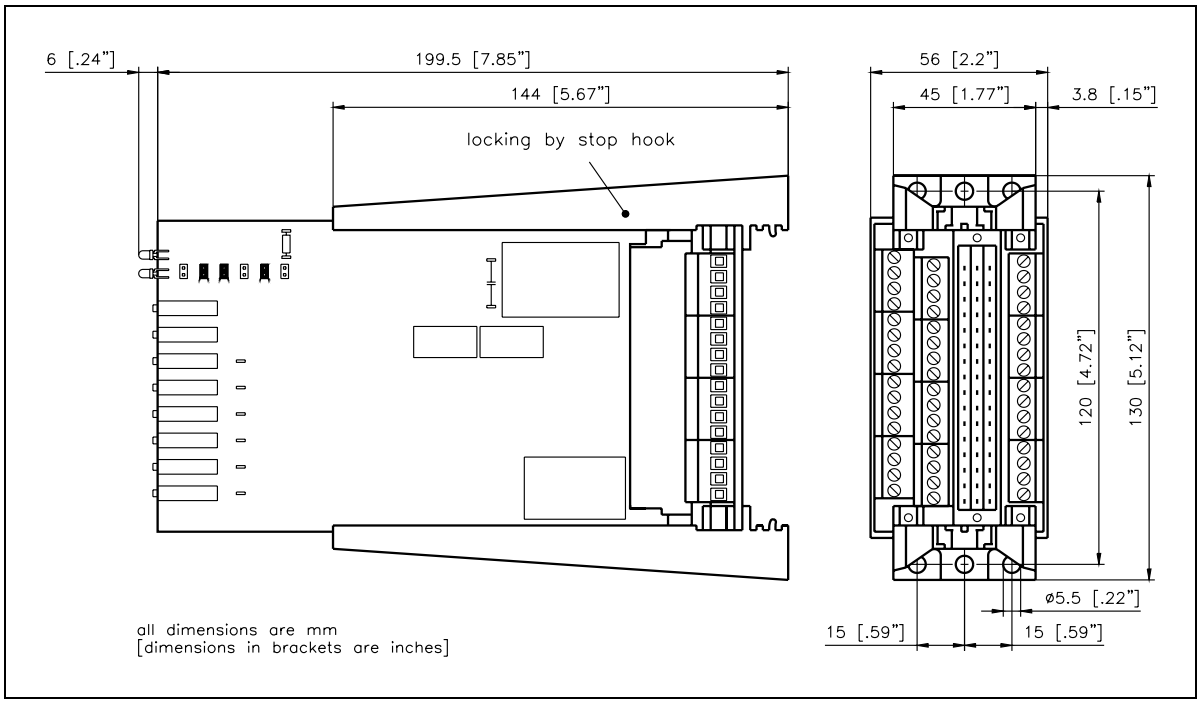
Notice: If the CMGZ100 has to control a winder or unwinder with varying bobbin diameters, the diameter of the bobbin goes into the calculation of the controller coefficients. If the bobbin is full, the stability of the loop is most critical as this is equal to a high control gain. A setting that allows stability ofver the whole range of the diameter therefore has to be used at the largest diameter.

7 Dimensions



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8 Technical data

Power supply	24VDC (18..36VDC) 3W
Excitation for strain gauges	5VDC max. 30mA for 2 pcs 350Ω-sensors
Analog output tension feedback	±10V max. 10mA short circuit proof
Controller analog output	±10V max. 10mA short circuit proof
Controller release	isolated input 12–30V AC or DC if input is inactive, integral part and output are set to zero
Limit switch 1 Minimum	Adjustable with potentiometer corresponding to 0–10V tension feedback, relay output 24V/0.5A; hysteresis 30mV
Limit switch 2 Maximum	Adjustable with potentiometer corresponding to 0–10V tension feedback, relay output 24V/0.5A; hysteresis 30mV
Connector	DIN41612 type F rows d + z
Temperature range	–10...+50°C [14...122°F]

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