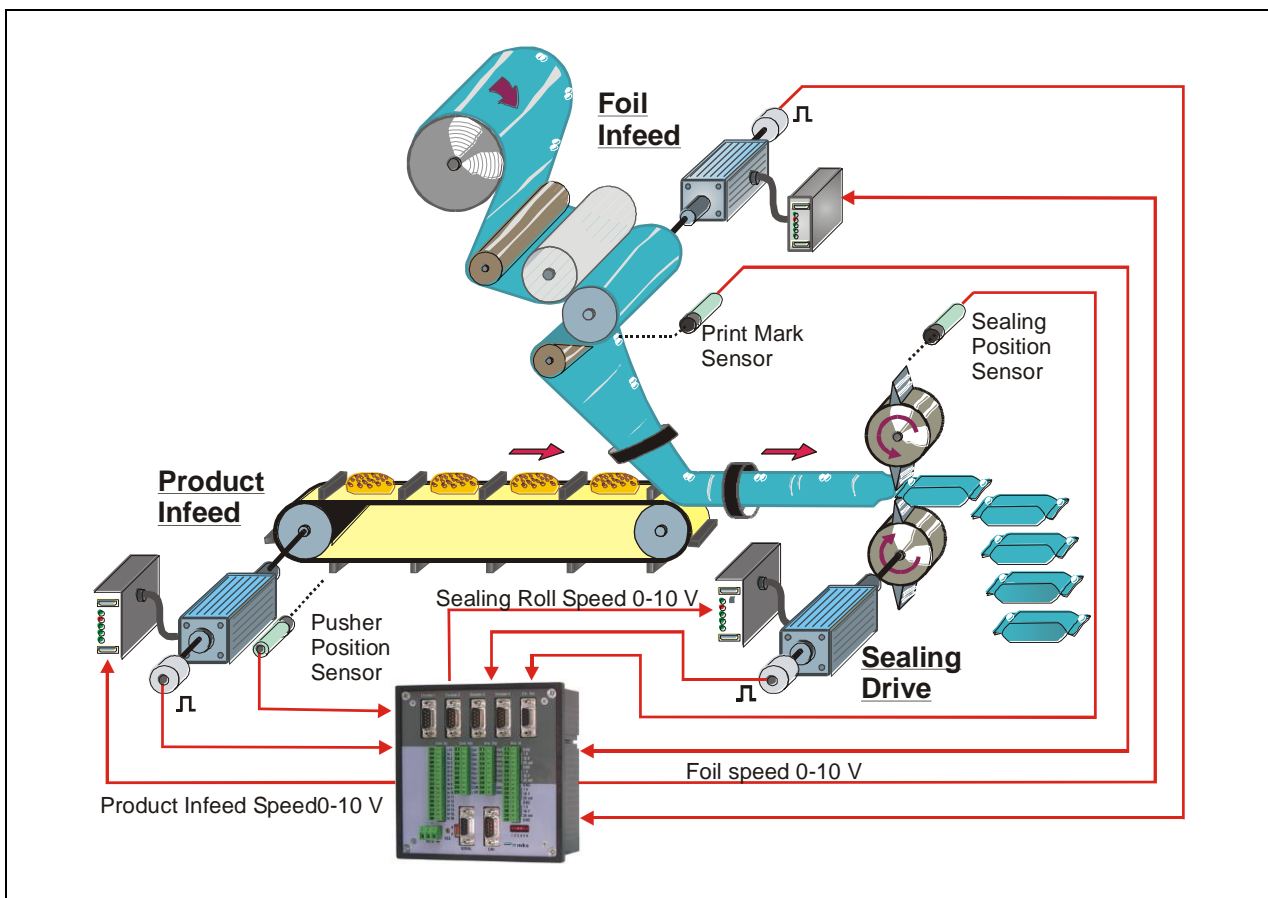


# Firmware TB 701.05

## Control System for Tubular Bag Packing Machines with Use of the MC700 Motion Controller



- No sophisticated system programming, just simple parameter settings.
- Immediately ready for use after short setup and commissioning procedure
- Highly dynamic solution with very short control cycles, therefore best sealing accuracy even with high speeds and production output
- Virtual Master axis for all involved drives

## Operating Instructions



## Safety Instructions

- This manual is an essential part of the unit and contains important hints about function, correct handling and commissioning. Non-observance can result in damage to the unit or the machine or even in injury to persons using the equipment!
- The unit must only be installed, connected and activated by a qualified electrician
- It is a must to observe all general and also all country-specific and application-specific safety standards
- When this unit is used with applications where failure or maloperation could cause damage to a machine or hazard to the operating staff, it is indispensable to meet effective precautions in order to avoid such consequences
- Regarding installation, wiring, environmental conditions, screening of cables and earthing, you must follow the general standards of industrial automation industry
- - Errors and omissions excepted –



General instructions for cabling, screening and grounding can be found in the SUPPORT section of our website <http://www.motrona.com>

Version:	Modification
TB701 01/TJ/hk_Oct. 2009	Initial version
TB701 02 / TJ_Sept. 2010	4 programmable cams for infeed chain, implementation of serial codes for status and actual values
TB701 03 / TJ_Oct. 2010	Adjustable stop position of sealing jaw
TB701 04 / TJ_Nov. 2010	Automatic length correction of the foil
TB701 05 / TJ / hk_Dec. 2010	New parameter "product offset" for easier adjustment of the product position in the foil

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# 1. Preamble

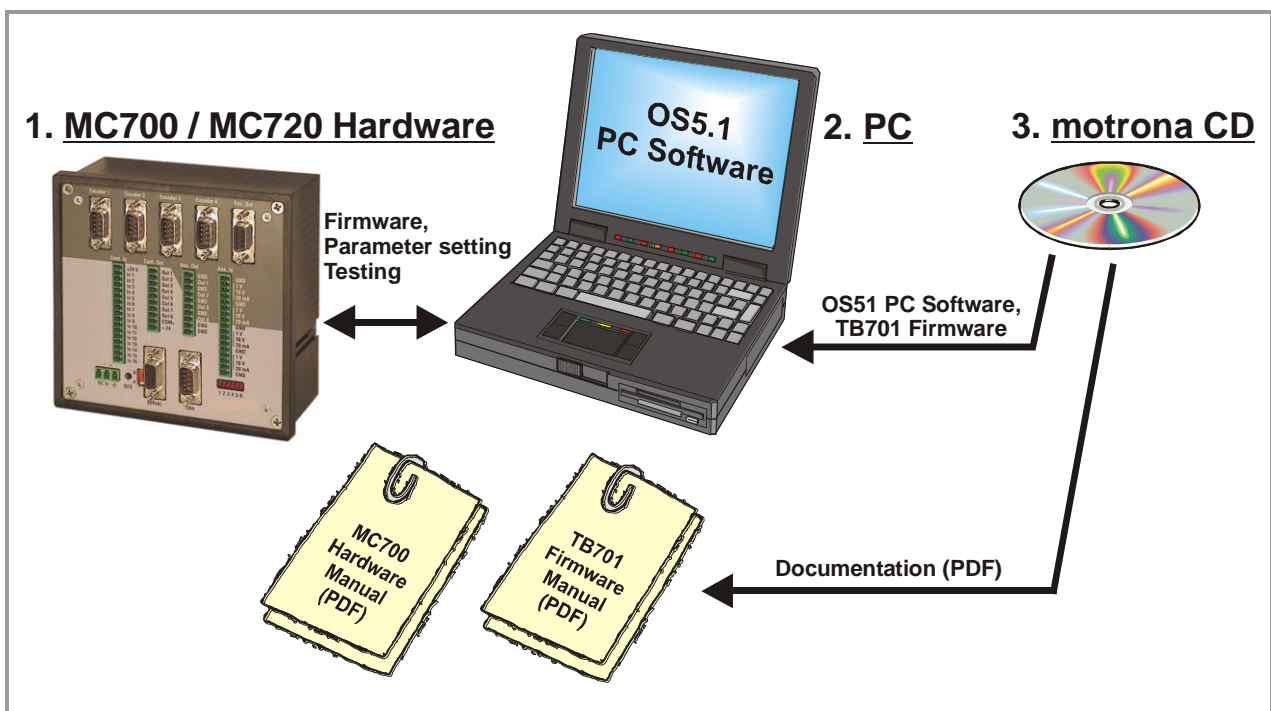
This document provides all information about the TB701 firmware, including parameters, variables and hints for commissioning.

For implementation of this application you will need:

1. a motion controller hardware of type MC700 or MC720
2. a PC with operating system Windows 98, NT, 2000, XP or Windows7
3. the motrona CD containing the PC operator software OS5.1, the TB701 firmware file and the pdf files for the manuals MC700\_de.pdf (hardware description, connections, specifications) and TB701xxx.pdf (description of the firmware as actually at hand)

All of above files are also available for free download from our homepage:

<http://www.motrona.com>



Using the TB701 Motion Firmware is subject of a license fee.

For full operation, the firmware requires entry of a valid license key issued by motrona.

## 2. General Information

### 2.1. Introduction

The present firmware has been developed for the motion control and synchronization of all principal drives necessary to operate a standard Tubular Bag Packing Machine, using an infeed belt or chain, a foil feeder and a rotary sealing tool.

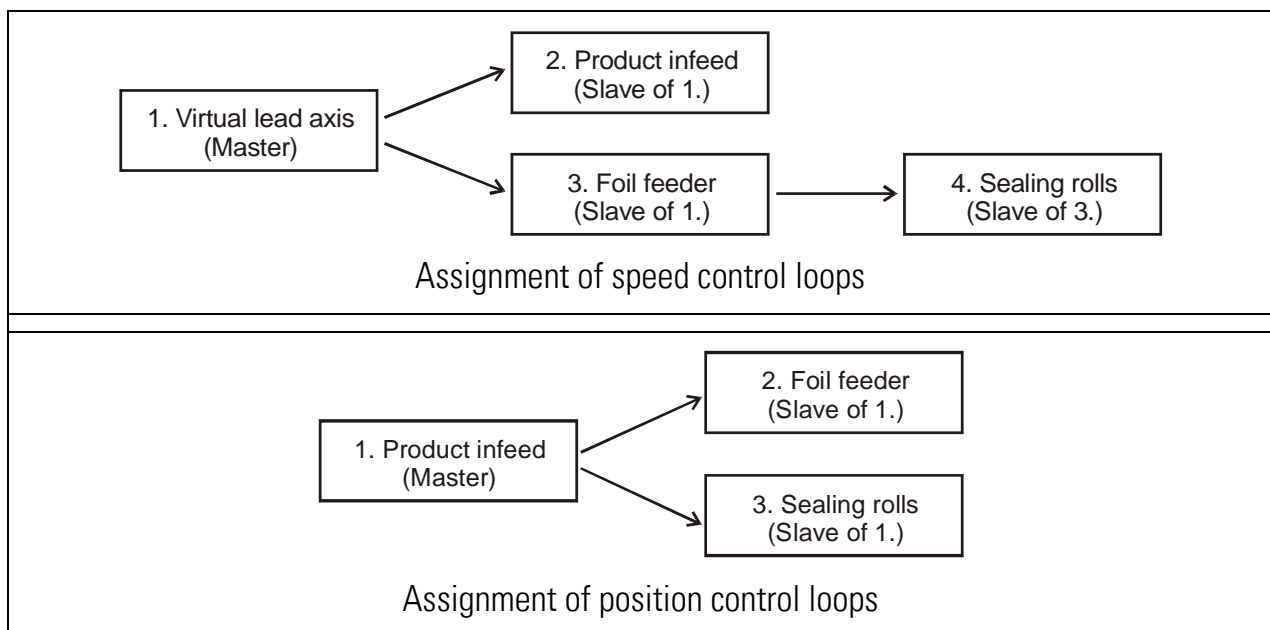
The firmware package includes a Virtual Master Axis with remotely programmable speeds and ramps. All drives are linked to this virtual master and execute their specific speed profiles according to production settings and operator parameters.

There are two levels of drive synchronization:

a) the speed control loop provides correct speeds of the product and the foil at the transition point as well as the proper speed profile of the sealing jaws, which operate synchronous to the foil while sealing is in progress, and change the speed according to the package format when outside the sealing zone.

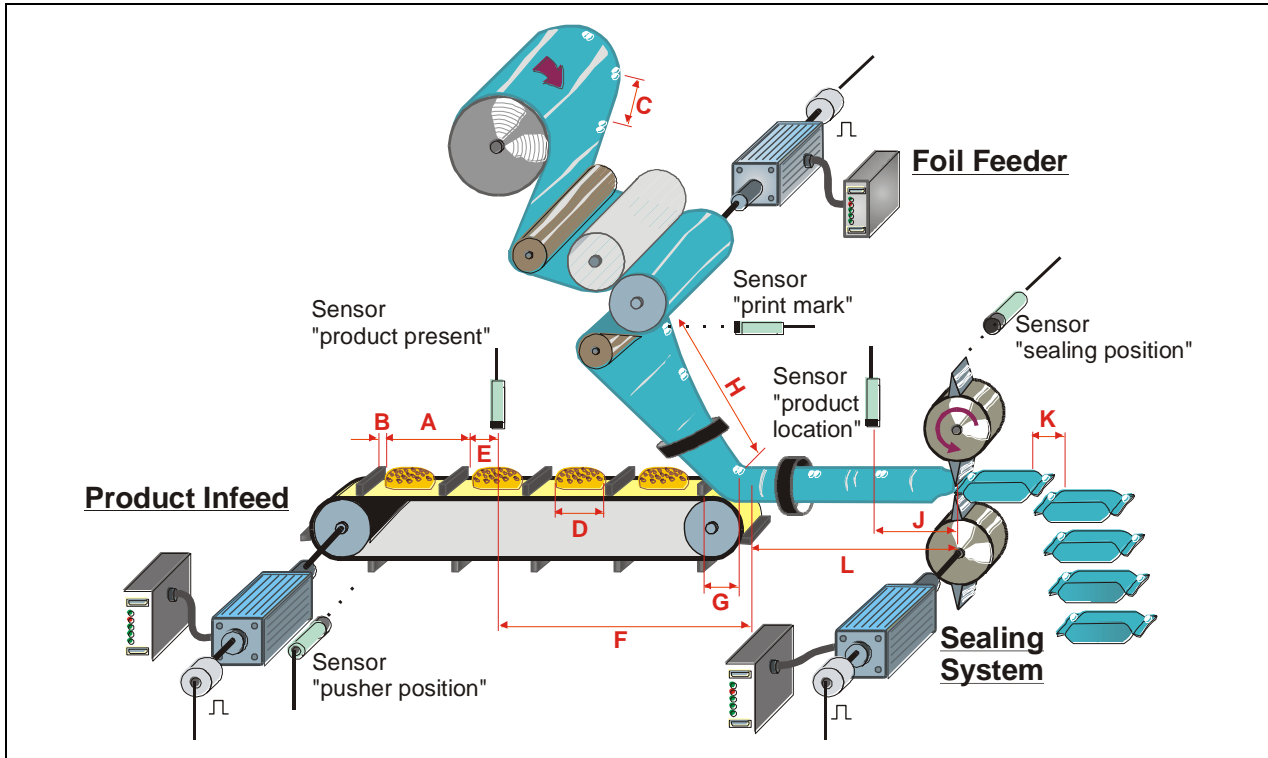
b. the position control loop provides for correct placement of the product inside the foil with consideration of the foil impression, and for precise accomplishment of the sealing procedure in the proper position between two products.

The diagrams below explain the dependency of the various drive components one to each other, with regard to speeds and with regard to relative positions.



## 2.2. System Overview

The subsequent drawing shows all essential components of the control system. Important machine dimensions and distances are marked with red letters "A" to "L" and these figures will be used later for setup and commissioning of the controller.

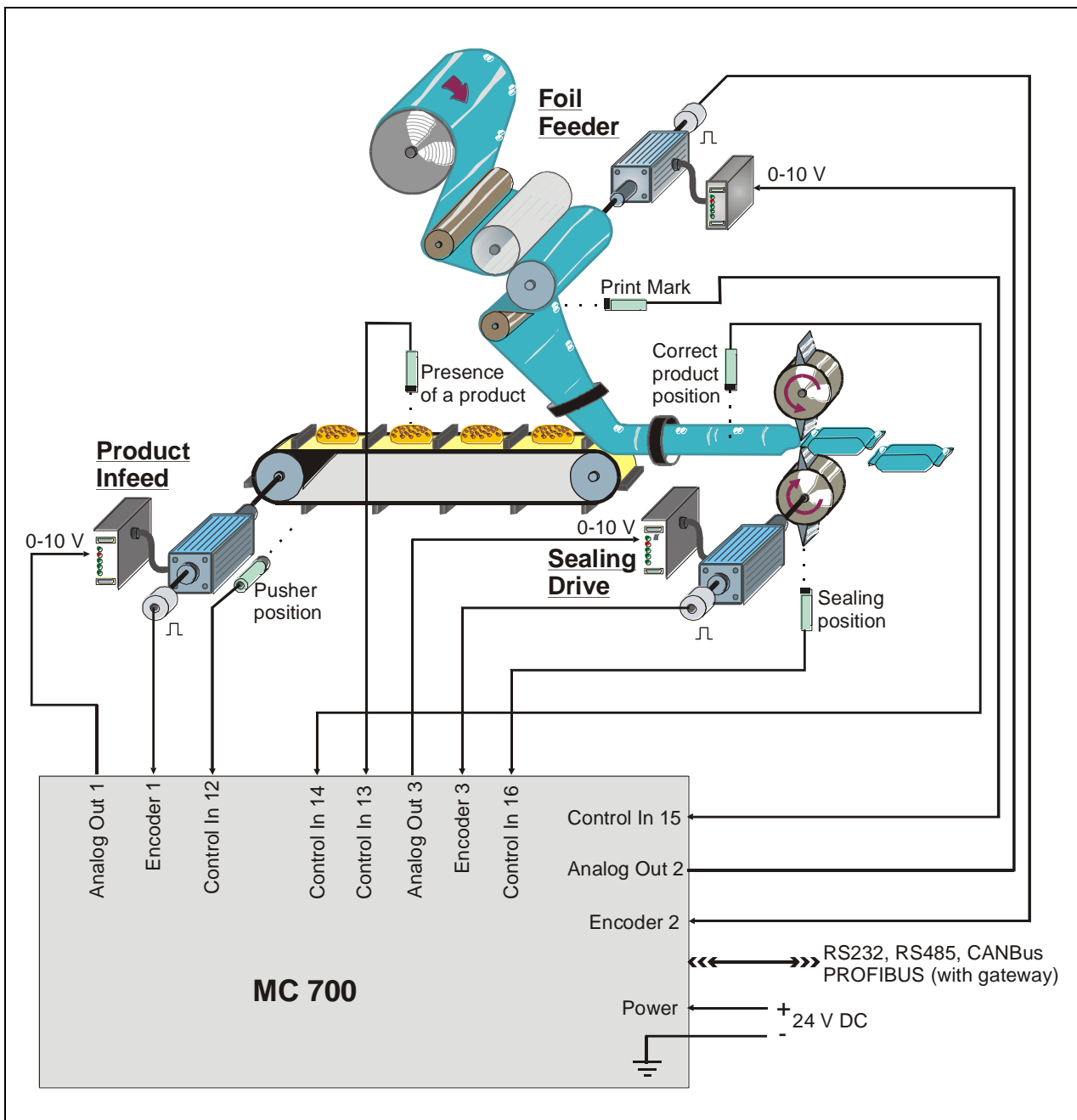


## 2.3. The MC700 Controller (Hardware)



## 2.4. Global Connection Overview

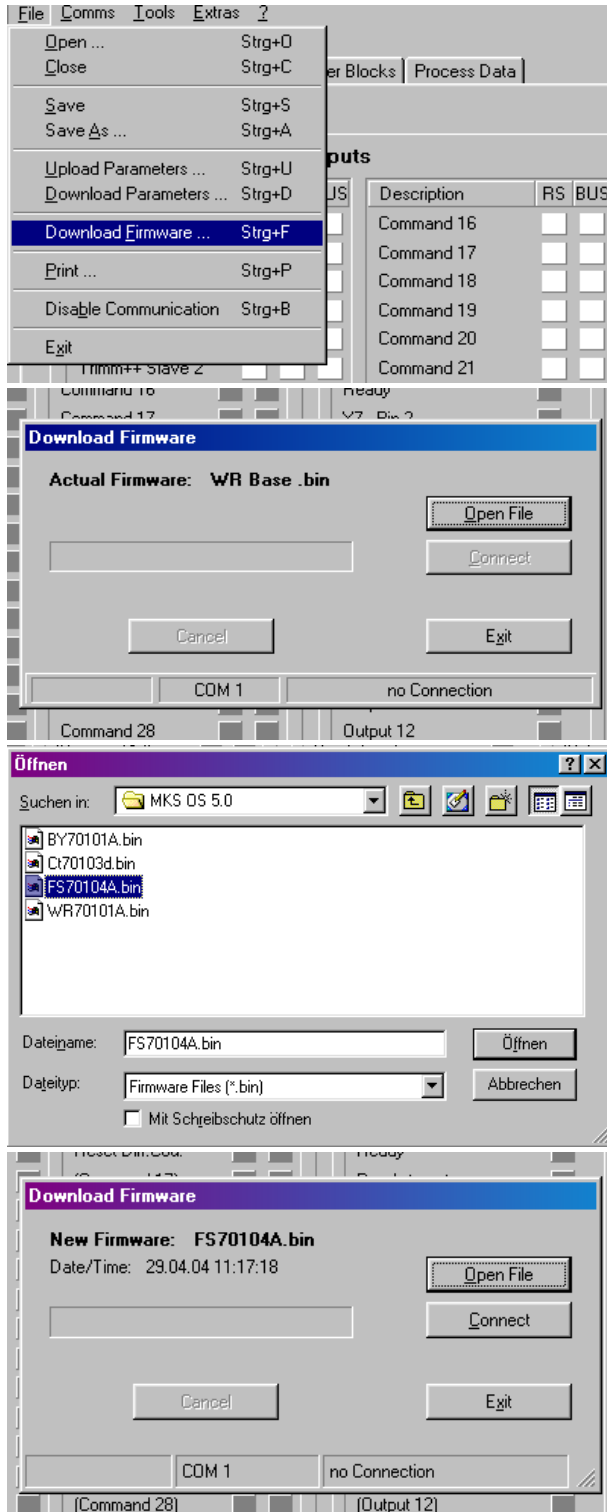
The drawing below explains the principle of connections and signal flows between machine and controller. All associated terminal assignments are printed to the front plate of the controller. Full details about electrical properties of signals, pin assignments of Sub-D-connectors etc. can be found in the hardware manual of the MC 700 unit.



### 3. Download Procedure

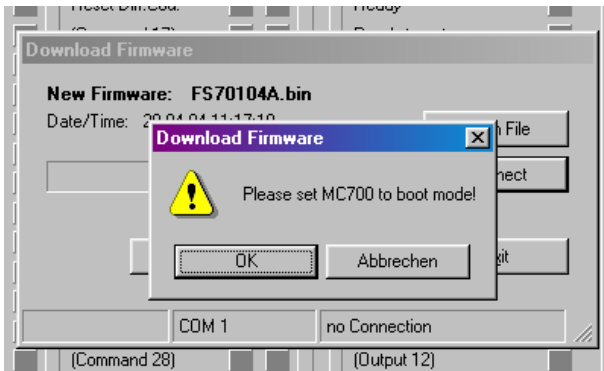
Ex factory, all MC 700- and MC 720 controllers have loaded the MC-Base firmware, which was used for factory testing purposes.

To download an application firmware, please take the following steps:



- Connect the PC to the controller, using a RS232 cable (see 3.8 of the hardware manual). Apply power to the controller and start the OS5.1 PC software. Select “Download Firmware” from the “File” menu.
- The screen now indicates the firmware which is actually loaded to the unit, in general “MCBasexx.bin”
- Click to “Open File” and select drive and file name of the download firmware (for the current application please choose TB701.05a.ecr or any higher version for download)
- Then click to “Connect” to download the selected firmware.

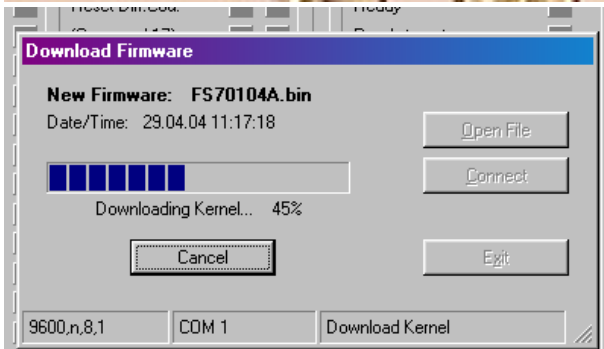




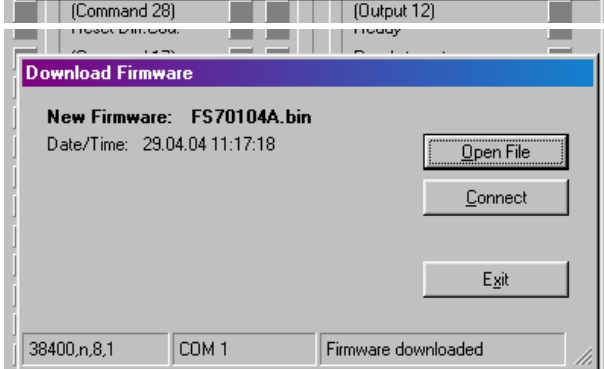
- The PC now requests you to set the controller to the "boot mode". To do this, slide the front switch from the "Run" position to the "Program" position and push the Reset button located behind the front plate, by means of a pin



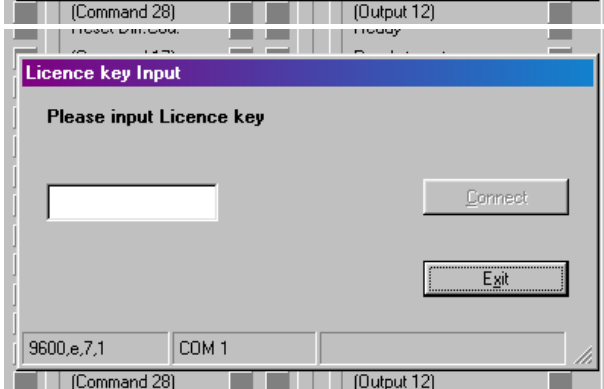
- Click "OK" to start the download



- The download uses several loading steps and the progress is displayed on the screen



- After successful conclusion of the procedure
  - a. Click to "Exit"
  - b. Slide the switch back to the "Run" position
  - c. Activate the **Reset** button for new initialization of the controller



- Finally you must input the license key:
  - a. Select "Input license key" from the "File" menu
  - b. Input the license key you received from motrona and click to "connect"

## 4. How to use the OS5.1 Operator Software

The OS5.1 software uses a clear structure of register cards and the contents automatically adapt to the firmware of the controller. This chapter describes the specific properties of the operator software when used with the TB701 firmware for Tubular Bag Machines.

### 4.1. Digital Inputs and Outputs

The register card marked "I/Os shows the logical states of all digital inputs and outputs.

Inputs				Outputs			
Description	X6	RS	BUS	Description	X6	RS	BUS
Control Enable	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Reset Diff.Chain	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Start / Stop	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Reset Diff. Film	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Master Speed +	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Reset Diff. Seal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Master Speed -	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Jog forw. Chain	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Trim forw. Seal.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Jog rev. Chain	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Trim rev. Seal.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Jog forw. Film	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Homing Seal. Jaw	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Jog rev. Film	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Jog all	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Jog forw. Seal.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Trim forw. Film	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Jog rev. Seal.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Trim rev. Film	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Clear Error	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Emergency-Stop	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	DisablePrintmark	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Index Chain	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Junction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Product Sensor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	(Command 28)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Misplaced Sensor	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Store to EEPROM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Printmark Film	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Adjust Program	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cutting Pulse	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Test Program	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Outputs	
Description	X7,RS,BUS
Ready	<input checked="" type="checkbox"/>
Alarm	<input type="checkbox"/>
Sealing Jaw Home	<input type="checkbox"/>
No Product	<input type="checkbox"/>
Film Printer	<input checked="" type="checkbox"/>
No Printmark	<input type="checkbox"/>
Vir.CuttingPulse	<input type="checkbox"/>
Error	<input type="checkbox"/>
Vir.M. in motion	<input type="checkbox"/>
Chain in motion	<input type="checkbox"/>
Film in motion	<input type="checkbox"/>
Film Index ok	<input type="checkbox"/>
Waste Bag	<input type="checkbox"/>
Max. Corr. Chain	<input type="checkbox"/>
Max. Corr. Film	<input type="checkbox"/>
Max. Corr. Seal.	<input type="checkbox"/>

Description	X7,RS,BUS
Alarm Infd.Chain	<input type="checkbox"/>
Alarm Film Feed	<input type="checkbox"/>
Alarm Seal. Jaw	<input type="checkbox"/>
Misplaced Prod.	<input type="checkbox"/>
Wrong Printmark	<input type="checkbox"/>
Junction detect.	<input type="checkbox"/>
Chain Cam 1	<input checked="" type="checkbox"/>
Chain Cam 2	<input type="checkbox"/>
Chain Cam 3	<input type="checkbox"/>
Chain Cam 4	<input type="checkbox"/>
(Output 26)	<input type="checkbox"/>
(Output 27)	<input type="checkbox"/>
(Output 28)	<input type="checkbox"/>
(Output 29)	<input type="checkbox"/>
(Output 30)	<input type="checkbox"/>
(Output 31)	<input type="checkbox"/>

### 4.2. Description of the Input Functions

All inputs which are in use are marked with a corresponding text. Unused inputs are marked with the default text "Command". The unit provides 16 physical hardware-inputs and another 16 inputs for operation via serial command or fieldbus.



The signal names "In 01" to "In16" are printed to the front plate of the MC700 controller. Please observe that signal numbers are different from the terminal numbers of which you find on the screw terminal strips.

Indicator boxes in the column marked "X6" shine blue when the associated hardware input is HIGH and shine white when the input is LOW. Where the input signal has not been assigned to any hardware input, the color of the box box remains grey.

Indicator boxes in the columns marked "RS" shine blue, when the associated input signal has been switched on via serial link. White box means "signal off". You can switch on and off every input from your PC by clicking to the corresponding indicator box in the "RS" column.

Indicator boxes in the column "BUS" shine blue, when the associated input signal has been switched on via CAN-Bus. White box means again "signal off".

At any time all input signals can be controlled via serial interface or CAN-Bus, independent if they are assigned to a hardware input or not. However please note that inputs with index or marker pulse function can be operated by hardware signal only.

All input signals follow a logical "OR" conjunction and the input signal is in "ON" state when at least one of the associated boxes shines blue.



In the subsequent tables the operating mode of each input is clarified by one of the following symbols:



















= static operation



= dynamic operation, rising edge

Ser/Bus = activation by serial command or by field bus only.

Input	Text	State	Function
In01 	Control Enable	LOW:	The controller and all functions are fully disabled. All analogue outputs are forced to zero. All counters are kept in RESET state
		HIGH:	The controller is alive and all functions are active
In02 	Start / Stop	LOW:	All drives are kept in their current position under closed-loop control. It is possible to move individual drives in forward or reverse direction by means of the corresponding "JOG" commands. Input "Homing Seal Jaw" is active for initiation of a homing cycle with the sealing rolls. Homing of the sealing jaw is optional but not mandatory
		HIGH:	Automatic machine operation is in progress and manual commands like "Jog" or "Homing" are inhibited.
In03 	Master Speed +	HIGH:	Digital command to increase the actual production speed of the whole machine by means of increasing the virtual master lead frequency. (function similar to a motorized speed potentiometer)
In04 	Master Speed -	HIGH:	Digital command to decrease the actual production speed of the whole machine by means of increasing the virtual master lead frequency. (function similar to a motorized speed potentiometer)
In05 	Trim forw. Seal	HIGH:	Shifts the sealing position slowly in forward direction with regard to the product
In06 	Trim rev. Seal	HIGH:	Shifts the sealing position slowly in reverse direction with regard to the product
In07 	Homing Seal Jaw (optional)		Initializes a homing cycle to move the sealing jaws into their home position as defined by the physical location of the "Sealing Position" sensor and the associated parameter "Cutting Pulse Offset". The Home position is opposite to the sealing position (180° displacement).  <u>Clarification:</u> after starting a homing cycle the sealing rolls start to move fast with „Home Speed High“ until they come close to the final home position. Then the speed slows down to „Home Speed Low“. After reaching the home position at low speed the drive stops in a closed-loop position control and the output "Sealing Jaw Home" goes HIGH to indicate that the home position has been reached.
In08 	Jog All		Jogs the whole machine, i.e. moves all three drives forward according to the settings of the corresponding jog speeds.

Input	Text	State	Function
In09 	Trim Forw. Film	HIGH:	Shifts the print mark position slowly forward with regard to the product position and sealing position (only the film is adjusted while the sealing position relative to the product will not change)
In10 	Trim Rev. Film	HIGH:	Shifts the print mark position slowly backward with regard to the product position and sealing position (only the film is adjusted while the sealing position relative to the product will not change)
In11 	Emergency Stop	HIGH:	Emergency stop input. The whole machine will ramp down to standstill using the emergency stop ramp as set under parameter "Quick Stop Ramp".
In12 	Index Chain		Sensor input to signal the pusher position of the infeed chain (reference impulse of the chain). <b>Important:</b> the front side of the pusher has to generate a rising edge at the sensor output
In13 	Product Sensor *)		Sensor input "Presence of a product". This sensor must generate a HIGH signal when a product is present while the pusher signal (IN12) is on. With a LOW signal the foil and the sealing rolls will be stopped after the last detected product and restart only after detection of the next product
In14 	Misplaced Sensor *)		Sensor input for "wrong product position" inside the film. Under normal conditions this input has to be LOW in the defined "forbidden zone" (i.e. around the later penetration zone of the sealing tools). If a HIGH signal should be detected inside the forbidden zone, the unit would respond with the sequence "Wrong Product Position" according to the setting of parameter "Misplaced Product Q-Stop".
In15 	Print Mark Film *)		Sensor input for the Print Mark Impulse. The controller triggers to the front edge of the print mark respectively to the rising edge of the print mark sensor. This information will be used to control the position of the product inside the film and the sealing position.
In16 	Cutting pulse		Sensor input for the sealing position. The rising edge on this sensor, together with the setting of parameter "Cut Pulse Offset", has to mark the position where the sealing jaws are totally closed in their vertical sealing position

\*) Optional signals, not absolutely necessary for operation of the machine

Input	Text	State	Function
Ser/Bus	Reset Diff. Chain	OFF:	The infeed chain operates under closed-loop PI control, i.e. speed and position of the chain are synchronized to the virtual master axis.
		ON:	The infeed chain operates "open loop", i.e. the chain moves according to a feed-forward command only, without any feedback and position control.
Ser/Bus	Reset Diff. Film	OFF:	The foil feeder operates under closed-loop PI control, i.e. speed and position of the film are synchronized to the virtual master axis.
		ON:	The foil feeder operates "open loop", i.e. the film moves according to a feed-forward command only, without any feedback and position control.
Ser/Bus	Reset Diff. Seal.	OFF:	The sealing rolls operate under closed-loop PI control, i.e. speed and position of the rolls are synchronized to the virtual master axis.
		ON:	The sealing rolls operate "open loop", i.e. the rolls move according to a feed-forward command only, without any feedback and position control.
Ser/Bus	Jog forw. Chain		Jogs the chain feeder forward or reverse while the corresponding signal is ON, with consideration of the corresponding jog speed and jog ramp settings
Ser/Bus	Jog rev. Chain		
Ser/Bus	Jog forw. Film		Jogs the foil feeder forward or reverse while the corresponding signal is ON, with consideration of the corresponding jog speed and jog ramp settings
Ser/Bus	Jog rev. Film		
Ser/Bus	Jog forw. Seal.		Jogs the sealing rolls forward or reverse while the corresponding signal is ON, with consideration of the corresponding jog speed and jog ramp settings
Ser/Bus	Jog rev. Seal.		



Jog commands can only be activated while the control input "Start-Stop" is in LOW state and the machine has come to a complete standstill after automatic operation

After termination of each jog command the actual position of the corresponding axis will be stored as the new reference position which the controller will maintain by means of closed-loop position control.

Input	Text	State	Function
Ser/Bus	Clear Error		Command to erase all actual error states and the related error messages
Ser/Bus	Disable Print Mark	ON:	All print mark evaluation remains disabled while this signal is active
Ser/Bus	Junction	ON:	<p>Signal to consider jumping of the print mark distance on the joint position where a new film roll has been glued on an empty roll. Jumping distances of print marks will be interpreted as "film roll transition" while this signal is ON. When the junction position of the film reaches the chain (where the product is inserted), all print mark correction will occur in forward direction only. As a result the machine may temporary produce longer bags, but never shorter bags.</p> <p>The function is intended to avoid that, after changing the film roll, the print mark control could cause bags which are too short for the size of the product. The function is active only when the print mark distance control has been enabled (see parameter "Print Mark Tolerance")</p>

### 4.3. Description of the Output Functions

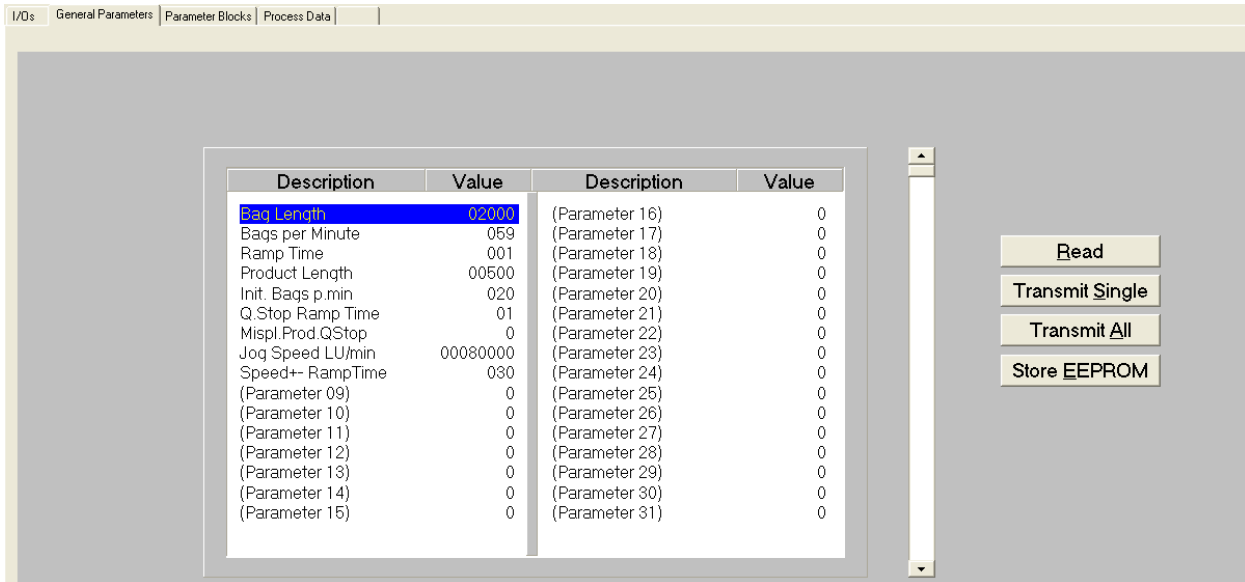
Output	Text	Function
Out01	Ready	Signal to indicate that the controller is ready to operate, and that it has successfully passed the auto-tests after initialization of the unit. However the indication "Ready" is not a guarantee for error-free operation of all controller functions.
Out02	Alarm	Signal to indicate that one of the axis has built up a positional error higher than the acceptable error according to setting.
Out03	Sealing Jaw Home	Signal to indicate that the sealing rolls are in their home position (tools are in park position).
Out04	No Product	Signal to indicate that the Product Sensor has detected a missing product. The foil and the sealing rolls will be temporary stopped when the empty pusher reaches the transition point where the products are pushed into the tube.
Out05	Film Printer	Signal to trigger a printing command, e.g. for printing a "Best before" date to the film. The duration of this signal is 1/10 of the total bag length.
Out06	No Printmark	Signal to indicate that no print mark could be detected for a subsequent number of cycles according to setting.
Out07	Vir. Cutting Pulse	Virtual cutting pulse (sealing pulse respectively) to indicate the real sealing position used by the controller (resulting from the physical position of the sealing sensor and the corresponding Offset setting).
Out08	Error	Collective Error Message. Output to signal that the unit has detected a wrong course of events. The reason for an error can be found out by checking the error status register or by checking the error message in the bottom line of the PC software.
Ser/Bus	Vir. M. in Motion	Signal to indicate that the virtual master axis moves at a virtual speed higher than the standstill definition set to parameter "Zero Speed Vir. Master".
Ser/Bus	Chain in Motion	Signal to indicate that the chain moves at a speed higher than the standstill definition set to parameter "Zero Speed Chain".
Ser/Bus	Film in Motion	Signal to indicate that the film moves at a speed higher than the standstill definition set to parameter "Zero Speed Film".
Ser/Bus	Film Index o.k.	With Print Mark Operation only: signal to indicate that the print mark position with regard to the pusher position is inside the allowed tolerance window as set under parameter "Index o.k. Window".
Ser/Bus	Waste Bag	Signal to indicate that a waste bag has been produced with a bag length outside if the acceptable tolerance (setting by parameter "Sealing Tolerance").



Output	Text	Function
Ser/Bus	Max. Cor. Chain	Indicates that the proportional correction of the chain control loop has reached its maximum as defined under "Maximum Correction". As a result the position of the chain could run out of the acceptable range (e.g. due to current limit of the drive or mechanical problems or else).
Ser/Bus	Max. Cor. Film	Indicates that the proportional correction of the film control loop has reached its maximum as defined under "Maximum Correction". As a result the position of the film could run out of the acceptable range (e.g. due to current limit of the drive or mechanical problems or else).
Ser/Bus	Max. Cor. Seal.	Indicates that the proportional correction of the sealing control loop has reached its maximum as defined under "Maximum Correction". As a result the position of the rolls could run out of the acceptable range (e.g. due to current limit of the drive or mechanical problems or else).
Ser/Bus	Alarm Inf. Chain	Indicates that the positional error of the infeed chain has reached or exceeded the limit as defined under parameter "Alarm".
Ser/Bus	Alarm Film Feed	Indicates that the positional error of the film feeder has reached or exceeded the limit as defined under parameter "Alarm".
Ser/Bus	Alarm Seal. Jaw	Indicates that the positional error of the sealing rolls has reached or exceeded the limit as defined under parameter "Alarm".
Ser/Bus	Misplaced Pro.	Indicates that the product position sensor has detected a product inside the forbidden zone of the foil (sealing area).
Ser/Bus	Wrong Print Mark	Indicates that the number of subsequent print marks with wrong print mark distance has exceeded the limit defined under parameter "Max. Wrong Print Marks"
Ser/Bus	Junction detected	Indicates that, due to the continuous control of print mark distances, a junction has been detected (i.e. a glue joint between two film rolls). This output resets automatically after the actual sealing position has caught the proper print mark position again.
Ser/Bus	Chain Cam 1	Cam Output No.1, output to switch on and off according to the actual chain position (see parameters "Cam 1 on", "Cam 1 off" and "Cam 1 Delay Time")
Ser/Bus	Chain Cam 2	Cam Output No.2, output to switch on and off according to the actual chain position (see parameters "Cam 2 on", "Cam 2 off" and "Cam 2 Delay Time")
Ser/Bus	Chain Cam 3	Cam Output No.3, output to switch on and off according to the actual chain position (see parameters "Cam 3 on", "Cam 3 off" and "Cam 3 Delay Time")
Ser/Bus	Chain Cam 4	Cam Output No.4, output to switch on and off according to the actual chain position (see parameters "Cam 4 on", "Cam 4 off" and "Cam 4 Delay Time")

# 5. Description of Parameters

All parameters is assigned to either one of the drives or to a specific group of functions which can be accessed via a corresponding register card in the menu. Some of the parameters use remarks **highlighted by red color**. This indicates a cross-reference to the system overview given in chapter 2.2.

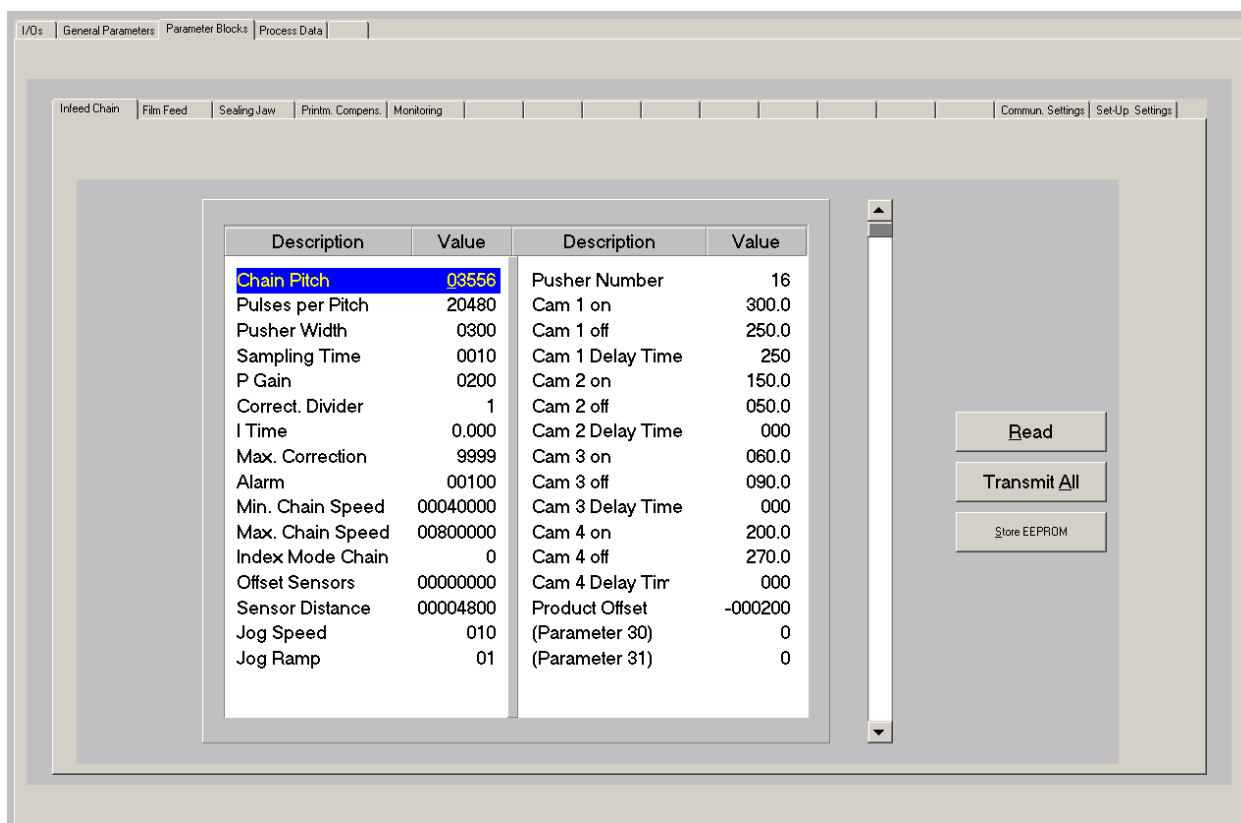


## 5.1. General Operational Parameters

<b>Bag Length</b> (see dimension "C" in chapter 2.2)	Setting of the desired bag length with regard to the engineering units chosen (entry e.g. in integer millimeters or 1/10 mm or inch) Setting range 1 – 99 999 length units. When print marks are used for sealing, this setting has to coincide with the print mark distance on the film.
<b>Bags per Minute</b>	Setting of the desired production speed (products per pro Minute). After release of the start signal the machine it will automatically ramp up to this production speed. Range 0 – 999 bags/min. Activating the inputs "Master Speed+" or "Master Speed-" will temporary override this setting until to the next start of the machine.
<b>Ramp Time</b>	Ramp time for acceleration of the whole machine from 0% up to 100% of the possible maximum speed. This ramp is valid for normal acceleration under control of the Start/Stop input. Range 0 – 999 sec.
<b>Product Length</b> (see dimension "D" in chapter 2.2)	Net length of the product to be packed. Range 1 – 99 999 length units. The setting of the product length is required to determine incidents like "wrong product position" or "impermissible number of products in one bag" etc.

<b>Init Bags p. min.</b>	<p>Initial production speed after start of the machine. Every time the machine was shut down and gets started again by the "Control Enable" command, it will at first ramp up to this production speed and hold it.</p> <p><u>Clarification:</u> This function is to avoid that, after possible interruption of the production, the machine would immediately turn back to full speed. The operator should rather be able to double-check all machine functions at low speed before ramping up to full production speed again.</p>
<b>Q-Stop Ramp Time</b>	<p>Quick Stop Ramp. Separate ramp time to stop the machine upon special events like Emergency Stop or Quick Stop triggered by wrong product position inside the foil etc.</p>
<b>Mispl. Prod. Qstop</b>	<p>Misplaced Product Quickstop. Parameter to determine the behavior of the machine when a misplaced product has been detected.</p> <p><b>0:</b> When a product with wrong position has been detected inside the foil, the sealing jaws move to their defined waiting position and waits until a trouble-free sealing becomes possible again. Then the sealing rolls restart automatically to continue production.</p> <p>As a result we will get one longer bag with one or even several misplaced products inside, followed by regular bags again as soon as the misplaced product problem was solved</p> <p><b>1:</b> The whole machine shuts down to standstill using the Quick Stop Ramp. All misplaced products have to be removed manually. After this the machine can be restarted again by cycling the Start/Stop control signal</p>
<b>Jog Speed LU/min</b>	<p>Collective setting of a Jog Speed to jog the whole machine at a time. Scaling is length units per minute. Setting range 1 – 99 999 999 units/min.</p>
<b>Speed+ Ramp Time</b>	<p>Ramp time to accelerate the machine from 0% up to 100% of the maximum speed and vice-versa. The same acceleration ramp will also apply with use of the "Master Speed+" and "Master Speed-" commands for changing the actual speed. Setting range 0 – 999 sec.</p>

## 5.2. Parameters for the Product Infeed Chain



<b>Chain Pitch</b> (see dimension "A" in chapter 2.2)	Distance between the front edges of two successive pushers. Setting range 1 – 99 999 length units
<b>Pulses/Pitch</b>	Number of counted increments (chain encoder) between two pushers when the chain moves exactly one division forward (i.e. total number of counted edges with x2 or x4 evaluation)  This setting can be received by proper calculation of the mechanical gearings and conditions. It is also possible to measure the count or verify the calculated result with use of the Adjust Menu of the Operator Software
<b>Pusher Width</b> (see dimension "B" in chapter 2.2)	Mechanical width of the pusher according to the evaluation of the Pusher Sensor. Setting range 1 – 9999 length units.  It is advisable to use an ample setting (e.g. 2 or 3 mm larger than the real width). Otherwise, caused by mechanical tolerances and clearance of the chain, the product sensor could misinterpret a pusher as a product, resulting in wrong control action with the function "no product – no film"
<b>Sampling Time</b>	Parameter for smoothing the lead frequency in case of unstable conditions. In the actual case of the infeed chain this parameter can always be set to 001 (no smoothing), since the chain drive only refers to the virtual master axis which is stable
<b>P-Gain</b>	Proportional Gain of the PI control loop of the chain drive. Setting range 0 – 9999. Recommended settings: 500 ... 2500 (suitable setting can be found out and optimized with use of the Adjust Menu)

<b>Correct. Divider</b>	<p>Digital attenuation of the strength of the correction signal for positional errors of the chain (attenuation may be advantageous with too high encoder resolution or mechanical instability caused by backlash or clearance).</p> <p>1: normal setting (no attenuation).  2: acts like a frequency divider 1 : 2 to the encoder feedback  3: acts like a frequency divider 1 : 4 to the encoder feedback etc.</p>
<b>I-Time</b>	<p>Sets the integration time (seconds) to compensate for linearity errors of the chain drive. Setting range: 000 - 999  000 = Integration off, 001 = very fast integration, 999 = very slow integration  With use of servo drives the best setting is in general 000</p>
<b>Max. Correction</b>	<p>Parameter for limitation of the active correction voltage on the analogue output. Setting range: 0001 – 9999 mV.  Recommended settings are <math>\geq 1000</math> mV (in general 9999)</p>
<b>Alarm</b>	<p>Switching threshold for the output "Alarm Infeed Chain".  The alarm will be activated when the position error of the infeed chain reaches or exceeds the alarm level.  Setting range: 1 – 99 999 encoder increments</p>
<b>Min. Chain Speed</b>	<p>Crawling speed of the chain to move to its final parking position after ramping down by Stop command.  Setting range: 0 – 99 999 999 length units / minute.  <u>Clarification:</u> This function will prevent that the heated sealing jaws will come to a stop right in their closed sealing position. When the machine ramps down to standstill, it will always continue moving with this crawling speed until the sealing jaws are out of the dangerous range to burn the film.</p>
<b>Max. Chain Speed</b>	<p>Maximum Chain Speed (for all machine operations).  Setting range: 0 – 99 999 999 lengths units / min..  <u>Clarification:</u> This is an absolute limitation of the upper chain speed, i.e. the controller will never allow any speed higher than this setting. Therefore an ample setting with a few percent of reserve should be used. Still the setting should be close to the real conditions, since too ample settings would reduce the signal resolution and therefore the accuracy of the whole system.</p>
<b>Index Mode Chain</b>	<p>Parameter for specification of the signal of the Pusher Position Sensor  0: HTL impulse (24V), applied to the screw terminal of input "In12"  1: differential TTL impulse, applied to pins Z, /Z of connector "Encoder 1"</p>
<b>Offset Sensors</b> (see dimension "E" in chapter 2.2)	<p>Distance between the front edge of the pusher and the response point of the product sensor in home position*.  Setting range: 0 – 99 999 999 lengths units  *) for this definition the chain has to be placed exactly in the switching position of the Pusher Sensor, as shown in the drawing of chapter 2.2.</p>

<b>Sensor Distance</b> (see dimension "F" in chapter 2.2)	<p>Distance between the response point of the Product Sensor and the rear edge of the product which has just been pushed into the tube (the pusher just dived down and does no more to the product)</p> <p><u>Clarification:</u> The pusher always pushes the product forward until it reaches the tube. Then the pusher dives down and the product will be moved by the foil itself. The distance to be set under this parameter refers to the position of the rear edge of the product exactly in the transitory situation where the pusher terminates pushing and the tube takes over the transportation of the product.</p> <p>This setting may be subject of necessary variation in one or the other direction, especially in cases where missing products should cause the film to stop with the sealing jaws in closed sealing position.</p>
<b>Jog Speed</b>	<p>Set speed for manual operation of the infeed chain alone.          Setting range: 0% – 100 % of the defined maximum speed</p>
<b>Jog Ramp</b>	<p>Ramp time to accelerate and decelerate the chain with jog commands.          Setting range: 0 – 99 seconds (from 0% to 100% of the speed).</p>
<b>Pusher number</b>	<p>Total number of pushers on the chain and evaluation of pusher signals. This parameter configures the mode of evaluation of the Pusher Sensor signals:</p> <p><b>0:</b> After power-up and release of the "Control Enable" signal only the position of the very first pusher will be taken. All following index impulses will be generated by the controller internally (i.e. operation with a virtual pusher impulse which automatically repeats according to the pitch setting of the chain)</p> <p><b>1:</b> The physical signal of every individual pusher will be evaluated directly, without any consideration of the pitch setting of the chain</p> <p><b>n:</b> The chain provides a total number of "n" pushers (n = 001 – 99). Only one specific pusher per chain cycle is used for a reference signal, i.e. the pusher position gets always updated after n pushers. The signals of the other pushers between will be simulated internally from the settings of chain division (pitch). As a result we have cycles with one physical impulse followed by [n-1] virtual impulses.</p> <p><u>Clarification:</u> Internal generation of virtual pusher signals will successfully eliminate manufacturing tolerances and mechanical clearance of the individual pushers on the chain, which will result in better stability and accuracy of the control system</p>
<b>Cam 1 on</b>	<p>ON / OFF switching points of the cam output „Chain Cam 1“, scaled in angular degrees. Setting range: 0° - 359.9°.</p>
<b>Cam 1 off</b>	<p>The range of 360° equates to one chain division (i.e. the distance between two pushers as set under „Chain Pitch“). 0° corresponds to the position where the front edge of the pusher triggers the pusher sensor.</p>


<b>Cam 1 Delay Time</b>	<p>Dead time compensation for cam output „Chain Cam 1“ in msec. Setting range: 0 – 999 msec.</p> <p>Anticipation time to switch the output ON and OFF prior to occurrence of the switching event, in order to compensate for delays of the associated actuator.</p>
<b>Cam 2 on</b>	ON / OFF switching points of the cam output „Chain Cam 2“, scaled in angular degrees. Setting range: 0° - 359.9°.
<b>Cam 2 off</b>	The range of 360° equates to one chain division (i.e. the distance between two pushers as set under „Chain Pitch“). 0° corresponds to the position where the front edge of the pusher triggers the pusher sensor.
<b>Cam 2 Delay Time</b>	<p>Dead time compensation for cam output „Chain Cam 2“ in msec. Setting range: 0 – 999 msec.</p> <p>Anticipation time to switch the output ON and OFF prior to occurrence of the switching event, in order to compensate for delays of the associated actuator.</p>
<b>Cam 3 on</b>	ON / OFF switching points of the cam output „Chain Cam 3“, scaled in angular degrees. Setting range: 0° - 359.9°.
<b>Cam 3 off</b>	The range of 360° equates to one chain division (i.e. the distance between two pushers as set under „Chain Pitch“). 0° corresponds to the position where the front edge of the pusher triggers the pusher sensor.
<b>Cam 3 Delay Time</b>	<p>Dead time compensation for cam output „Chain Cam 3“ in msec. Setting range: 0 – 999 msec.</p> <p>Anticipation time to switch the output ON and OFF prior to occurrence of the switching event, in order to compensate for delays of the associated actuator.</p>
<b>Cam 4 on</b>	ON / OFF switching points of the cam output „Chain Cam 4“, scaled in angular degrees. Setting range: 0° - 359.9°.
<b>Cam 4 off</b>	The range of 360° equates to one chain division (i.e. the distance between two pushers as set under „Chain Pitch“). 0° corresponds to the position where the front edge of the pusher triggers the pusher sensor.
<b>Cam 4 Delay Time</b>	<p>Dead time compensation for cam output „Chain Cam 4“ in msec. Setting range: 0 – 999 msec.</p> <p>Anticipation time to switch the output ON and OFF prior to occurrence of the switching event, in order to compensate for delays of the associated actuator.</p>
<b>Product Offset</b>	<p>Offset to adjust the product position on the film during transition from chain to foil. Setting range: +/- 99 999 lengths units.</p> <p>This setting will internally be added to the foil parameter „Offset“ and to the sealing parameter „Sealing Offset“ as well. As a result, changes of this parameter will only affect the location of the product with regard to the foil, but not at all the sealing position with regard to the print mark.</p>

### 5.3. Parameters for the Foil Feeder

<b>P-Gain</b>	Proportional Gain of the PI control loop of the foil drive. Setting range 0 – 9999. Recommended settings: 500 ... 2500 (suitable setting can be found out and optimized with use of the Adjust Menu)
<b>I-Time</b>	Sets the integration time (seconds) to compensate for linearity errors of the chain drive. Setting range: 000 - 999 000 = Integration off, 001 = very fast integration, 999 = very slow integration With use of servo drives the best setting is in general 000
<b>Circ. Feed Roll</b>	Circumference of the film feed roll Setting range 1 – 99 999 lengths units
<b>PPR Feed Roll</b>	Number of counted increments of the foil feed encoder for one full 360° revolution of the feeder roll (i.e. total number of counted edges with x2 or x4 evaluation)  This setting can be received by proper calculation of the mechanical gearings and conditions. It is also possible to measure the count or verify the calculated result with use of the Adjust Menu of the Operator Software
<b>Trim Time</b> (see also Parameter "Mode")	Differential speed for manual adjustment of the print mark position with use of the control inputs "Trim+" and "Trim-" Setting range: 001(fast position change) to 999 (slow position change)  When the controller is operated in "Mode 8" (as recommended), the same differential speed will also be used to make corrections with detected print mark errors.
<b>Alarm</b>	Switching threshold for the output "Alarm Film Feed". The alarm will be activated when the position error of the film reaches or exceeds the alarm level. Setting range: 1 – 99 999 encoder increments
<b>Ramp Form</b>	Selectable ramp form for stopping and restarting the film in case of missing products on the chain feeder (no product – no film) 0: parabolic ramp form 1: linear ramps 2: sin <sup>2</sup> shaped ramps (recommended)
<b>Correct. Divider</b>	Digital attenuation of the strength of the correction signal for positional errors of the film (attenuation may be advantageous with too high encoder resolution or mechanical instability caused by backlash or clearance). 1: normal setting (no attenuation). 2: acts like a frequency divider 1 : 2 to the encoder feedback 3: acts like a frequency divider 1 : 4 to the encoder feedback etc.
<b>Max. Correction</b>	Parameter for limitation of the active correction voltage on the analogue output. Setting range: 0001 – 9999 mV. Recommended settings are $\geq 1000$ mV (in general 9999)




<b>Photocell-&gt;Chain</b> (see dimension "H" in chapter 2.2)	<p>Length of the film between the print mark sensor and the transition point of the product (position where the pusher has just dived down and pushed the product into the foil) Setting Range: 0 – 999 999 lengths units.</p> <p>Because detection of the print mark in general occurs several bag lengths before the insertion of the product and before sealing, the controller has to remember every single print mark on the way between the sensor and product insertion or the sealing position respectively. This parameter is used to calculate the necessary length or the print mark shift register and the controller will store up to 32 print marks. More than a total number of 32 marks will cause an alarm message.</p>
<b>Offset</b> (see dimension "G" in chapter 2.2)	<p>Distance between the front edge of the last active pusher before product transition and the proximate print mark (machine has to be in a home position with a print mark under the switching position of the mark sensor and with a pusher in the switching position of the pusher sensor)</p> <p>Setting range: 0 – 99 999 999 length units</p> <p>This setting specifies the relation between print mark location, product position and sealing position. The desired positions can be set by either direct numeric entry, or with manual adjusting by using the "Trim Film" functions</p>
<b>Index Mode</b>	<p>Parameter to specify the print mark signal characteristics</p> <p>0: HTL impulse (24V), applied to screw terminal input "In15"</p> <p>1: TTL impulse (differential), applied to pins Z, /Z of connector "Encoder 2"</p>
<b>Phase Adjust</b>	<p>Digital attenuation of the controller's response to print mark errors. Errors of the print mark position can be corrected either straightaway or softly with several steps:</p> <p>0: full correction of the complete error with the subsequent machine cycle</p> <p>1: correction reduced to 50% of the residual error per subsequent cycle</p> <p>2: correction reduced to 33.3% of the residual error per subsequent cycle</p>
<b>Ma. Index Divider</b>	<p>Impulse divider for evaluation of the relative pusher / print mark position</p> <p>01: evaluation of pusher / print mark position after every pusher signal</p> <p>02: reduced evaluation after every second pusher signal only</p> <p>03: reduced evaluation after every fourth pusher signal only etc.</p> <p><u>Clarification:</u> with high machine cycle rates stability problems may come up when the corrections come up too fast one after each other. By experience the correction rate should not be more than 3 to 5 corrections per second, (corresponding to machine speeds of 180 to 300 bags per minute)</p>
<b>Index ok Window</b>	<p>Programmable tolerance window to indicate that the print mark position is in an acceptable range. Output "Film Index o.k." will be ON when the print mark is inside the tolerance window.</p> <p>Setting range: 1 – 9999 encoder increments</p>

<b>Max. Index Correction</b>	Parameter to limit the amount of correction with print mark errors. All errors higher than this maximum correction setting are no more compensated straightaway but in several subsequent steps. Setting range: 1 – 99999 length units
<b>Mode</b> (see also parameter "Trim Time")  	Operation Mode of the Foil Feeder: <b>1:</b> Operation according to bag length setting, no print mark evaluation <b>2:</b> Print mark operation with direct (tight) correction of errors <b>8:</b> Print mark operation with soft error compensation via "Trim Time" The controller will also accept other settings than just 1, 2 and 8. For the current application with tubular bag machines these settings would however not make sense. The preferable mode setting with tubular bag machines is Mode 8.
<b>Max. Speed Film</b>	Maximum Film Speed (for all machine operations). Setting range: 0 – 99 999 999 lengths units / min. <u>Clarification:</u> This is an absolute limitation of the upper film speed, i.e. the controller will never allow any speed higher than this setting. Therefore an ample setting with a few percent of reserve should be used. Still the setting should be close to the real conditions, since too ample settings would reduce the signal resolution and therefore the accuracy of the whole system.
<b>Sampling Time</b>	Parameter for smoothing unsteady encoder frequencies of the film encoder. Unstable motion of the film and the associated encoder frequency would directly affect the running smoothness of the sealing rolls. Normal settings under steady conditions: 1 msec. - 10 msec. Setting range: 1 – 1000 msec.
<b>Jog Speed</b>	Set speed for manual operation of the film alone. Setting range: 0% – 100 % of the defined maximum speed
<b>Jog Ramp</b>	Ramp time to accelerate and decelerate the film with jog commands. Setting range: 0 – 99 seconds (from 0% to 100% of the speed).
<b>Printer Offset</b>	Parameter to set the position where a printer command should be triggered Setting range: 0 – 99 999 length units (with respect to the print mark) Used to set the position of an additional print on the bag, e.g. "Best before" date
<b>Bags No Printmark</b>	Parameter to set a maximum number of "missing print marks" The output "No Print mark" will switch ON after a number of subsequently missed print marks according to the setting of this parameter.
<b>Printmark Tolerance</b>	Setting of the maximum acceptable tolerance for the distances between two consecutive print marks. Setting range 0 – 9999 length units.  The real distance between two marks is measured by the controller continuously and must always be in the range " <b>Bag Length +/- Printmark Tolerance</b> ". Otherwise the mark will be declared as non-valid and ignored. With setting "0" this function is switched off and every detected print mark will be accepted.

<b>Max. Wrong Printmarks</b>	Maximum acceptable number of non-valid print marks. When the number of non-valid print marks in a sequence reaches a maximum according to this setting, the alarm output "Wrong Printmark" will switch ON. Setting range: 0 – 99 non-valid marks.
<b>Index Corr. Win.</b>	Threshold where the controller refrains from making index corrections When the detected print mark error lies inside this window, the controller will accept the error without doing corrections.
<b>NoProduct Offset</b>	<u>For applications only where the products are inserted manually to the chain, and therefore always many pushers will run without a product.</u> Setting range 0 – 999 999 length units.  In above case the foil will be frequently in standstill and will only move one bag length forward when again one more product is in approach. This is a disadvantageous condition with limited control options, and therefore can cause cumulative displacement of the print mark position. Setting this parameter to an average correction value will help to avoid unacceptable displacement during the disadvantageous condition. All errors will be reset automatically when the controller gets full control again by two or three subsequent products in the chain.
<b>Trim Time Homing</b>	Separate Trim Speed, active with the very first print mark correction after power-up of the system. Setting range: 001(fast position change) to 999 (slow position change) This function is useful at the beginning of production, to get fully misadjusted print mark positions more quickly into the zone where they should be
<b>Max. Length Cor.</b>	Maximum value of the correction of the Bag Length Setting when the automatic length correction is on (see clarification below).
<b>Length Cor. Cyc.</b>	Automatic Correction of the Bag Length Setting by continuous measurement of the real print mark distance. Setting range: 0 - 6. <b>0:</b> Automatic correction is disabled <b>1:</b> Automatic correction to operate after 1 format out of tolerance <b>2:</b> Automatic correction to operate after 2 formats out of tolerance <b>3:</b> Automatic correction to operate after 4 formats out of tolerance etc. (see clarification below).
<b>Length Cor. Tol.</b>	Parameter to set the tolerance threshold where the automatic Length Correction should intervene. Setting range: 0 – 9999 length units.
<b>Clarification:</b> In consequence of stretch of the film or of slip on the film feed roll, the print mark distance can change over the time, so that the real bag length is no more exactly equal to the bag length setting. Because of the proportional characteristics of the controller this would result in a slight but permanent displacement between print mark and sealing position. To avoid this, after a consecutive deviation of the measured mark distances the bag length setting can be substituted by the average bag length found by measurement. Parameter „Length Cor. Cyc.“ determines after how many deviations this correction becomes active, and parameter „Length Cor. Tol.“ defines the window where a measured distance is declared to be out of tolerance	

## 5.4. Parameters for the Sealing Rolls

Circ. Sealing Jaw	Active circumference of the outer circle of the sealing rolls (including tools) Setting range: 1 – 99 999 length units
PPR Sealing Roll	Number of encoder impulses from the sealing roll encoder for one full 360° rotation of the roll (total number of counted edges with x2 or x4 evaluation) This value can be calculated from the mechanical machine data, and can be measured or verified with use of the Adjust-Menu of the PC software
Trim Time	Differential speed for manual adjustment of the sealing position with use of the "Trim+" and "Trim-" control inputs. Setting range 001(very fast adjustment) to 999 (very slow adjustment)
Sync before Cut	This setting determines how long <u>before</u> the rising edge of the virtual sealing impulse the rolls must already run synchronous to the film. Setting range: 1 – 9999 length units.
Sync after Cut	This setting determines how long <u>after</u> the rising edge of the virtual sealing impulse the rolls must still run synchronous to the film. Setting range: 1 – 9999 length units.
<p>The diagram illustrates the timing of the sealing process. It shows three main curves: 'Film speed' (a constant horizontal line), 'Sealing roll speed' (a bell-shaped curve that ramps up before the physical impulse and ramps down after it), and 'Physical sealing impulse (sensor)' (a rectangular pulse). A 'Virtual Sealing Impulse (operational)' is shown as a pulse that occurs while the sealing roll speed is high. Two horizontal double-headed arrows indicate 'Sync before' (the time from the start of the roll speed ramp to the start of the virtual impulse) and 'Sync after' (the time from the end of the roll speed ramp to the end of the virtual impulse). A third horizontal double-headed arrow indicates 'Cut Pulse Offset' (the time from the physical impulse to the start of the virtual impulse).</p>	
<b>Seals per Rev.</b>  	<p>Number of sealing jaws on the sealing roll – number of sealings accomplished with every revolution of the roll. Setting range: 1 – 999 tools/rev.</p> <p>When sealing rolls on the machine are exchanged against another set of rolls with a different number of tools per revolution, it is enough to change only this parameter correspondingly. From this setting the controller will automatically calculate and set all other parameters concerned, according to the new sealing jaw configuration.</p>

<b>Vmax / VLine</b>	<p>Maximum acceptable ration between film speed and circumferential speed of the sealing tools. With short bag lengths the speed of the rolls will never increase beyond this ratio. Setting range: 01 – 25</p> <p><u>Clarification:</u> with all bag formats shorter than the circular distance of two subsequent sealing tools, between two sealing actions the tools have to accelerate to a speed higher than the film speed. With very short bags also very high overspeed will be claimed from the sealing drive when outside the sealing zone.</p> <p>This parameter is not only intended to limit the speed to the possible maximum RPM the drive can perform, but also serves for optimization of the speed profile.</p> <p><b>Setting this parameter to 01 means that the tools can never move faster than the film, i.e. no bag length higher than the circular tool distance can be done!</b></p>
<b>Index Mode</b>	<p>Parameter for specification of the signal of the Sealing Position Sensor:</p> <p><b>0:</b> HTL impulse (24V), applied to the screw terminal input "In16"</p> <p><b>1:</b> TTL impulse (differential), applied to pins Z, /Z of connector "Encoder 3"</p>
<b>+/- Sync Rate</b>	<p>Parameter for fine-tuning of the sealing tool speed with regard to the foil speed. Tuning may be useful to avoid slight pulling or jamming by the tools while in engagement with the film surface.</p> <p>Setting range: +/- 99.9% with respect to the film speed.</p> <p>Normal setting is 0. Positive settings will produce tool speeds faster than the film and negative settings will produce speeds slower than the film.</p> <p>This setting will affect the relative speed between film and tool only, but not at all the bag length.</p>
<b>Ramp Form</b>	<p>Selection for the ramp shapes of the sealing tool profile</p> <p><b>0:</b> Parabolic S-ramps (recommended in general with standard servo drives)</p> <p><b>1:</b> Linear ramps (recommended with less dynamic systems, e.g. DC drives)</p> <p><b>2:</b> Sin<sup>2</sup> shaped ramps (recommended with extremely dynamic servo systems)</p>
<b>Sealing Mode</b>	<p>Operation Mode of the sealing process:</p> <p><b>1:</b> Sealing / cutting according to bag length setting (no index evaluation)</p> <p><b>2:</b> Index operation between pusher and sealing impulse, i.e. the location of the product will finally determine where the sealing position is.</p>
<b>Chain End-&gt;Cut</b> (see dimension "L" in chapter 2.2)	<p>Distance between the product transition point (dive-down position of the pusher) and the center position of the sealing jaws in their completely closed condition. Setting range: 0 – 999 999 length units.</p> <p>The controller will store the accurate positions of up to 32 products inside the tube. An alarm message will occur when more than 32 products are detected between transition point and sealing point.</p>
<b>Sealing Offset</b>	<p>Fine-tuning of the accurate sealing position with reference to the product.</p> <p>Setting range: +/- 9999 length units.</p>
<b>Max.Index Corr.</b>	<p>Maximum correction of the sealing tool position within one machine cycle.</p> <p>Higher errors will be compensated with several steps.</p>

<b>Cut Pulse Offset</b>	Adjustable displacement of the active switching position of the Sealing Impulse (virtual impulse) with regard to the physical impulse of the sealing position sensor. Setting range +/- 999 999 encoder increments. See drawing page 28
<b>P-Gain</b>	Proportional Gain of the PI control loop of the sealing drive. Setting range 0 – 9999. Recommended settings: 500 ... 2500 (suitable setting can be found out and optimized with use of the Adjust Menu)
<b>Correct. Divider</b>	Digital attenuation of the strength of the correction signal for positional errors of the sealing rolls (attenuation may be advantageous with too high encoder resolution or mechanical instability caused by backlash or clearance). 1: normal setting (no attenuation). 2: acts like a frequency divider 1 : 2 to the encoder feedback 3: acts like a frequency divider 1 : 4 to the encoder feedback etc.
<b>Max. Correction</b>	Parameter for limitation of the active correction voltage on the analogue output. Setting range: 0001 – 9999 mV. Recommended settings are $\geq 1000$ mV (in general 9999).
<b>Jog Speed</b>	Set speed for manual operation of the sealing rolls alone. Setting range: 0% – 100 % of the defined maximum speed.
<b>Jog Ramp</b>	Ramp time to accelerate and decelerate sealing rolls with jog commands. Setting range: 0 – 99 seconds (from 0% to 100% of the speed).
<b>Home Speed High</b>	Rapid motion for searching the home position of the sealing rolls (1st phase, fast and approximate approach to the home position). Setting range: 0% – 100 % of the defined maximum speed.
<b>Home Speed Low</b>	Crawl Speed for the final approach to the home position (2nd phase, accurate approach to the target position). Setting range: 0% – 100 % of the defined maximum speed.
<b>Home Ramp</b>	Ramp Time for the homing function. Setting range 01 – 99 sec.
<b>Home Switchpoint</b>	Distance from the home position where the drive speed should slow down from Rapid Motion to Crawl Speed Setting range 0 – 99 999 length units (see also description of input In07 on page 12)
<b>Home Window</b>	Position window around the home position where the output "Sealing Jaw Home" is ON (rolls are in home position zone). Setting range 1 – 100 length units.
<b>Seal Tolerance</b>	Adjustable window for the acceptable sealing tolerance. When for any reasons a sealing occurs outside of this window, output "Waste Bag" will switch ON. Setting range: 1 – 9999 length units.

<b>Alarm</b>	Switching threshold for the output "Alarm Seal Jaw". The alarm will be activated when the position error of the sealing tool reaches or exceeds the alarm level. Setting range: 1 – 99 999 encoder increments.
<b>Mispl. Sens. Dist.</b> <i>(see dimension "I" in chapter 2.2)</i>	Distance between the response point of sensor "Correct Product Position" and the center position of the sealing point. Setting range 1 – 99 999 length units.
<b>Seal Gap Length</b> <i>(see dimension "K" in chapter 2.2)</i>	Width of the sealing range where no product is allowed to be (zone reserved for sealing, forbidden zone for products) Setting range 1 – 9999 length units.
<b>Index Corr. Win.</b>	Tolerance window for suppression of index control actions. When the index error (product – sealing position) lies inside this window, the controller will refrain from making corrections for stability reasons. Setting range 1 – 9999 length units.
<b>Stop Position</b>	Wait Position of the sealing jaws when the machine is stopped (input „Start/Stop“ going LOW). Parameter to enter the distance between the Sealing Position and the desired Wait Position, i.e. the jaws will always stop by this amount behind the sealing position. Setting range 1 – 99999 length units.

## 5.5. Print Mark Delay Compensation (Compensation of the Sensor Delay Time)

With high requirements to the sealing accuracy with print marks the delay time of the print mark sensor plays a major roll. The following settings provide accurate compensation of position errors caused by sensor delay times at various speeds.

<b>Compens. 25% Speed</b>	Value of the length error at 25% of the film speed Setting range: 0 – 999 length units
<b>Compens. 50% Speed</b>	Value of the length error at 50% of the film speed Setting range: 0 – 999 length units
<b>Compens. 75% Speed</b>	Value of the length error at 75% of the film speed Setting range: 0 – 999 length units
<b>Compens. 100% Speed</b>	Value of the length error at 100% of the film speed Setting range: 0 – 999 length units

The controller automatically interpolates the correction values at all speeds between above interpolation points.

## 5.6. Monitoring Functions

<b>Zero Speed Vir. Ma.</b>	Standstill definition for the virtual master axis. Output "Vir. M. in Motion" will switch ON as soon as the virtual axis reaches a speed higher than this setting. Setting range: 0 – 999 999 length units per minute.
<b>Zero Speed Chain</b>	Standstill definition for the Chain Feeder. Output "Chain in Motion" will switch ON as soon as the chain drive reaches a speed higher than this setting. Setting range: 0 – 999 999 length units per minute.
<b>Zero Speed Film</b>	Standstill definition for the Chain Feeder. Output "Film in Motion" will switch ON as soon as the foil drive reaches a speed higher than this setting. Setting range: 0 – 999 999 length units per minute.
<b>LED Function</b>	Parameter to set the function of the LEDs on the front plate of the controller <b>0:</b> The LEDs indicate the switching state of the first 6 hardware-outputs of the controller (Out1 – Out6) <b>1:</b> The LEDs indicate the actual position error of the infeed chain <b>2:</b> The LEDs indicate the actual position error of the foil drive <b>3:</b> The LEDs indicate the actual position error of the sealing rolls (see also chapter 6)
<b>Sel.Diag.AnaOut4</b>	Parameter to attach any of the available process data values to the diagnostics analogue output "Ana Out 4". Setting range 0 - 31 (as shown in the list "Process Data" of chapter 8)
	Parameter „Ana Out4 Gain“ on register card „Setup Settings provides scaling of the analogue diagnostic signal (see chapter 5.8). The output voltage on the output results from following calculation: $\text{Output (volts)} = [\text{Ana Out 4 Gain} \times \text{Actual Measuring Value}] : 2048$ Example: Setting <u>Ana Out4 Gain</u> to 10.00 will generate a 10 volts full scale output when the parameter value reaches 2048.
<b>Batch Counter</b>	Product counter. Indicates the total number of all products sealed with automatic operation. When you like to maintain this counter value also after power-down, a „Store EEPROM“ command has to be released prior to switching power off.
<b>Waste Counter</b>	Counter for Waste Products Indicates the total number of products sealed "out of tolerance" When you like to maintain this counter value also after power-down, a „Store EEPROM“ command has to be released prior to switching power off.



## 5.7. Communication Settings (Serielle Kommunikation)

This register card sets the communication parameters for the CAN interface and the serial link. Settings and operation of the CANopen interface are explained separately in the manual **CI700**, which is available on our homepage or on our CD-ROM.

<b>Ser. Unit Address</b>	Serial unit address. Range 11 ... 99. Address numbers containing zeros like 01, 02, 03, ..., 10, 20, etc. are not permitted because these are reserved for broadcast messages (collective addressing of several units). <b>Factory default address is always 11.</b>			
<b>Ser. Baud Rate</b>	Serial baud rate: 0: 38400 Bit/s 1: 19200 Bit/s 2: 9600 Bit/s 3: 4800 Bit/s 4: 2400 Bit/s <b>Factory default setting: 2</b>			
<b>Serial Data Format</b>	<b>Setting</b>	<b>Data bits</b>	<b>Parity</b>	<b>Stop bits</b>
	0	7	even	1
	1	7	even	2
	2	7	odd	1
	3	7	odd	2
	4	7	none	1
	5	7	none	2
	6	8	even	1
	7	8	odd	1
	8	8	none	1
	9	8	none	2
	<b>Factory default setting: 0</b>			

## 5.8. Set Up Settings

These settings define all important hardware properties of inputs and outputs of the MC700 controller. You must only make settings for those functions that are really used and wired with this application.

<b>Mode Counter (1-4)</b>	Determines the number of edges counted from the four incremental encoder inputs: <b>0 = x1, 1 = x2 2 = x4</b>
<b>Dir. Counter (1-4)</b>	Assigns a counting direction (up / down) to the corresponding encoder input, depending on the quadrature A/B phase displacement. These parameters are found out and set best in the Test menu or the Adjust menu
<b>Ana-Out Offset (1-4)</b>	Sets the zero position of the corresponding analogue output. This parameter uses a numeric range from <b>-2047... 0000 ... +2047</b> corresponding to <b>-100% ... 0 ... +100%</b> of full-scale output. The normal setting is "0"
<b>Ana-Out Gain (1-4)</b>	Sets the full-scale output of the corresponding analogue output, directly in volts. <b>0 – 10,00</b> means 0 – 10 volts or 20 mA output
<b>Ana-In 1-4 Offset</b>	Not used with this application
<b>Ana-In 1-4 Gain</b>	Not used with this application
<b>Index Output</b>	Not used with this application
<b>Frequency Output</b>	-For factory testing purpose only-
<b>Dir. Frequency</b>	Sets the counting direction of the virtual master frequency: <b>1 = forward, 0 = reverse</b>
<b>Frequency Select</b>	Selects the source of the output frequency appearing at connector "Encoder Output", used for cascading and other purpose: <b>0:</b> The output frequency is the same signal as applied to input "Encoder1" <b>1:</b> The output frequency is the signal generated by the virtual master axis
<b>Index 1 select</b>	Not used with this application
<b>Index 2 select</b>	Not used with this application
<b>Index 3 select</b>	Not used with this application
<b>Index 4 select</b>	Not used with this application

## 5.9. Process Data (Actual Measuring Values)

You can follow all real process data assigned to this firmware, when you open the register card "Process data". These actual values are updated continuously.

Description	Value	Description	Value
Product_Offset	+00000000	Bag Leng.Err.Cou	+00000000
Master State	+00000000	Index State Film	+00000000
Frequency Chain	+00000000	Index Corr. Film	+00000000
Diff. Cou. Chain	+00000000	Trim-Reg. Film	+00000000
Chain Length Cou	+00000000	Film State	+00000000
Chain Pitch Cou.	+00000000	Prm.Dist.Vir.Ma.	+00000000
Chain Index Len.	+00000000	Bag Length Incr.	+00001000
Chain Index Cou.	+00000000	Diff.Cou.Seal.Jaw	+00000000
Chain State	+00000000	Pos.Cou.Seal.Jaw	+00000000
Index_Offs. Film	+00000000	Act.MarkErr.Seal	+00000000
Mark_Offset Seal	+00000000	Mark Corr. Seal.	+00000000
Frequency Film	+00000000	Set Length Seal.	+00000000
Diff. Cou. Film	+00000000	Act.Length Seal.	+00000000
Film Length Cou.	+00000000	Seal Jaw State	+00000000
Film Cut Counter	+00000000	Chain Cam Count.	+00000000
Printm. Distance	+00000000	Control State	+00000000

<b>Product Offset</b>	Offset value between the product and the film on the transition point (See parameter "Product Offset" at the end of chapter 5.2)
<b>Master State</b>	Control state of the virtual master axis: 0: standstill 1: stable operation on actual set speed or acceleration ramp to set speed 2: ramps down to the minimum speed 3: overtravel phase, minimum speed to move tool outside of sealing zone 4: ramps down from minimum speed to standstill
<b>Frequency Chain</b>	Actual encoder frequency of the chain encoder (Hz).
<b>Diff. Cou Chain</b>	Differential counter of the chain drive (actual position error of the chain control in encoder increments of the chain encoder).
<b>Chain Length Cou.</b>	Actual position of the chain. (32-bit round loop counter, counting continuously the increments of the chain encoder).
<b>Chain Pitch Cou.</b>	Counter for the actual pusher position. Counts the encoder increments of the chain encoder and resets to zero with every rising edge of the pusher sensor
<b>Chain Index Len.</b>	Counts continuously the distance from one virtual pusher to next (Sensor + Offset, resets with every virtual pusher impulse)

<b>Chain Index Cou.</b>	Counts the number of pushers within one full transition cycle of the chain.
<b>Chain State</b>	<u>Control state of the chain drive:</u> <b>0:</b> standstill, open loop (Ana Out = 0 V) <b>1:</b> closed loop position control is active <b>2:</b> chain operates synchronous to the virtual master axis
<b>Index_Offset Film</b>	Index Offset of the foil in increments of the film encoder = sum of „Offset“ (film) and „Product Offset“ (chain)
<b>Mark_Offset Seal</b>	Printmark Offset of the sealing tools in increments of the film encoder = sum of „Sealing Offset“ (Sealing roll) and „Product Offset“ (chain)
<b>Frequency Film</b>	Actual frequency of the film encoder (Hz)
<b>Diff. Cou. Film</b>	Differential counter of the film drive (actual position error of the film control in encoder increments of the film encoder).
<b>Film Length Cou.</b>	Actual position of the film. 32-bit round loop counter, counting continuously the increments of the foil encoder.
<b>Film Cut Counter</b>	Counts the film length between two sealing actions (film encoder increments) Resets to zero with every virtual sealing impulse (Sensor + Sealing offset)
<b>Printm. Distance</b>	Actual measuring result of the print mark distance (film encoder increments) (memorized result between last and second to last print mark)
<b>Bag Len. Err. Cou</b>	Counts the total number of bags which were sealed “out of tolerance”
<b>Index State Film</b>	- for factory use only -
<b>Index Corr Film</b>	Actual amount of mark correction of the film in film encoder increments
<b>Trim-Reg. Film</b>	Trim and phase correction register of the foil (real-time depletion of the print mark error, with mode 8 by use of the Trim register)
<b>Film State</b>	<u>Control state of the foil drive:</u> <b>0:</b> standstill, open loop (Ana Out = 0 V) <b>1:</b> closed loop position control is active <b>2</b> film moves synchronous to the virtual master axis <b>3</b> acceleration phase after a stop caused by missing product <b>4</b> deceleration to standstill caused by missing product <b>5</b> standstill under closed loop control, waiting due to missing products
<b>Prm.Dist.Vir.Ma.</b>	Print mark distance on the film, scaled in increments of the <u>chain</u> encoder
<b>Bag Length Incr.</b>	Actual bag length in foil encoder increments (parameter setting +/- automatic length correction)
<b>Diff. Cou. Seal. Jaw</b>	Differential counter of the sealing drive (actual position error of the sealing control in encoder increments of the roll encoder).
<b>Pos. Cou. Seal Jaw</b>	Actual position of the sealing tool between two sealing actions (round-loop counter for the sealing encoder, reset with every virtual sealing impulse)

<b>Act. Mark Error</b>	Actual position error of the sealing tool with reference to the print mark (film encoder increments)
<b>Mark Corr. Seal</b>	Resulting index correction of the sealing rolls (increments of the film encoder)
<b>Set Length Seal</b>	Pre-calculated distance to the next sealing position in film increments (actual bag length +/- actual compensation of print mark error)
<b>Act. Length Seal</b>	Real distance to the previous sealing position (film increments)
<b>Seal Jaw State</b>	<u>Control state of the sealing drive:</u> <b>0:</b> standstill, open loop (Ana Out = 0 V) <b>1:</b> closed loop position control is active (any position) <b>2:</b> closed loop standstill in home position <b>3:</b> acceleration to synchronous speed <b>4:</b> ramp from asynchronous to synchronous <b>5:</b> synchronous phase before the sealing action <b>6:</b> synchronous phase after the sealing action <b>7:</b> ramp from synchronous to asynchronous <b>8:</b> asynchronous phase <b>9:</b> ramp from synchronous to standstill
<b>Chain Cam Counter</b>	Separate length counter for the cam control, counting continuously the chain increments from one pusher to the next with reference to the pusher sensor.
<b>Control State</b>	<u>General operating state of the controller:</u> <b>0:</b> Offline (Control-Enable Low) <b>1:</b> Error <b>2:</b> Stop (after Control Enable or after Error) <b>3:</b> Automatic operation (Run) <b>4:</b> Jog <b>5:</b> Homing, move sealing roll to home position <b>6:</b> Keypad entry (MC720 hardware only) <b>7:</b> Initializing of the controller in progress <b>8:</b> Test program in progress <b>9:</b> Adjust program in progress <b>10:</b> Low-Power-State (undervoltage)

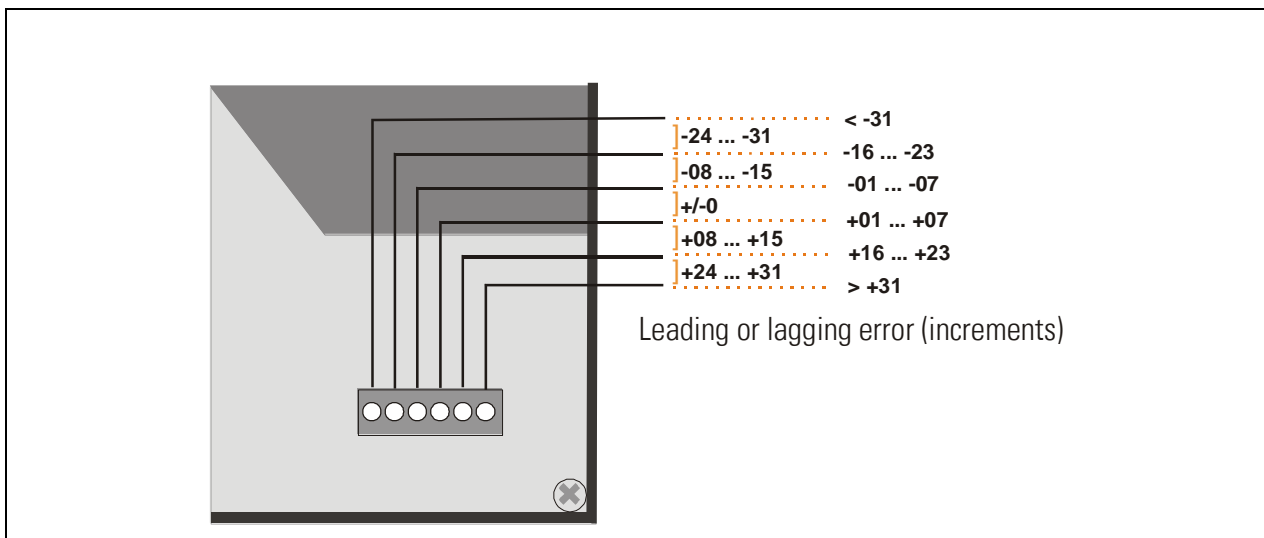
## 6. Function of the LED Indicators

Parameter „LED Function“ in parameter block „Monitoring“ allows to set the function of the 6 front LEDs to one of the following modes:

LED Function = 0: shows the switching states of the digital outputs Out1 (left) to Out6 (right).

LED Function = 1 (chain), 2 (film) or 3 (sealing) show the proportional control error (position error) of the particular drive with regard to the scheduled position.

The scaling is always directly in encoder increments according to the display code explained below. Since the LEDs are updated in cycles of a few hundred microseconds only, this simplified indication is still very useful for estimation of the control behavior of the drives.



Positive errors (LEDs on right side of centre position) indicate that the drive lags the line. Negative errors (LEDs on left side of centre position) indicate that the drive leads the line. Under regular production conditions and with good adjustment of the control loop, you should find between 2 and 4 of the centre LEDs on or blinking, which indicates at the same time that the accuracy is fine.

Where you find one of the extreme left or right LEDs on, this indicates that the controller is not adjusted well, or that the dynamic response of the drive is not sufficient. This however does not really mean that your total accuracy must be bad, because errors of continuously repeating nature may eliminate themselves.



Upon detection of a Control Error all LEDs will start to blink conjointly at a time with a frequency of about 1Hz. This kind of error indication is independent of the setting of parameter „LED Function“.

The LEDs will return to normal function after the error has been cleared. An error message in the bottom line of the PC software explains the details of the error, and an error code can be read out from the corresponding control register.

## 7. Hints for Commissioning

For set-up and commissioning of all drives, the "Adjust" menu is available under "Tools" in the main menu of the screen.

To start the Adjust menu, input "Control Enable" must first be LOW.



At this time all drives must be adjusted to proper and stable operation over the full range of later production speeds:

- the film drive and especially the sealing drive need a maximum of dynamics and response
- set ramps to zero, switch OFF any integral or differential component of the internal PID speed control loop
- operate the drives with proportional speed control only, with the P-Gain set as high as possible).

During commissioning all drives must be able to move into both directions without any mechanical limitations. Please make sure that all parameters where the setting is well-known have already be set accordingly on the associated register card.

The Adjust Menu provides 3 submenus, assigned to the drives "Infeed Chain", Film Feed" and Sealing Jaw". All drive adjustment has to be accomplished for any of the 3 drives individually according to a fully identical procedure.

Adj. Infeed Chain | Adjust Film Feed | Adj. Sealing Jaw | Disabled

**Counters**

	Virtual Master	Master	Slave
Counter	0	0	0
Frequency	0	0	0
Z-Distance	50000	0	0
Direction			<input checked="" type="radio"/> Forward <input type="radio"/> Backward

**Adjust controls**

Vir. Master speed: 200000 [Up] [Cycle]

Ramp time: 1 [Down]

P Gain: 500 [▲] [▼] [Reset is On]

Ana-Out 1 Gain: 1010 [▲] [▼]

**Analogue output**

Output voltage = 0 Volts

**Differential Error**



The Adjust Menu always uses the Virtual Master axis as a reference, i.e. every drive gets adjusted as a slave of the virtual master. The procedure includes the definition of the directions of rotation, the setting of the analogue output levels by Ana-Out Gain and the tuning of the control loop by means of P-Gain. More over the screen indicates encoder frequencies and index impulse distances of the respective drive.

## 7.1. Settings

All necessary settings are described using the example of the chain feeder drive. Settings with the other drive are fully similar. The following adjustments are relevant for successful commissioning:

- **Vir. Master Speed:** Set the virtual speed that you would like to use during the adjustment phase of the Slave. This setting is in Length Units / minute and the default value appearing on the screen is 10% of the maximum line speed you have set before (this is the recommended speed for first adjustments).
- **Ramp Time:** This ramp time is used for all acceleration and deceleration during the adjust procedure.
- **P-Gain:** An initial setting of 500 is recommended.
- **Ana-Out-Gain:** Start with the default value of 1000, which corresponds to a maximum analogue output of 10.00 volts.

## 7.2. Setting the Direction of Rotation

- Click to the "Up" key to start the slave drive. The Slave will ramp up to the speed according to your previous ramp and frequency settings.
- Please observe the motor: Does it move into **forward** direction? If it does not, the polarity of the analogue speed reference is not correct or the direction setting of the drive is wrong. Please set the drive to rotate the motor forward now.
- When we rotate forward, it is a must that the Counter in the "**Slave**" column **counts up** (increments). Where you find it counts down, please click to the other direction box (Forward or Reverse) to force it to upwards count
- In the indicator box "Z-Distance" you can read the incremental distance between two index pulses (e.g. the distance between two pushers of the chain)
- Once we count up correctly, click to the "Down" key to stop the drive again. The definition of direction of rotation for this drive is finished now.



### 7.3. Tuning the Analogue Output

- Start the drive again by clicking "Up". Now switch the Reset to OFF by clicking to the Reset key showing actually "Reset is On". This activates the closed loop control.
- Observe the colour bar and the differential counter in the field "Differential Error". There are two possibilities:
  - a) The bar graph moves to the right and the counter counts up (+):  
This indicates that the analogue signal is too low. Please increase the setting of "Ana-Out Gain" by overtyping the figures or by scrolling it up with the arrow key.
  - b) The bar graph moves to the left and the counter counts down (-):  
This indicates that the analogue signal is too high. Please decrease the setting of "Ana-Out Gain" by overtyping the figures or by scrolling it down with the arrow key.

"Ana-Out Gain" is set correctly when the bar graph remains in its center position and the differential counter swings around zero (e.g. +/-8)



**Hint:**

You can reset the differential counter to zero at any time by cycling the "Reset" command.

### 7.4. Setting of the Proportional Gain

The setting of "P-Gain" determines how strong the controller responds to position and speed errors of the drive. In principle, this setting therefore should be as high as possible. However, depending on dynamics and inertia of the whole system, too high gain values will produce stability problems.

Please try to increase the setting of P-Gain from 500 to 1000, 1500, 2000 etc. However, as soon as you find unsteady operation, noise or oscillation, you must reduce the setting again correspondingly.

We also recommend using the "Cycle" function for observations of the stability. When clicking to this key, the drive will continuously ramp up and down while you can check the differential counter for stable operation.

### 7.5. Optimization of the Settings

Please observe the behavior of the motor / drive / bar graph at different speeds between 0% and 100% of the later maximum speed. If necessary you can still slightly adapt the settings of Ana-Out-Gain and P-Gain.

Where the differential counter should still display some error while the machine is in standstill (0 or +/-1 are quite o.k.), this indicates a zero offset of the driver. You can eliminate this best by tuning the Offset value on the driver directly, but also with use of parameter "Analogue Offset" of the corresponding analogue output of the MC700 controller.

After this the Adjustment Procedure of the drive is finished and you can exit the Adjust Menu.

## 7.6. More Steps to Get the Machine Ready

- Verify carefully that all sensors and photocells switch ON and OFF reliably in their accurate switching position.
- Where you like to run the infeed chain without material, please keep the "Product Sensor" switched ON (if available). When no product sensor is used, please tie input "In13" to HIGH (+24 V).
- In an initial phase it is recommendable to deactivate the sensor from wrong product position (if available).
- Carry out several homing cycles with the sealing tools and make sure that the jaws stop exactly opposite of the fully closed sealing position respectively exactly between two sealing actions (adjustment of parameter "Cut Pulse Offset").
- Start the machine without material and without film and try out different speeds and different bag length settings.
- Set the parameters "Cutting Mode" of the film drive and of the sealing drive both to "1" (print mark evaluation disabled). Use a transparent film and verify that the length of the bags corresponds accurately to the expected bag length setting.
- Insert a few products manually and adjust the desired sealing position with use of the Trim+ / Trim- commands. Please note that the adjusted sealing position will only be maintained permanently if you have executed the "Store EEPROM" command prior to switching power off.
- Release the function of the "Product Sensor" and check the behavior of the machine with the function "missing product" (no product-no film). Adjust the stop position of the pusher in front of the tube by means of the relevant parameters.

## 7.7. Adjustment of Relative Positions Product-Print Mark-Sealing

As soon as you like to operate with print marks, please set parameter "Mode" of the film drive to "8" (recommended) or to "2" (results in short but tough corrections). At the same time parameter "Sealing Mode" of the sealing drive has to be set to "2". Verify that your setting of the bag length is exactly equal to the print mark distance on the film. After this the Print Mark Operation is active.

The following procedure and sequence has proved to work fine:

- Run the machine slowly with a few products inserted by hand. Use the "Trim" functions of the sealing rolls first in order to adjust the positions between the product and the sealing action (do not look at the print mark at this time).
- As soon as you have adjusted the product with the sealing successfully, you can now use the "Trim" function of the foil drive to adjust also the print mark with the sealing position.
- Once all positions are fine one to each other, please store this situation by applying a "Store EEPROM" command to the controller. In case of non-observance the positions will be lost upon power-down and you will have to adjust everything again after the next start of the machine.
- Increase the production speed step by step and observe all functions of the machine. Where necessary you can still do some fine-tuning of one or the other parameter.
- You are ready to run production now.



- The Trim function of the sealing drive will only change the sealing position with reference to the product position, but the location of the print mark will not change.
- The Trim function of the foil drive will displace the print mark with respect to the product and to the sealing position as well.

## 8. Parameter Lists and Serial Access Codes

(The Sub-Codes of all parameters are strictly "0")

General Parameters						
Name	Dimension	Serial Code		Minimum	Maximum	Default
		(Hex)	(Dec)			
Bag Length	length units	0000	0	1	999999	1000
Bags per minute	1/min	0001	1	0	999	100
Ramp Time	seconds	0002	2	0	999	5
Product Length	length units	0003	3	1	99999	500
Init.Bags p. min	1/min	0004	4	0	999	100
Q.Stop Ramp Time	seconds	0005	5	0	999	1
Mispl.Prod.Q.Stop		0006	6	0	1	0
Jog Speed LU/min	length units./min.	0007	7	1	99999999	20000
Speed+ Ramp Time	seconds	0008	8	0	999	10
(Parameter 09)		0009	9	0	0	0
...		...	...			
(Parameter 31)		001F	31	0	0	0

Parameters of the Infeed Chain						
Name	Dimension	Serial Code		Minimum	Maximum	Default
		(Hex)	(Dec)			
Chain Pitch	length units	0100	256	1	99999	1000
Pulses per Pitch	increments	0101	257	1	99999	1000
Pusher Width	length units	0102	258	1	9999	400
Sampling Time	msec.	0103	259	1	1000	1
P Gain		0104	260	0	9999	1000
Correct. Divider		0105	261	1	9	1
I-Time	seconds	0106	262	0.000	9.999	0
Max. Correction	mV	0107	263	0	9999	9999
Alarm	increments	0108	264	1	32000	100
Min. Chain Speed	length units./min	0109	265	0	9999999	10000
Max. Chain Speed	length units./min	010A	266	1	9999999	100000
Index Mode Chain		010B	267	0	1	0
Offset Sensors	length units	010C	268	0	99999999	0
Sensor Distance	length units	010D	269	0	99999999	10000
Jog Speed	%	010E	270	0	100	10
Jog Ramp	seconds	010F	271	0	99	1
Pusher Number		0110	272	0	0	0
Cam 1 on	0,1 degrees	0111	273	0	359,9	0
Cam 1 off	0,1 degrees	0112	274	0	359,9	0
Cam 1 Delay Time	msec.	0113	275	0	999	0
Cam 2 on	0,1 degrees	0114	276	0	359,9	0
Cam 2 off	0,1 degrees	0115	277	0	359,9	0
Cam 2 Delay Time	msec.	0116	278	0	999	0

Cam 3 on	0,1 degrees	0117	279	0	359,9	0
Cam 3 off	0,1 degrees	0118	280	0	359,9	0
Cam 3 Delay Time	msec.	0119	281	0	999	0
Cam 4 on	0,1 degrees	011A	282	0	359,9	0
Cam 4 off	0,1 degrees	011B	283	0	359,9	0
Cam 4 Delay Time	msec.	011C	284	0	999	0
Product Offset	length units	011D	285	0	99999	0
(Parameter 30)		011E	286	0	0	0
(Parameter 31)		011F	287	0	0	0

Parameters for the Film Feed Drive						
Name	Dimension	Serial Code		Minimum	Maximum	Default
		(Hex)	(Dec)			
P-Gain		0120	288	0	9999	1000
I-Time	seconds	0121	289	0.000	9.999	0
Circ. Feeding Roll	length units	0122	290	1	99999	10000
PPR Feeding Roll	increments	0123	291	1	99999	10000
Trim Time	ms/ length unit.	0124	292	1	999	100
Alarm	increments	0125	293	1	32000	100
Ramp Form		0126	294	0	2	0
Correct. Divider		0127	295	1	9	1
Max. Correction	mV	0128	296	0	9999	9999
Offset	length units	0129	297	-999999	+999999	0
Index Mode		012A	298	0	1	0
Phase Adjust		012B	299	1	9	1
Ma. Index Divider		012C	300	1	99	1
Index ok Window	increments	012D	301	1	9999	10
Max. Index Corr.	length units	012E	302	1	32000	32000
Photocell->Chain	length units	012F	303	1	999999	1000
Mode		0130	304	1	8	2
Max. Speed Film	length units/min	0131	305	1	9999999	100000
Sampling Time	msec.	0132	306	1	1000	1
Jog Speed	%	0133	307	1	100	10
Jog Ramp	seconds	0134	308	0	99	1
Printer Offset	length units	0135	309	0	99999	0
Bags No Printmark		0136	310	1	99	5
Printm. Tolerance	length units	0137	311	0	9999	0
Max. Wrong Printm.		0138	312	0	99	1
Index Corr. Win.	increments	0139	313	0	9999	0
No Product offset	length units	013A	314	0	999999	0
Trim Time Homing		013B	315	1	999	100
Max. Length Cor.	length units	013C	316	1	99999	99999
Length Cor. Cyc.		013D	317	0	6	0
Length Cor. Tol.	length units	013E	318	0	9999	0
(Parameter 31)		013F	319	0	0	0

Parameters for the Sealing Roll Drive						
Name	Dimension	Serial Code		Minimum	Maximum	Default
		(Hex)	(Dec)			
Circ Sealing Jaw	length units	0140	320	1	99999	1000
PPR Sealing Jaw	increments	0141	321	1	999999	1000
Trim Time	msec./ length unit	0142	322	1	999	100
Sync Before Cut	length units	0143	323	0	9999	10
Sync After Cut	length units	0144	324	0	9999	10
Seals per Rev.		0145	325	1	999	1
V max / V linie		0146	326	2	32	8
Index Mode		0147	327	0	1	0
+ / - Sync. Rate	%	0148	328	-99.99	+99.99	00.00
Ramp Form		0149	329	0	2	0
Sealing Mode		014A	330	1	2	1
(Parameter 11)		014B	331	0	0	0
Chain end -> Cut	length units	014C	332	1	999999	1000
Sealing Offset	length units	014D	333	-9999	+9999	0
Max. Index Corr.	length units	014E	334	1	9999	9999
Cut. Pulse Offset	increments	014F	335	-999999	+999999	0
P-Gain		0150	336	0	9999	1000
Corr. Divider		0151	337	1	9	1
Max. Correction	mV	0152	338	1	9999	9999
Jog Speed	%	0153	339	1	100	10
Jog Ramp	seconds	0154	340	0	99	1
Home Speed High	%	0155	341	1	100	10
Home Speed Low	%	0156	342	1	100	5
Home Ramp	seconds	0157	343	0	99	1
Home Switchpoint	length units	0158	344	1	99999	100
Home Window	length units	0159	345	1	9999	10
Seal.Tolerance	length units	015A	346	1	99999	10
Alarm	increments	015B	347	1	32000	100
Mispl.Sensor Dist.	length units n	015C	348	0	99999999	500
Seal.Gap Length	length units	015D	349	0	9999	0
Index Corr. Win	increments	015E	350	0	9999	0
Stop Position	length units	015F	351	0	99999	500

Compensation of the Print Mark Sensor Delay						
Name	Dimension	Serial Code		Minimum	Maximum	Default
		(Hex)	(Dec)			
Compens. 25% Speed	length units	0160	352	-999	+999	0
Compens. 50% Speed	length units	0161	353	-999	+999	0
Compens. 75% Speed	length units	0162	354	-999	+999	0
Compens 100% Speed	length units	0163	355	-999	+999	0
(Parameter 4)		0164	356	0	0	0
...	...	...	...			
(Parameter 31)		017F	383	0	0	

Monitoring						
Name	Dimension	Serial Code		Minimum	Maximum	Default
		(Hex)	(Dec)			
Zero Speed Vir.Ma.	length units/min.	0180	384	0	999999	0
Zero Speed Chain	length units/min.	0181	385	0	999999	0
Zero Speed Film	length units/min.	0182	386	0	999999	0
LED Function		0183	387	0	3	0
Sel.Diag.AnaOut4		0184	388	0	31	0
(Parameter 05)		0185	389	0	0	0
...		...	...			
(Parameter 15)		018F	399	0	0	0
Batch Counter		0190	400	0	999999999	0
Waste Counter		0191	401	0	999999999	0
(Parameter 18)		0192	402	0	0	0
...		...	...			
(Parameter 31)		019F	415	0	0	0

Process Data (Actual Measuring Values and Conditions)					
Nr.	Name	Dimension	Serial Code		Description (see also chapter 5.9)
			(Hex)	(Dec)	
0	Product Offset		00C0	192	Offset value between the product and the film on the transition point
1	Master State		00C1	193	Control state of the virtual master axis
2	Frequency Chain	Hz	00C2	194	Actual frequency of the chain encoder
3	Diff. Cou. Chain	chain inc.	00C3	195	Differential counter for the chain drive
4	Chain Length Cou.	chain inc.	00C4	196	Position counter of the chain
5	Chain Pitch Cou.	chain inc.	00C5	197	Actual pusher position with respect to the Product Sensor
6	Chain Index Len.	chain inc.	00C6	198	Distance between two consecutive impulses of the Pusher Sensor
7	Chain Index Cou.		00C7	199	Counter for number of pushers during one chain cycle
8	Chain State		00C8	200	Control state of the chain
9	Index_Offset Film	film inc.	00C9	201	Actual index offset of the film
10	Mark_Offset Seal	film inc.	00CA	202	Mark offset of the sealing jaw
11	Frequency Film	Hz	00CB	203	Actual frequency of the foil encoder
12	Diff. Cou. Film	film inc..	00CC	204	Differential counter for the foil drive
13	Film Length Cou.	film inc.	00CD	205	Position counter of the film
14	Film Cut Counter	film inc.	00CE	206	Film position between two sealing actions
15	Printm. Distance	film inc.	00CF	207	Actual measuring result of the print mark distance
16	Bag len. Err. Cou.		00D0	208	Number of bags out of tolerance
17	Index State Film		00D1	209	Control state of the print mark evaluation
18	Index Corr. Film	film inc.	00D2	210	Actual value of correction of print mark errors
19	Trim-Reg. Film	film inc.	00D3	211	Trim and phase correction register of the film
20	Film State		00D4	212	Control state of the foil drive
21	Prm.Dist.Vir.Ma.	chain inc.	00D5	213	Distance between print marks, expressed in increments of the feeder chain
22	Bag Length Incr.	film inc..	00D6	214	Bag length expressed in film increments
23	Diff.Cou.SealJaw	sealing roll inc.	00D7	215	Differential counter for the sealing drive
24	Pos.Cou.SealJaw	sealing roll inc..	00D8	216	Actual position of the sealing tool
25	Act.MarkErr.Seal	film inc.	00D9	217	Actual error between sealing jaws and print mark
26	Mark.Corr.Seal	film inc.	00DA	218	Index correction of the sealing rolls
27	Set Length Seal.	film inc.	00DB	219	Pre-calculated distance to the next sealing position
28	Act.Length Seal.	film inc.	00DC	220	Effective distance to the previous sealing position
29	Seal Jaw State		00DD	221	Control state of the sealing drive
30	Chain Cam Count.	chain inc.	00DE	222	Separate length counter for the cam controller
31	Control State		00DF	223	General operating state of the controller



Status Words			
Status word	Ser. Code		Clarification (for location of the bits see table below)
	(Hex)	(Dec)	
Hardware Commands	00E0	224	State of the control inputs
Serial Commands	00E1	225	State of commands transmitted via serial link
CAN Commands	00E2	226	State of commands transmitted via CAN interface
All Commands	00E3	227	Logical "OR" of all actual commands (hardware, serial, CAN)
Output Status	00E4	228	State of the control outputs
Error Status	00E5	229	Error state

Inputs and Commands (Overview)				
Command	Serial code for this command		Bit No. inside the status words "Serial Commands" (Code 00E1 hex) "CAN Commands" (Code 00E2 hex)	Hardware input "Cont.In"
	(Hex)	(Dec)		
Control Enable	0900	2304	0	X6 / 1
Start / Stop	0901	2305	1	X6 / 2
Master Speed +	0902	2306	2	X6 / 3
Master Speed –	0903	2307	3	X6 / 4
Trim forw. Seal.	0904	2308	4	X6 / 5
Trim rev. Seal.	0905	2309	5	X6 / 6
Homing Seal.Jaw	0906	2310	6	X6 / 7
Jog All	0907	2311	7	X6 / 8
Trim forw. Film	0908	2312	8	X6 / 9
Trim rev. Film	0909	2313	9	X6 / 10
Emergency-Stop	090A	2314	10	X6 / 11
Index Chain	090B	2315	11	X6 / 12
Product Sensor	090C	2316	12	X6 / 13
Misplaced Sensor	090D	2317	13	X6 / 14
Printmark Film	–	–	–	X6 / 15
Cutting Pulse	–	–	–	X6 / 16
Reset Diff.Chain	0910	2320	16	–
Reset Diff.Film	0911	2321	17	–
Reset Diff.Seal.	0912	2322	18	–
Jog forw. Chain	0913	2323	19	–
Jog rev. Chain	0914	2324	20	–
Jog forw. Film	0915	2325	21	–
Jog rev. Film	0916	2326	22	–
Jog forw. Seal.	0917	2327	23	–
Jog rev. Seal.	0918	2328	24	–
Clear Error	0919	2329	25	–
Disable Printmark	091A	2330	26	–
Junction	091B	2331	27	–
(Command 28)	091C	2332	28	–
Store to EEPROM	091D	2333	29	–
Adjust Program	091E	2334	30	–
Test Program	091F	2335	31	–

Outputs				
Output	Ser. Code of this output		Bit No. inside the status word "Output Status" (Code 00E4 Hex)	Hardware output "Cont.Out"
	(Hex)	(Dec)		
Ready	0A00	2560	0	X7 / 1
Alarm	0A01	2561	1	X7 / 2
Sealing Jaw Home	0A02	2562	2	X7 / 3
No Product	0A03	2563	3	X7 / 4
Film Printer	0A04	2564	4	X7 / 5
No Printmark	0A05	2565	5	X7 / 6
Vir. Cutting Pulse	0A06	2566	6	X7 / 7
Error	0A07	2567	7	X7 / 8
Vir.M.in motion	0A08	2568	8	—
Chain in motion	0A09	2569	9	—
Film in motion	0A0A	2570	10	—
Film Index o.k.	0A0B	2571	11	—
Waste bag	0A0C	2572	12	—
Max. Cor. Chain	0A0D	2573	13	—
Max. Cor. Film	0A0E	2574	14	—
Max. Cor. Seal.	0A0F	2575	15	—
Alarm Inf. Chain	0A10	2576	16	—
Alarm Film Feed	0A11	2577	17	—
Alarm Seal. Jaw	0A12	2578	18	—
Misplaced Product	0A13	2579	19	—
Wrong Printmark	0A14	2580	20	—
Junction detected	0A15	2581	21	—
(Output 22)	0A16	2582	22	—
...				
(Output 31)	0A1F	2591	31	—

Errors			
Error No.	Error text	Bit No. inside the status word "Error Status" (Code 00E5 Hex)	Description
00	DPRAM Error	0	Hardware error of the CAN interface
01	Power Low	1	Undervoltage (power input < 15 volts)
02	No Sealing Pulse	2	Missing index signal of the sealing rolls
03	(No Home Position)	3	n.a.
04	Print Mark Buffer overflow	4	Overflow of the print mark buffer (distance from mark sensor to sealing position is too long)
05	Film Stop Buffer overflow	5	Overflow of the "film stop" position buffer (distance from product sensor and transition point is too long)
06	Sealing not possible	6	Bag length too short (no sealing possible)
07	Product gap buffer overflow	7	Overflow of the product position buffer (distance from product sensor to sealing position is too long)
08	Cutmark buffer overflow	8	Overflow of the sealing position buffer (distance from transition point to sealing position is too long)
09	(Error 09)	9	n.a.
10	Value Range Exceed 0	10	Settings of parameters are incompatible or the maximum numeric range of internal calculations is exceeded  [since the backgrounds for these specific errors are more sophisticated, please contact motrona in case of need]
11	Value Range Exceed 1	11	
12	Value Range Exceed 2	12	
13	Value Range Exceed 3	13	
14	Value Range Exceed 4	14	
15	Value Range Exceed 5	15	
16	Value Range Exceed 6	16	
17	Value Range Exceed 7	17	
18	Value Range Exceed 8	18	
19	Value Range Exceed 9	19	
20	(Error 20)	20	n.a.
...			
31	(Error 31)	31	n.a.