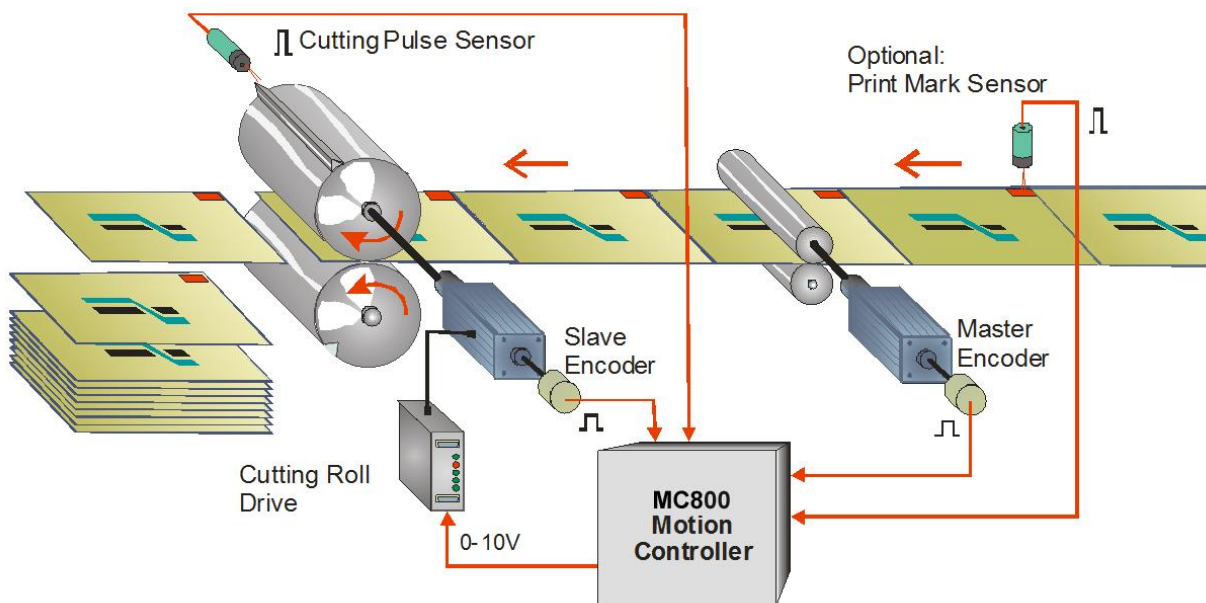


# Software Manual

## CT 803.08

### MC800 Motion Control Firmware Motion Control for Rotating Cutters and Printing Rolls



- Easy parameter setting instead of sophisticated programming
- Immediately ready to work, with minimum commissioning time
- High dynamic response by means of short cycle time, therefore accurate cutting results also during change of line speed
- High cutting precision due to 2 MHz of feed-back frequency
- Suitable for "stand-alone" operation as well as for connection to field bus systems
- Extremely smooth motion by optimized S-shape profiles
- Additional feeding roll with dancer control

Version:	Changes:
Ct80302a / TJ-AG/ Mar 2016	Original Version
Ct80303a / TJ-AG/ Apr 2016	New features implemented: - Virtual master (internal frequency generator) - Feeding roll with position control or dancer control
Ct80303b / TJ / Dec 2016	Chapter "Download Procedure" added
Ct80304a / TJ / Apr 2017	New parameters in block "Monitoring": - Cut. Pulse Monit. - Sel. Diag. Ana. Out
Ct80305a / TJ / Jun 2017	New features implemented: - Optional fieldbus interface modules - Cutting pulse monitoring enhanced
Ct80306a / TJ / Jul 2018	New feature implemented: Serial communication with Modbus RTU on board
Ct80307a / TJ / Feb 2019	New feature implemented: Function of each control input and output selectable by parameter
Ct80308a / TJ / Jun 2020	New feature implemented: Speed proportional P-Gain of cutting roll selectable

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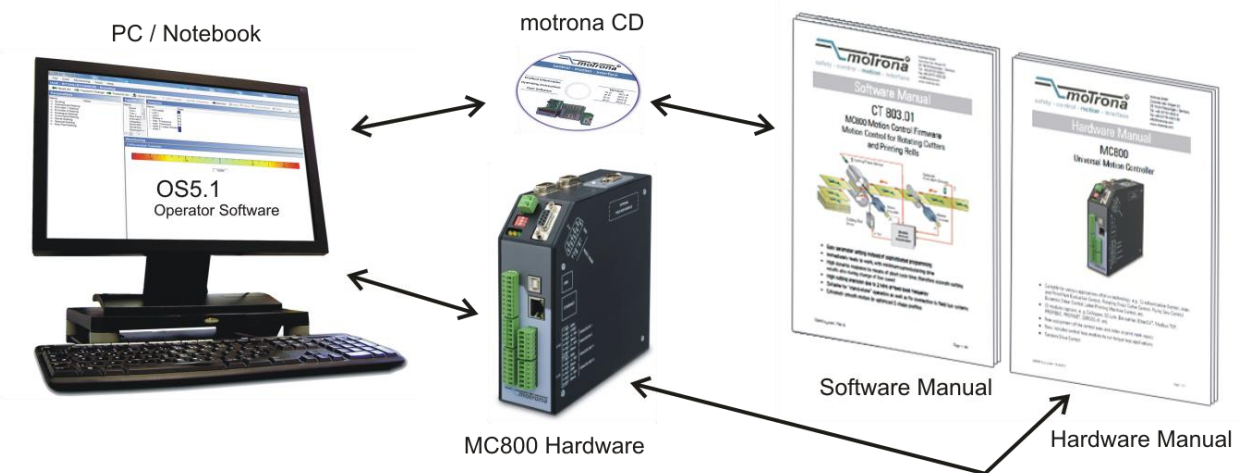
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# 1. Preamble

This document provides all information about the CT803 firmware, including parameters, variables and hints for commissioning.

To implement this application, you will need:

1. A motion controller hardware of type MC800
2. A PC with operating system Windows XP or Windows 7
3. The motrona CD or motrona website containing the PC operator software OS5.1, the CT803 firmware and the pdf files for the manuals MC800xxx.pdf (hardware description, connections, and specifications) and CT803xxx.pdf (description of the firmware as actually at hand)



All of above files are also available for free download on [www.motrona.com](http://www.motrona.com)

Moreover, at the "Applications" site of above homepage you can watch a short demo movie showing a typical application of the firmware described here.

**The CT803 firmware is liable to payment of a license fee and can only be used with the corresponding license key!**

## 2. General Remarks about this Firmware Functions

### 2.1. Introduction

The CT803 firmware is suitable for control of rotating cutter systems, partial printing screens and rotating punching or sealing applications.

This firmware has been designed for the special requirements of these rotating systems, under consideration of maximum efficiency and accuracy, with minimum stress for all mechanical parts. Very short control cycles together with intelligent motion profiles provide excellent performance under all operating conditions.

This unit is very easy to set up. All settings are made by PC, with use of the motrona operator software OS5.0. All relevant operational parameters and variables are accessible by RS232/RS485 communication.

**The firmware is suitable for control of cutting applications as well as for partial printing screens or punching applications. This manual always says "cutting" or "cut" and the reader may replace this by "printing" or "punching" when applicable.**

### 2.2. Principle of operation

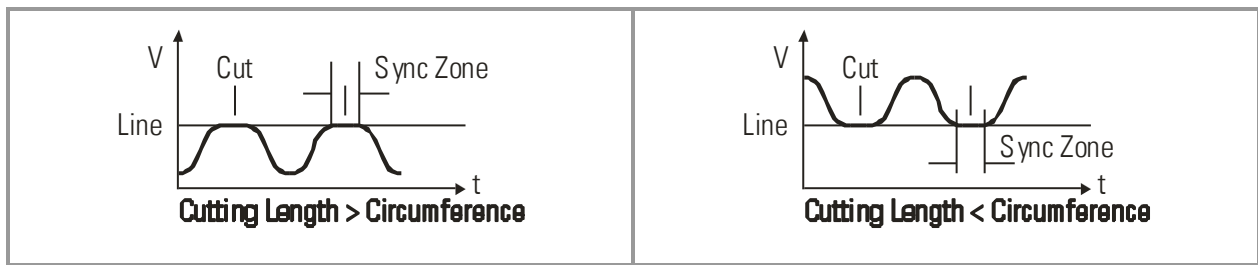
When a cutting process needs synchronous circumferential speed of the cutting tool with the line, the only length that can be cut is the one corresponding to the circumference of the cutting roll (at constant rotational speed). Change of the cutting length needs exchange of the cutting roll against another one with appropriate diameter.

The CT803 controller uses a two-speed principle featuring full synchronism while the cut is in progress, but taking a different roll speed when the tool is outside the cutting zone (where synchronism is not necessary). So, in terms of one revolution of the roll, we are talking about two speed zones: The "synchronous cutting zone" (which is register settable) and the "asynchronous zone" where the roll follows a speed profile calculated in order to get the desired cutting length. The speed profile of the "asynchronous zone" is calculated in a way that the physically possible minimum of acceleration and deceleration torque is applied to the drive with respect to actual line speed and preset cutting length.

All speed transitions use self-optimizing S-shape profiles for minimum wear and tear of all mechanical parts, unless a linear ramp form has specifically been selected by corresponding parameter setting.

With length settings smaller than the roll circumference, the "asynchronous zone" will take higher speeds than the "synchronous zone". With length settings longer than the circumference, the asynchronous speed will be lower and the drive can even go to a temporary standstill if necessary.

The figure below shows two typical speed profiles:



Continuous closed loop control of the relative roll position with respect to the length progress of the line, combined with a short update time provide best cutting accuracy and exceptional smooth motion of the cutting roll at any time.

It is a must to use a 4-quadrant drive or a servo drive for the cutting roll, because the CT803 must be able to accelerate and decelerate the roll under real closed loop conditions. However, no special requirements are necessary for the line drive for full performance.

### 2.3. System Configuration

As master mostly a measuring wheel equipped with an incremental encoder is used. Also the motor of a feed roll that is controlled by an other device can be the master. For testing and commissioning the shear without material, a "Virtual Master Axis" can be selected, providing simulation of the line encoder at the selected line speed.

The CT803 controller provides two slave axes: One for the cutting roll, and an additional feeding roll that runs synchronous to the master.

The slave feeding roll can optionally be controlled by a dancer or tension sensor.

All axes, the master and the two slaves, must be equipped with incremental encoders.

**The encoder resolutions should be at least 5 times higher than the maximum acceptable cutting error.**

Quadrature encoders with A/B output channels must be used.

At maximum line speed, the master encoder frequency should be at least about 1 kHz, for best resolution of the analog output. Moreover, the input frequency must not exceed the maximum level of 2 MHz.

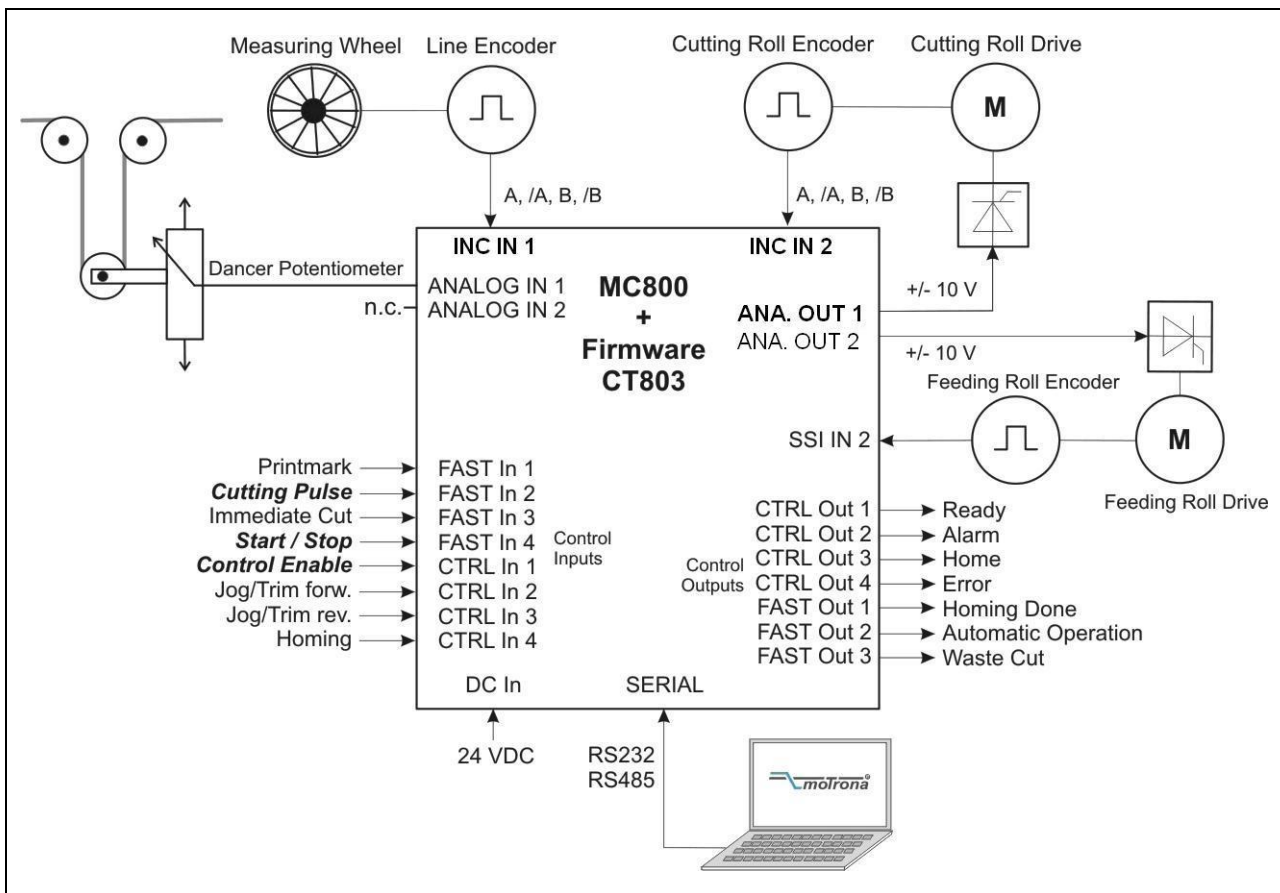
It is best to choose the ppr numbers of line and cutting roll encoders in a way to produce frequencies in the same range. Acceptable ratios are in the range of

$$\underline{5:1 \dots 1:1 \dots 1:5}$$

Mismatching beyond 1:16 and 16:1 are not allowed, especially with maximum speed of the cutting roll (see register "v max / v line").

Where applicable, the (x1), (x2) or (x4) hardware multiplication of the Master channel or the Slave channels may be used to adapt the frequencies.

The block diagram below shows the principle of wiring of a rotating cutter system:



Please note: Signals printed **bold** are mandatory, all other signals optional.

The line encoder must be connected to input "INC IN 1" (X9), the cutting roll encoder to input "INC IN 2" (X7) and the feeding roll encoder to input "SSI IN 2" (X8). Please note, in the present version this input works as an RS422 incremental input!  
(Terminal "CLK" = A, "/CLK" = /A, "DATA" = B and "/DATA" = /B).

For speed reference of the cutting roll drive, the analog output "ANALOG OUT 1" is used and for speed reference of the feeding roll drive, the analog output "ANALOG OUT 2" is used. A signal from a dancer potentiometer or tension sensor can be connected to "ANALOG IN 1".

If you do not need the additional feeding roll slave, please leave all corresponding input and output signals unconnected and the feeding roll parameters to their default settings.

The unit must receive a „cutting pulse“ with each revolution of the cutting roll. You can use an external sensor (proximity switch, light barrier) or the zero pulse of the cutting roll encoder, if the encoder is fitted directly to the cutting roll with no gear ratio between.

It is necessary to adjust the cutting roll drive to its maximum dynamic response (no internal ramps, no integral control loop, high proportional gain), because the CT803 will generate the ramps which the drive has to follow with no additional delay.

Two inputs "Trim / Jog" provide manual displacement of the cutting point on the material and also allow jogging the cutting roll with in standstill.

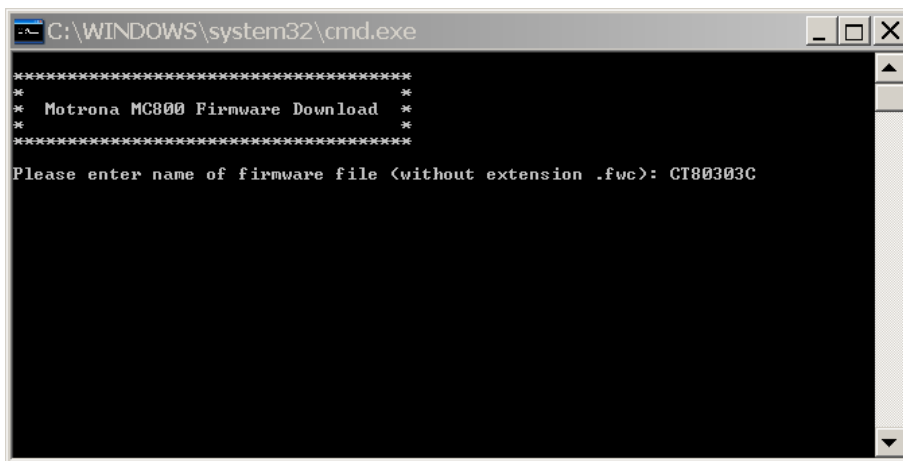
After power-on or after manually moving of the cutting roll, e. g. by Jog function, you can perform a homing sequence to move the cutting roll to its home position. When you start the homing sequence, the cutting roll moves with a register settable speed till the cutting pulse appears. Then it moves on to the home position, which is located opposite to the centre point of the synchronous zone.

### 3. Download Procedure

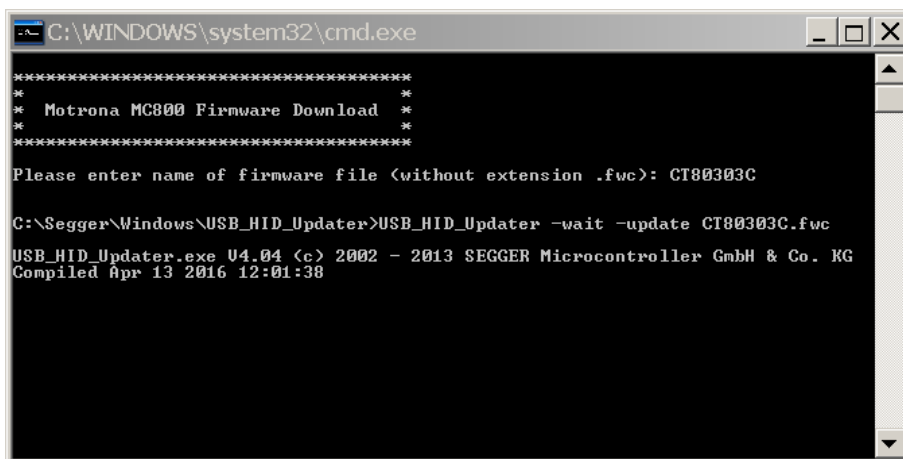
Ex factory, all MC800 controllers have loaded the MC800xxx base firmware, which was used for factory testing purposes.

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

- Switch off the MC800
- Copy the firmware-file "CT803xxx.fwc" to the motrona OS5.1 folder
- Go to OS5.1 folder and double-click to "Download\_MC800\_Firmware.bat".  
The following window appears:



- Input name of firmware file "CT803xxx" without extension ".fwc" and press Enter key  
The window now reads:





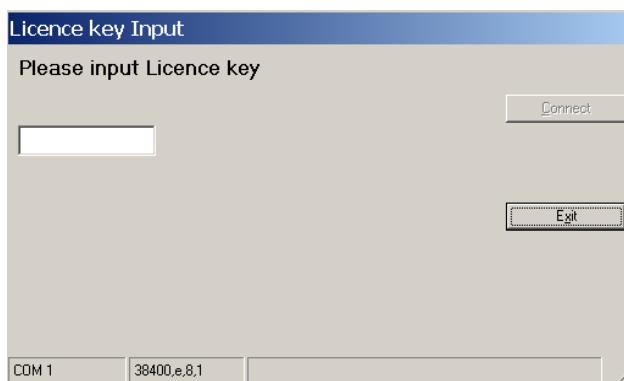
- Connect the USB interface of the MC800 with your PC
- Power on the MC800.  
The download starts, and download progress is shown in the window:

```

C:\WINDOWS\system32\cmd.exe
Please enter name of firmware file <without extension .fw>: CT80303C
C:\Segger\Windows\USB_HID_Updater>USB_HID_Updater -wait -update CT80303C.fwc
USB_HID_Updater.exe V4.04 (c) 2002 - 2013 SEGGER Microcontroller GmbH & Co. KG
Compiled Apr 13 2016 12:01:38
USB HID information about connected target:
Device 0:
  Productname: emLoad USB HID
  VID       : 0x8765
  PID       : 0x1114
  ReportSizes:
    Input    : 64 bytes
    Output   : 64 bytes
Old firmware version: 0x0000
New firmware version: 0x1f0bca3e
Updating <one dot = 512 bytes>:
.....

```

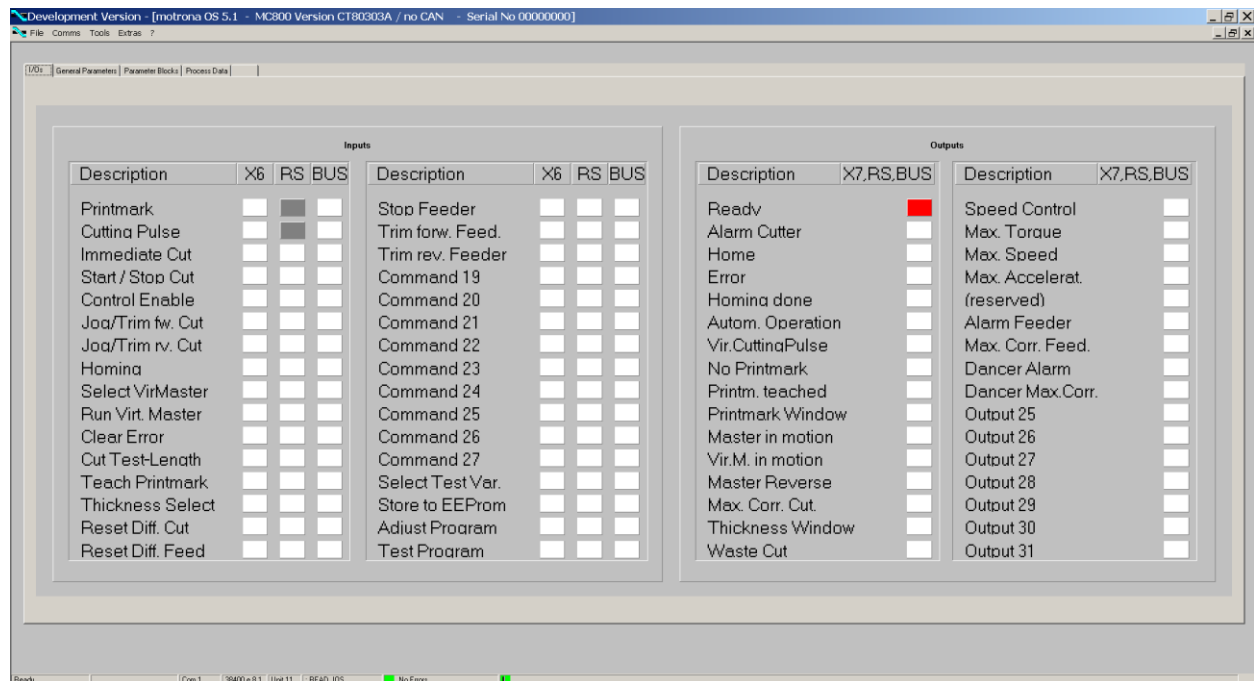
- When download is finished, please press any key to close download window
- Disconnect USB connection between MC800 and PC
- The new firmware in the MC800 starts automatically, there is no additional reset or power cycling required.
- Connect serial interface of the MC800 to your PC and start motrona OS5.1 operator software. The actual firmware of the MC800 is shown in the header of the main window.
- Finally you must input the license key:
  - Select "Input license key" from the "File" menu:



- Input the license key and click to "connect"
- Now the CT803 firmware is ready for operation.

## 4. How to Use the Operator Software

The OS5 software uses a clear structure of register cards and the contents automatically adapt to the firmware of the controller.



### 4.1. I/Os (Inputs and Outputs)

This register card shows the logical state of all digital inputs and outputs.

#### 4.1.1. Input commands

Input signals that are in use for the current application are marked with its designation, whereas unused inputs are marked with "Command ..." only.

**Each input command can be assigned to a hardware control input by the settings in parameter block "Ctrl. I/O Setting".**

Indicator boxes in the column marked "X6" shine blue, when the associated hardware input signal is HIGH, while LOW state is white.

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 Fieldbus. White box means again "signal off".

All input signals can be controlled via serial interface, independent of they are assigned to a hardware input or not.






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.

## Meaning and function of the input signals:





 = static operation

 = dynamic operation, rising edge







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

01	Print Mark	FAST IN 1		Sensor input for HTL print mark
02	Cutting Pulse	FAST IN 2		Sensor input for HTL cutting pulse. For definition of the knife position, the controller needs one index pulse with every cut, which can be generated either by a remote sensor or from the marker pulse of the encoder. (See registers "Index Select" at "Counter Settings")
03	Immediate Cut 	* (default: FAST IN 3)	<b>ON:</b>	When the cutting roll is at standstill, a high signal at this input will immediately start a cutting cycle, independent on what the actual length is. The subsequent cut will correspond to the preset length again, unless another Flying Cut will be triggered again.
04	Start / Stop Cut 	* (default: FAST IN 4)	<b>OFF:</b>	The cutting roll is held in its actual position (closed loop position control). The cutting roll can be moved into forward and reverse direction by use of the inputs "Jog forw" and "Jog rev". Input "Immediate Cut" allows actuating a cutting cycle.
			<b>ON:</b>	The automatic cutting procedure is in progress. Depending on the selected mode of operation, the unit cuts automatically according to length preset or to print marks. It is recommended to move the cutting roll to its home position before activating Start command (see also input "Homing" and register "Home Window")
05	Control Enable 	* (default: CTRL IN 1)	<b>OFF:</b>	The whole controller and all functions are disabled. All analog outputs are zero. All counters are hold in a Reset state.
			<b>ON:</b>	The controller is enabled
It is not mandatory to assign the input command "Control Enable" to a hardware input. If this input command is not assigned to any of the hardware control inputs it will be set automatically during initialisation after power on.				

**\*) Function can be assigned to FAST IN 3...4 or CTRL IN 1...4 (see chapter 4.3.7)**

06	Jog / Trim fw. Cut 	* (default: CTRL IN 2)	ON:	<p><u>With Start/Stop = OFF:</u> In stop state the inputs Jog / Trim fw. Cut and Jog / Trim rv. Cut move the cutting roll in one or the other direction (Jog speed register settable).</p> <p>After termination of a Jog command, the cutting roll will be held again in its new position in closed-loop control.</p>
07	Jog / Trim rv. Cut 	* (default: CTRL IN 3)		<p><u>With Start/Stop = ON:</u> At automatic cutting cycles the inputs Jog / Trim fw. Cut and Jog / Trim rv. Cut shift the cutting position forward or reverse (Trim speed register settable), i. e. the unit temporarily cuts longer or shorter pieces while one of the Trim inputs is ON.</p>
08	Homing	* (default: CTRL IN 4)		<p>Starts a homing cycle and moves the knife to a defined home position. Within a homing cycle the cutting roll moves forward till the cutting pulse appears. Then it moves on to the home position.</p> <p>When the input "Control Enable" is set to ON and the cutting roll is not yet in its home position, we recommend performing a homing cycle.</p>
09	Select Virt. Master	*	OFF:	The line encoder connected to "INC IN 1" acts as Master
			ON:	<p>An internal frequency generator acts as Master (Virtual Master Axis). This input will change only with the "Start / Stop" input in OFF state, i.e. it is only possible to change between real and virtual master axis while the cutting roll is in standstill.</p>
10	Run Virt. Master	*	OFF:	The virtual master frequency generator is switched off (0 Hz). A transition from ON to OFF will ramp down the frequency from its actual value to zero (standstill), according to the ramp time setting.
			ON:	The virtual master frequency generator is switched on. A transition from OFF to ON will ramp the frequency up from zero (standstill) to the selected speed, according to the ramp time setting.
11	Clear Error	*		Resets error states and clears the corresponding error messages

\*) Function can be assigned to FAST IN 3...4 or CTRL IN 1...4 (see chapter 4.3.7)

12	Cut Test Length	*	OFF:	The controller cuts the normal length as set to the "Cutting Length" register.
			ON:	The controller cuts the test length as set to the "Test Cut. Length" register.
				When this input receives a short ON pulse only, there will be just one single cut of the test length between the regular cuts, with the subsequent cycle.
13	Teach Printmark 	*		<p>This input defines the printmark position set point and locates the printmark window:</p> <p>When a printmark is detected while the input is ON, this printmark is selected as valid and the printmark window is located at this printmarks position.</p> <p>When "Teach Printmark" is reset to OFF without a printmark having been detected while it was ON, the falling edge of the input (i.e. the position where it has been reset to OFF) will be taken as printmark position set point. This can be used to teach printmark position when the material line is at standstill.</p> <p>(for more details see also parameter "Printmark Window")</p>
14	Thickness Select 	*	OFF:	Control characteristics adapted to thin or soft material
			ON:	Control characteristics adapted to thick or hard material
15	Reset Diff. Cut 	*	OFF:	The PI closed loop control of the cutting roll is on, position error count and position control are active
			ON:	The position error counter of the cutting roll is kept to zero; the PI control loop is switched off. The cutting roll operates "open-loop" with no correction of position errors.
16	Reset Diff. Feed 	*	OFF:	The PI closed loop control of the feeding roll is on, position error count and position control are active
			ON:	The position error counter of the feeding roll is kept to zero; the PI control loop is switched off. The feeding roll operates "open-loop" with no correction of position errors
17	Stop Feeder 	*	OFF:	The feeding roll is synchronous to the master. A transition from ON to OFF will ramp up the feeding roll from standstill to synchronous speed according to the ramp time setting.
			ON:	The feeding roll is stopped (position control at standstill). A transition from OFF to ON will ramp down the feeding roll from its actual speed to standstill, according to the ramp time setting.

\*) Function can be assigned to FAST IN 3...4 or CTRL IN 1...4 (see chapter 4.3.7)

18	Trim forw. Feed. ┌─	*		Shifts the position of the feeding roll forward or reverse (Trim speed settable by register "Trim Time Feeder"), i. e. the feeding roll temporarily runs faster or slower than the master while one of the Trim inputs is ON.
19	Trim rev. Feeder ┌─	*		
	(Command 19 ... 26)	*		Not in use
28	(Command 27)	Ser/Bus		For factory test only, <u>don't use!</u>
29	Select Test Var.	Ser/Bus		For factory test only, <u>don't use!</u>
30	Store to EEPROM	*	↗	Stores all actual registers and parameters to the EEPROM (safe for power-down)
31	Adjust Program ┌─	Ser/Bus		Switches the controller over from normal operation to the "Adjust" program (Condition: Control Enable = OFF)
32	Test Program ┌─	Ser/Bus		For factory test only, <u>don't use!</u>

\*) Function can be assigned to FAST IN 3...4 or CTRL IN 1...4 (see chapter 4.3.7)

#### 4.1.2. Outputs

Output signals that are in use for the current application are marked with a text, unused outputs are marked with "Output ..." only.

Each output signal can be assigned to a hardware control output (CTRL OUT 1...4 or FAST OUT 1...3) by the settings in parameter block "Ctrl. I/O Setting" (see chapter 4.3.7).

The indicator box shines red when the corresponding output signal is on (the assigned hardware output then is HIGH), otherwise the box remains white (the assigned hardware output then is LOW).

All output signals appear on the PC screen and are accessible via serial link, independent of they are assigned to a hardware input or not.

#### Meaning and function of the output signals:

01	Ready	Indicates that the unit is ready to operate after power-up, initialization and successful self-test. The signal however is not a guarantee that all functions really work trouble-free.
02	Alarm Cutter	Indicates that the cutting roll, with respect to its profile position set point, actually runs with a positive or negative position error higher than the limit set under parameter „Alarm Cut. Roll“.
03	Home	A HIGH state of this output indicates that the cutting roll is in its home position like defined by register "Home Window". The output is LOW whenever the cutting roll is outside the home window.

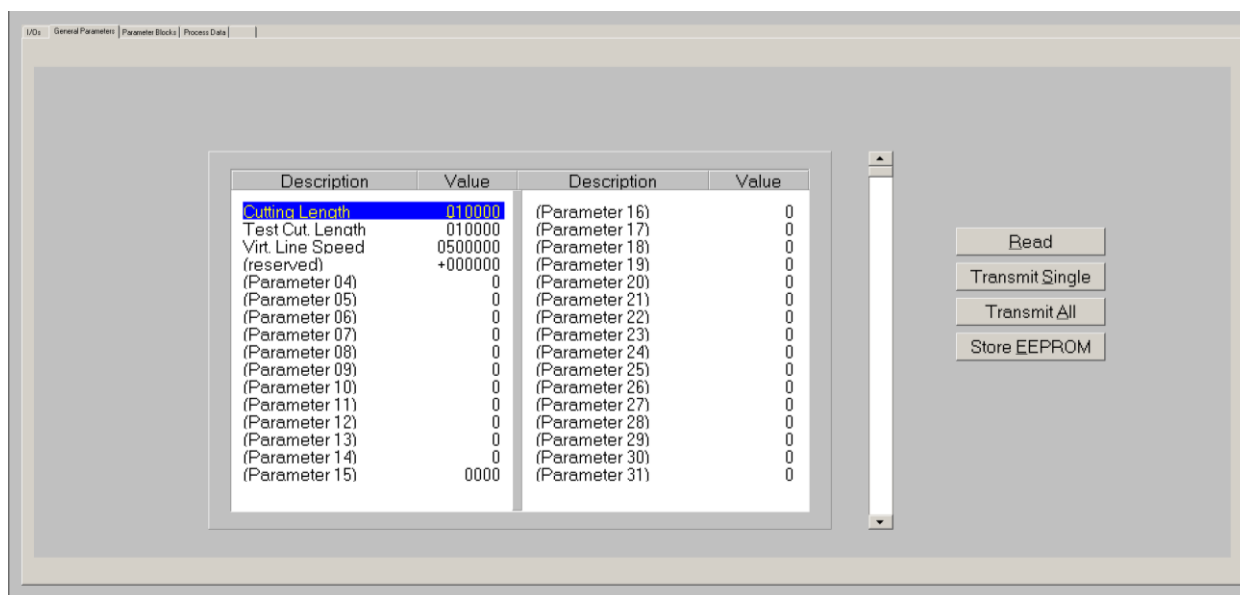
04	<b>Error</b>	This output goes HIGH when an error is detected during operation (see section "Error messages"). The error is also indicated in the bottom line of the PC operator software.
05	<b>Homing Done</b>	Set to on when the homing cycle is finished. Reset to off when the home position is no more valid and a new homing cycle should be executed (after Jog, Control Enable = low or power down).
06	<b>Automatic Operation</b>	Set to on during automatic cutting operation when input "Start/Stop" is on. When input "Start/Stop" is reset to off, this output is set to off not before the actual cut is finished and the cutting roll has come to standstill.
07	<b>Vir. Cutting Pulse</b>	The rising edge of this output indicates the virtual cutting pulse at the cutting position of the knife (see parameter "Cutting Pulse Offset"). The output is reset to low at the end of the synchronous zone after the cut (see parameter "Sync. After Cut")
08	<b>No Printmark</b>	Indicates that for an adjustable number of sheets no printmark has been detected within the printmark window (see parameter „Missing Printmark“).
09	<b>Printmark taught</b>	Indicates that the printmark position set point has successfully been set by input „Teach Printmark“.
10	<b>Printmark window</b>	This output is HIGH while the printmark window is open and detected printmarks are valid. When the printmark window function is disabled, this output is set all the time (every printmark is valid)
11	<b>Master in motion</b>	This output is HIGH when the line speed of "Encoder 1" input is higher than the standstill definition set in register "Zero Speed. Master"
12	<b>Vir.M. in motion</b>	This output is HIGH when the frequency generated by the virtual master axis is higher than the standstill definition set in register "Zero Freq. Master"
13	<b>Master Reverse</b>	Master reverse movement monitor. This output goes HIGH when the material line moves in reverse direction for a distance greater than set in register "Master Rev. Limit". The output is reset to LOW when the master moves forward again the same distance or when input "Clear Error" is activated.
14	<b>Max. Corr. Cut</b>	This output indicates that the proportional correction value of the cutting roll has reached the maximum as set to the "Max.Correction" register, and that possibly the cutting roll is out of control.
15	<b>Thickness Window</b>	Indicates that the knife is inside the thickness control window (See parameters "Thickness Mode", "Startpos. Thickn." and "Endpos. Thickn.")
16	<b>Waste Cut</b>	Indicates a waste cut, i. e. a cut is out of the tolerance window set by register "Cut Tolerance" or a test length cut.

17	<b>Speed Control</b>	Not in use
18	<b>Max Torque</b>	Not in use
19	<b>Max. Speed</b>	Not in use
20	<b>Max. Accelerat.</b>	Not in use
21	<b>(reserved)</b>	Not in use
22	<b>Alarm Feeder</b>	Indicates that the cutting roll, with respect to its scheduled position, actually runs with a positive or negative position error higher than the limit set under parameter „Alarm Feed. Roll“.
23	<b>Max. Corr. Feed.</b>	This output indicates that the proportional correction value of the feeding roll has reached the maximum as set to the “Max.Corr. Feed.” register, and that possibly the feeding roll is out of control.
24	<b>Dancer Alarm</b>	Indicates that the input value from the dancer potentiometer has exceeded the limit set by parameter “Dancer Alarm”.
25	<b>Dancer Max. Corr.</b>	Indicates that the proportional correction value of the feeding roll generated by the dancer control roll has reached the maximum as set to the “Dancer Max.Corr.” register, and that possibly the feeding roll is out of control.
	<b>(Output 25 ... 31)</b>	Not in use



## 4.2. General Parameters

This register card holds the essential variable settings of general nature



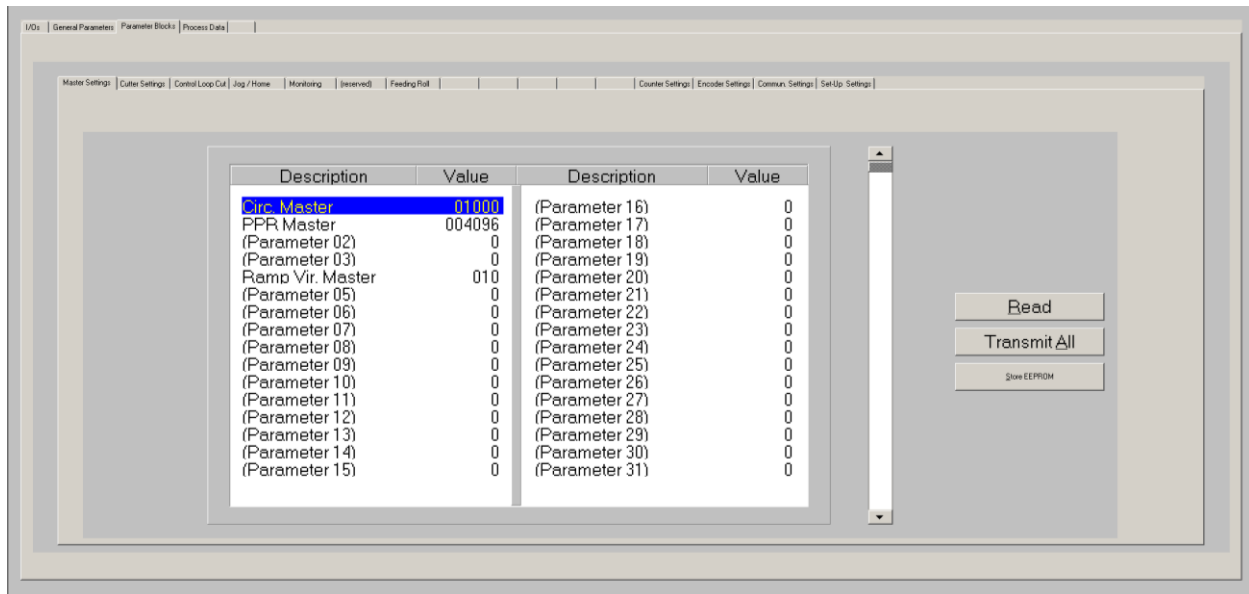
Prior to register setting you must decide which dimensions or length units (LU) you like to use for preset of the cutting length. This could be 0.1mm or 1mm or 0.001 inch or any other resolution you desire. All further settings refer to the Length Units you decided to use. E.g. when you chose to set the length with a 0.1 mm resolution, 1000 LUs will represent a length of 100.0 millimeters with all further entries.

When you transmit new register values during a cutting cycle the new values will not become active before the cutting pulse appears, because the precalculations for the new cutting profile take place in the synchronous zone after the cutting pulse.

<b>Cutting Length</b>	Preset of the desired cutting length, setting in "Length Units". This length will be cut when input "Cut Test Length" is LOW. Setting range 1 - 999 999 length units.
<b>Test Cut. Length</b>	Preset of the desired test length, setting in "Length Units". This length will be cut when input "Cut Test Length" is HIGH or was shortly HIGH during the previous cutting cycle. Test length can be used to cut test samples or waste pieces etc. Setting range 1 - 999 999 length units.
<b>Virt. Line Speed</b>	Speed set value of the virtual master axis, to be set as <u>Length Units (LU) per minute</u> Range 0 – 9 999 999 LU/min, the setting is limited to the value of register "Max. Line Speed". Internal resolution = 1/10000 of Max Line Speed.
<b>(reserved)</b>	Not in use with this application firmware
<b>(Parameter 04...31)</b>	Not in use

### 4.3. Parameter Blocks

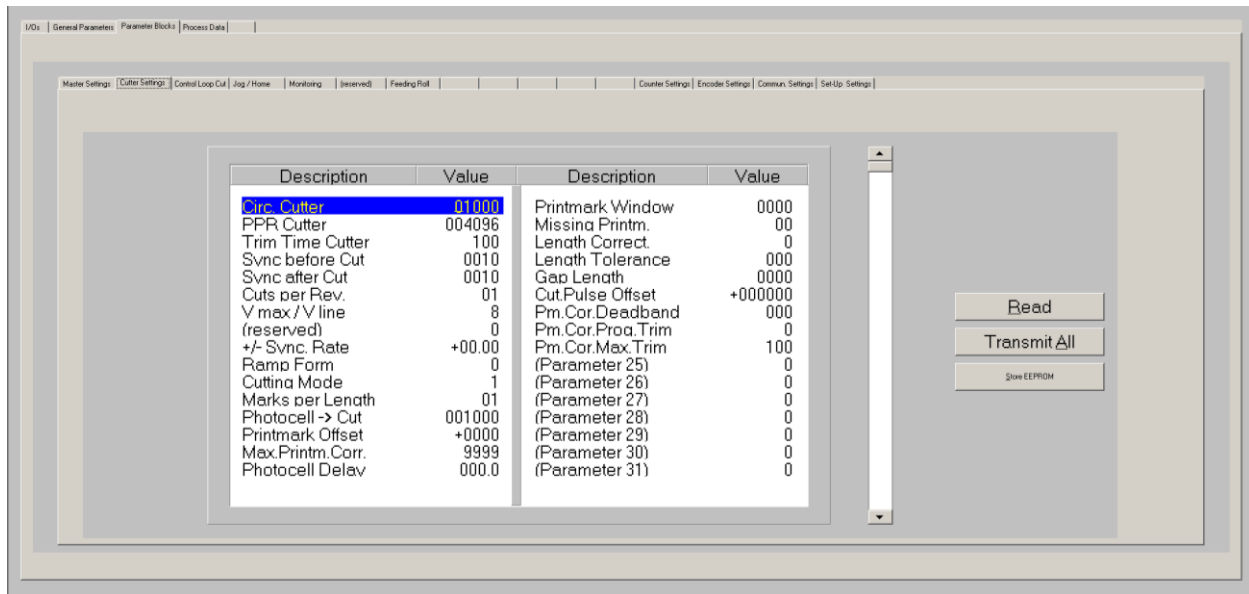
This field contains more parameters and machine specifications, separated to clearly arranged blocks.



#### 4.3.1. Master Settings

<b>Circ. Master</b>	This register must be set to the circumference of the line feed roll or the measuring wheel of the line encoder. Setting in length units you decided to use. Range 1 – 99999 length units.
<b>PPR Master</b>	Pulses per revolution of the line encoder. Enter the number of pulses from the encoder for one revolution of the feeding roll or measuring wheel with regard to the multiple edge count setting (x1, x2, x4) Range 1 - 999 999.
<b>(Parameter 02)</b>	-Not in use-
<b>(Parameter 03)</b>	-Not in use-
<b>Ramp Vir. Master</b>	Sets the ramp time of the virtual master axis between standstill and maximum speed (acceleration and deceleration) Range 0 – 999 s.
<b>(Parameter 05...31)</b>	-Not in use-

### 4.3.2. Cutter Settings



<b>Circ. Cutter</b>	Circumference of the cutting roll. Range 1 – 99999 length units.
<b>PPR Cutter</b>	Pulses per revolution of the cutting roll. Enter the number of pulses from the encoder for one revolution of the cutting roll with regard to the multiple edge count setting (x1, x2, x4). Range 1 - 999 999.
<b>Trim Time Cutter</b>	Adjustment time for one length unit of cut position displacement with use of the Trim function or for correction of cutting position in cutting mode 3. 001 = 1 ms for each length unit (fast) 999 = 999 ms for each length unit (slow)
<b>Sync before Cut</b>	This register defines, how long before the cut (rising edge of the virtual cutting pulse) the cutting roll must be synchronous to the line. Range 1 – 9999 length units.

<p><b>Sync after Cut</b></p>	<p>This register defines, how long after the cut (rising edge of the virtual cutting pulse) the cutting roll must remain synchronous before the speed profile starts to change speed.</p> <p>Range 1 – 9999 length units.</p> <div data-bbox="651 465 1177 689" data-label="Figure"> </div>
<p><b>Cuts per Rev.</b></p>	<p>Number of cuts per revolution of the cutting roll. Setting range 1-99.</p> <p>Set this register to 1 when your cutting roll has only one tool at its circumference to perform one single cut per revolution.</p> <p>There are two different ways of setting this register when you have mounted two or more tools around the cutting roll to perform two or more cuts by every revolution of the cutting roll:</p> <ol style="list-style-type: none"> <li>If you have more than one tool but only one single cutting pulse per revolution of the cutting roll, then set register "Cuts per Rev." to the number of cuts performed by one revolution of the cutting roll. The controller will generate the missing cutting pulses internally.</li> </ol> <p><b>Example:</b> Two cuts per revolution but only one cutting pulse</p> <p>→ Set "Cuts per Rev." = 2</p> <ol style="list-style-type: none"> <li>If you perform several cuts per revolution of the cutting roll and each cut generates its own separate cutting pulse, then proceed as follows: <ul style="list-style-type: none"> <li>Set register "Cuts per Rev." to 1.</li> <li>Do not set register "Circ. Cutter" to the real circumference of the cutting roll but set it to the partial circumference between two tools.</li> <li>Also set register "PPR Cutter" to the number of pulses between two tools at the cutting roll.</li> </ul> </li> </ol> <p><b>Example:</b> Two cuts per revolution and also two cutting pulses</p> <p>→ Set "Cuts per Rev." = 1, "Circ. Cutter" = half the cutting roll circumference and "PPR Cutter" = half the number of pulses per revolution.</p> <div data-bbox="1034 1232 1337 1355" data-label="Image"> </div> <div data-bbox="1034 1780 1337 1904" data-label="Image"> </div>

<b>V max / V linie</b>	<p>This setting is important only when the range of cutting lengths includes lengths shorter than the roll circumference, so the roll must accelerate between two cuts. The register sets the maximum speed ratio between the circumferential roll speed and the line speed that the drive will take when required.</p> <p>This means, whenever you cut shorter length, it is necessary the slave drive can at least run double line speed. The higher the ratio, the shorter the minimum length you can cut. It is important to know that this ratio setting does not refer to the maximum line speed, but to the real line speed you use when cutting short length. You are free to reduce your line speed with shorter length preset and i. e. set this register to 8. But then you must be sure that the cutter drive can really run 8 times the line speed you actually use for your shortest length. In general, setting 8 can be recommended. Range 2 – 8.</p>
<b>(reserved)</b>	Not in use with this application firmware
<b>+/- Sync Rate</b>	<p>This register allows a percental adaption of the synchronous speed in a range of +/- 99.9%. In general, this register will be set to 00.0 and the cutting roll will synchronize with the line exactly according to the encoder information. Some applications may require slightly higher or lower speed during the synchronous zone, e. g. due to the cutting tool design.</p> <p>This setting affects the synchronous speed only, but not the cutting length.</p>
<b>Ramp Form</b>	<p>Selects the shape of the ramps of the cutting roll speed 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>Cutting Mode</b>	<p>Operation mode:</p> <p><b>1:</b> Cut to length according to length preset (without print mark)</p> <p><b>2:</b> Cut according to the print marks on the material, correction of the cutting position is provided by continuous adaption of the cutting length setpoint</p> <p><b>3:</b> Cut according to the print marks on the material, correction of the cutting position is provided by additional speed. The additional speed can be adjusted by register "Trim Time".(This cutting mode is recommended when the distance of the printmark sensor is less than one sheet length)</p>

**Hints for printmark operation:**

Even with printmark operation, parameter "Cutting Length" must be set to the correct cutting length, i. e. it must be set to the printmark distance value.

With missing printmarks or those that were not detected correctly by the sensor, the controller automatically places the cut to the position where the printmark should have been. However, a sudden wide change of print mark distance which is not in multiples of the normal distance, or wrong or additional printmark pulses may result in waste cuts.

Where you run mixed production with length and printmark operation (sometimes with, sometimes without printmark), set parameter "Cutting Mode" to 2 or 3 and install a selector switch to apply to or remove the printmark pulse from input "Printmark", according to actual need.

When your application provides print marks with randomly varying distance, please take care of correct location of the print mark sensor. In this case the minimum distance between sensor and cutting position should be at least two times of the cutting length when using Cutting Mode 2, however it should be less than one cutting length when you use Cutting Mode 3

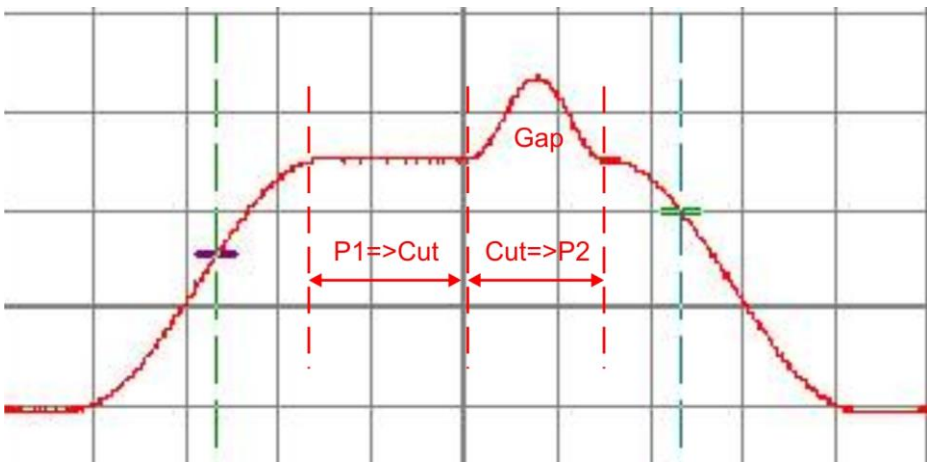
All subsequent parameters marked with an asterisk (\*) are only relevant for printmark operation. These parameters need not to be set with cut to length operation (Cutting Mode 1).

<p><b>Marks per Length *</b></p>	<p>Set this register to 1 when you have only one print mark with each cut. Set it to the number of print marks between two cuts, when you find several marks, but the cut should only be executed with one specific mark.</p> <p>Range: 1 – 99.</p>
<p><b>Photocell -&gt; Cut *</b></p>	<p>Distance between the print mark sensor and the cutting position. Range 0 - 999999 length units.</p> <p>The controller stores up to 64 print marks between sensor and cutting position in a FIFO shift register, and controls the cutting length according to the momentary actual mark.</p> <p>The unit will switch to Error state when more than 64 marks have been detected between the sensor and the carriage home position.</p> <div data-bbox="564 1570 1251 1877" style="text-align: center;"> </div>

\*) For printmark operation only

<b>Printmark Offset *</b>	<p>Fine adjustment of the desired cutting position with respect to the print mark. Setting to 0 results in placement of the cut to the edge of the print mark (rising edge of the photocell). A positive value moves the cut forward (leading the printmark), a negative value moves the cut backwards (lagging behind the printmark).</p> <p>Range +/- 9999 length units. With use of the Trim function for of cut position displacement Printmark Offset value is limited to one cutting length</p>
<b>Max. Printmark Correction *</b>	<p>The response to registered cutting position errors with printmark operation is limited to the value set here.</p> <p>Corrections of the cutting position greater than this value will be executed over several sheets.</p> <p>Range 9999 length units.</p>
<b>Photocell Delay*</b>	<p>Compensation of delay time of printmark sensor:</p> <p>Here you can set the latency time (dead-time) of the printmark sensor (e.g. photocell) scaled in milliseconds. The detected position of the printmark will be automatically corrected according to the delay time set here.</p> <p>Range 0.0 – 500.0 ms.</p>
<b>Printmark Window*</b>	<p>Defines a symmetric window around the rising edge of the print mark sensor. The print mark is supposed to appear inside this window and signals outside the window will not trigger the print mark registration. The position of the window is determined by input "Teach Printmark".</p> <p>Range 0-9999 length units. Setting 0 disables printmark window function, and then every printmark will be detected.</p> <p><b>Clarification:</b></p> <p>When using print mark operation, many times you can find several marks on one size of the sheet to be cut, and only one of these marks is valid for registration to define the cutting position. The unit can automatically blank out the other marks by defining a printmark window around the position of the valid printmark.</p> <p>To set the correct position of the printmark window, set input "Teach Printmark" to high when the valid print mark is close to the print mark sensor, but is not yet sensed. Move the line slowly until the sensor detects the mark and switches from low to high (rising edge required!). The "Teach Printmark" counter input must go back to low state before the sensor generates the next rising edge from the following mark. This stores the position of the valid print mark and the unit will not trigger to the other marks between.</p>
<b>Missing Printmark*</b>	<p>Monitoring of printmarks within the printmark window:</p> <p>This register sets the number of sheets without printmark until output "No printmark" is set.</p> <p>Range 0 – 99. Setting 0 disables the printmark monitoring.</p>

\*) For printmark operation only

<p><b>Length Correction*</b></p>	<p>Automatic overwrite of the length setting by the print mark distance found by measurement. Setting range 0 – 5.</p> <p>0 = Automatic length overwrite switched off  1 = Automatic length overwrite after 1 cycle  2 = Automatic length overwrite after 2 cycles  3 = Automatic length overwrite after 4 cycles  etc.</p> <p><b>Clarification:</b>  When cutting or printing paper or foils with print marks, the material can shrink or stretch for reasons of tension, ambient temperature, humidity etc.. As a result, the distance between two print marks (i. e. the cutting length) will change and no more exactly match the preset length. Due to the proportional control feature of the firmware, this would also cause a slight displacement of the real cutting position with respect to the print mark.</p> <p>The „Length Correction“ register sets a number of cutting cycles where the cut must be out of tolerance (see register “Length Tolerance”) in always the same direction and consecutively. When reached, the length preset is automatically overwritten by the mean value of the real length measured between the print marks and proportional position errors are eliminated.</p>
<p><b>Length Tolerance*</b></p>	<p>Defines the discrimination threshold for the automatic length overwrite as described before. Scaled in length units, setting range 0 – 999 length units.</p>
<p><b>Gap Length</b></p>	<p>With some applications it is desirable, after the cut, to produce a gap between following material and the piece actually cut, by short acceleration of the cutting roll. The gap width can be set directly in length units. Range 0-9999 LU.</p> <p>The entire gap is worked out during the after-cut-phase "Cut=&gt;P2". This means the superimposed gap profile is more flat with higher Cut=&gt;P2 values and steeper with shorter Cut=&gt;P2 values in order to always reach the desired gap distance.</p>  <p>With most applications, this function remains unused (Gap Length = 0).</p>

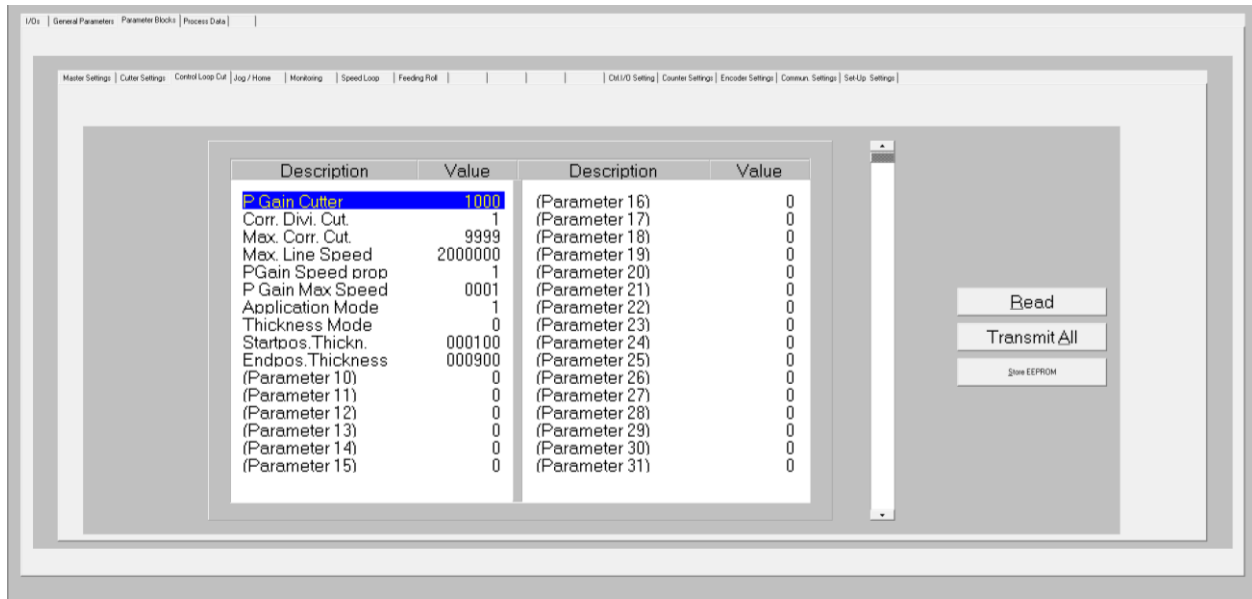
\*) For printmark operation only



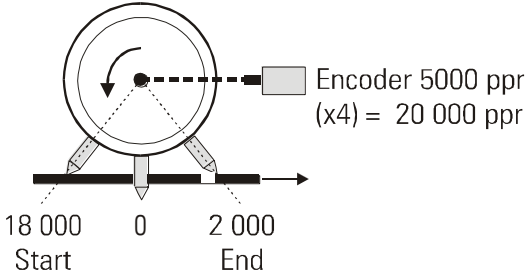
<b>Cutting Pulse Offset</b>	Offset register for virtual displacement of the physical cutting pulse (generated from encoder index or by proximity). Setting in +/- encoder increments. This register makes superfluous a precise mechanical adjustment of the location of the pulse (the virtual cutting pulse must be located exactly in the peak position of tool penetration). Setting range: +/- 999999 increments.
<b>Pm. Cor. Deadband *</b>	Printmark Correction Deadband: Window to limit the response to registered cutting position errors with printmark operation. When the registered cutting position error is less than the deadband setting, no correction will be executed.  Setting range 0 – 999 length units.
<b>Pm. Cor. Prog. Trim *</b>	Printmark correction progressive trimm function: Sets the characteristic of the response to cutting position errors in Cutting Mode 3.  0: Compensation of the cutting position error is linear, i. e. with a constant additional speed as set by register Trimm Time ≥1: Compensation of the cutting position error is progressive, i. e. with higher speed as the actual print mark error is high, and with continuously decreasing speed as the actual error declines. With setting 1, the progressive compensation is very sharp, with higher setting the progressive compensation gets softer.  Setting Range 0 – 9. Recommended Setting: 3...5
<b>Pm. Cor. Max. Trim *</b>	Printmark correction maximum trimm: Limitation of the additional speed for with Cutting Mode = 3 and Pm. Cor. Prog. Trim ≠ 0  Setting Range 0 – 999. Recommended Setting: 20
<b>(Parameter 25...31)</b>	-Not in use-

\*) For printmark operation only

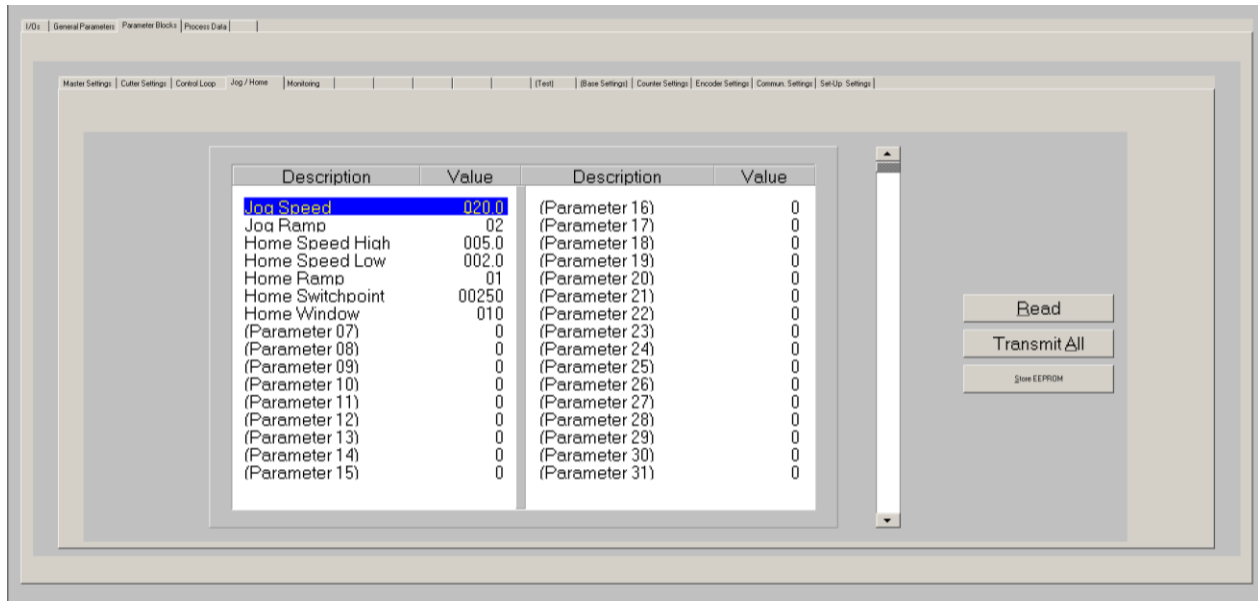
### 4.3.3. Control Loop Settings



<p><b>P Gain Cutter</b></p>	<p>Proportional gain for compensation of relative errors of the cutting roll position with respect to the scheduled position.</p> <p>Setting range: 0 – 9999</p> <p>Recommended settings: 500 – 2500.</p>
<p><b>Corr. Divi. Cut.</b></p>	<p>This register provides a digital attenuation of the position correction signal of the cutting roll, when the drive on mechanical grounds (dead band or backlash) cannot respond. In such a case, it is not desirable to make corrections immediately. The Correction Divider provides a window for the drive “backlash”, within which the controller produces no correction, and a division of the incremental position error count.</p> <p>1: No window, Reaction to every error increment, no division of the position error counter.</p> <p>2: Window +/- 1 increment, division by 2</p> <p>3: Window +/- 3 increments, division by 4</p> <p>4: Window +/- 7 increments, division by 8</p> <p>5: Window +/- 15 increments, division by 16</p> <p>etc.</p> <p>9: Window +/- 255 increments, division by 256</p>
<p><b>Max. Corr. Cut.</b></p>	<p>Limitation of the active correction signal resulting from the proportional position control loop of the cutting roll. When the correction has reached this limit, the analog output will no more follow to further increase of the error, but the error record itself will be continued in the background.</p> <p>Setting range: 0 – 9999 mV. Recommended settings: <math>\geq 1000</math> mV</p>

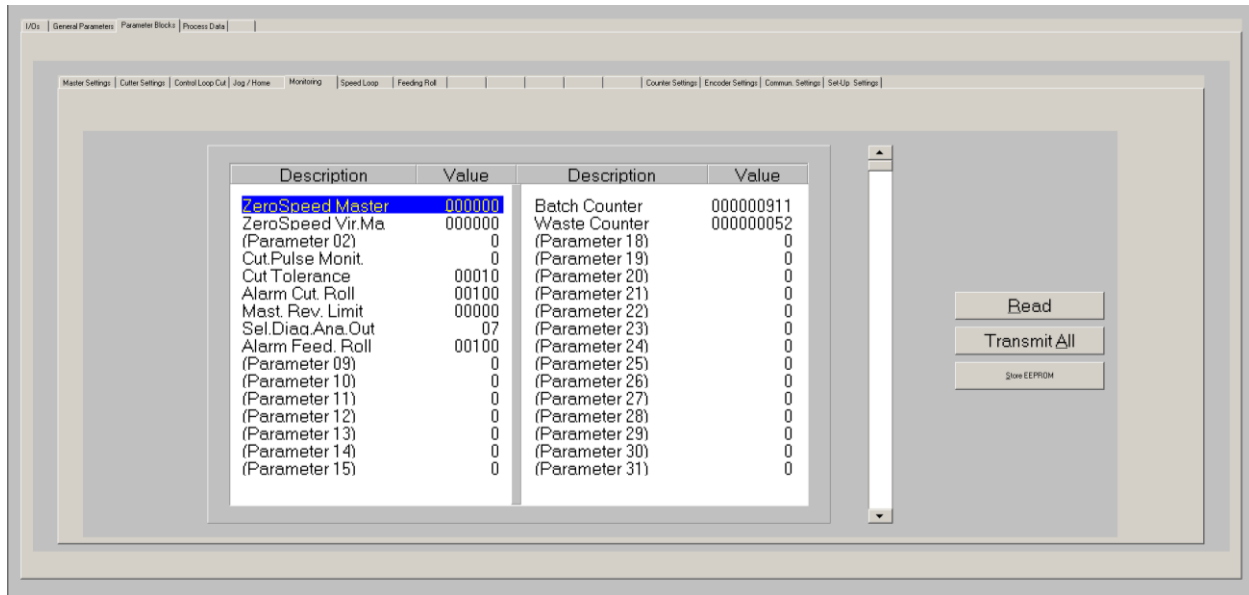
<b>Max. Line Speed</b>	<p>Setting of the maximum applicable line speed. Setting range 1 – 9 999 999 LU/min.</p> <p>This setting is used for internal scaling and resolution of the line speed. For best resolution, this value should not be set higher than really necessary for the application. Upper limit to the value of register "Virt. Line Speed".</p>
<b>P Gain Speed prop.</b>	<p>By this parameter a constant or variable P-Gain of the cutting roll can be selected:</p> <p><b>0:</b> Constant P-Gain of the cutting roll as set by parameter P Gain Cutter (Default setting, suitable for most applications)</p> <p><b>1:</b> P-Gain of the cutting roll is proportional to line speed: P-Gain value starts with "P Gain Cutter" at standstill and changes with rising line speed proportionally to value "P Gain Max Speed" at maximum line speed (only used for special applications where a speed variable P-Gain is required)</p>
<b>P Gain Max Speed</b>	<p>P-Gain of the cutter at maximum line speed. Only valid when parameter "P Gain speed prop" is set to 1 (see above)</p>
<b>Application Mode</b>	<p>Application-specific fine tuning of control loop</p> <p><b>0:</b> Recommended setting for printing, embossing, stamping and similar applications where the processed material remains unsplit.</p> <p><b>1:</b> Setting for cutting applications</p>
<b>Thickness Mode</b>	<p>Parameter to adapt the control loop characteristics to different thickness and hardness grades of the material.</p> <p>Setting range is <b>0, 1</b> or <b>2</b>.</p> <p><b>Normal setting is 0, a different setting is only necessary for very thick or very hard material when normal cut performance is not sufficient.</b></p> <p>Best setting depends on many details like tool shape, drive dynamics, material properties etc. and must therefore be found out. The parameter is active in a small "Thickness Window" only, which opens shortly prior to the cut and closes shortly after the cut.</p>
<b>Startpos. Thickn.</b> <b>Endpos. Thickness</b>	<p>Opening position ("Startpos. Thickn.") and closing position ("Endpos. Thickness") of the "Thickness Window" with regard to the cutting pulse (which represents zero). Setting in Encoder Increments.</p> <p>"Startpos. Thickn." must be set to a position shortly before the tool touches the material while "Endpos. Thickness" must be set to a position where the tool has moved out of the touching range of the material (see example below).</p> <p><b>Example for settings of Start and End of the "Thickness Window" with a 5000 ppr encoder at edge evaluation (x4)</b>  <b>Startpos. Thickn. = 18 000</b>  <b>Endpos. Thickness = 2 000</b></p> 
<b>(Par.10...31)</b>	-Not in use-

### 4.3.4. Jog / Home



<b>Jog Speed</b>	Preset of the desired cutting roll speed for Jog operations with use of the inputs "Jog / Trim fw. Cut" and "Jog / Trim rv. Cut" in stop state. Setting range 000 – 100%, where 100% corresponds to the "Maximum Line Speed" setting.
<b>Jog Ramp</b>	Ramp time for Jog operations of the cutting roll. Setting range 01 – 99 s with respect to speed changes between standstill and full Jog speed.
<b>Home Speed High</b>	Fast Homing speed. Every homing cycle will start with this speed. Setting range 000 – 100%, where 100% corresponds to the "Maximum Line Speed" setting.
<b>Home Speed Low</b>	Slow Homing speed. A Homing cycle will end with this speed. Setting range 000 – 100%, where 100% corresponds to the "Maximum Line Speed" setting
<b>Home Ramp</b>	Ramp time for acceleration and deceleration with Homing cycles. Range: 0 – 99 s.
<b>Home Switchpoint</b>	Distance from the final home position where the speed changes over from High speed to Low speed within a homing cycle. Range: 1 – 99999 length units.
<b>Home Window</b>	Sets a window around the home position of the cutting roll, which is located opposite to the centre point of the synchronous zone. Setting range 1-999 length units. The output "Home" indicates by High state that the cutting roll position is inside this window. If a cut is started with the cutting roll not being in this window the controller will display "No Home Position" error.
<b>(Parameter 07...31)</b>	-Not in use-

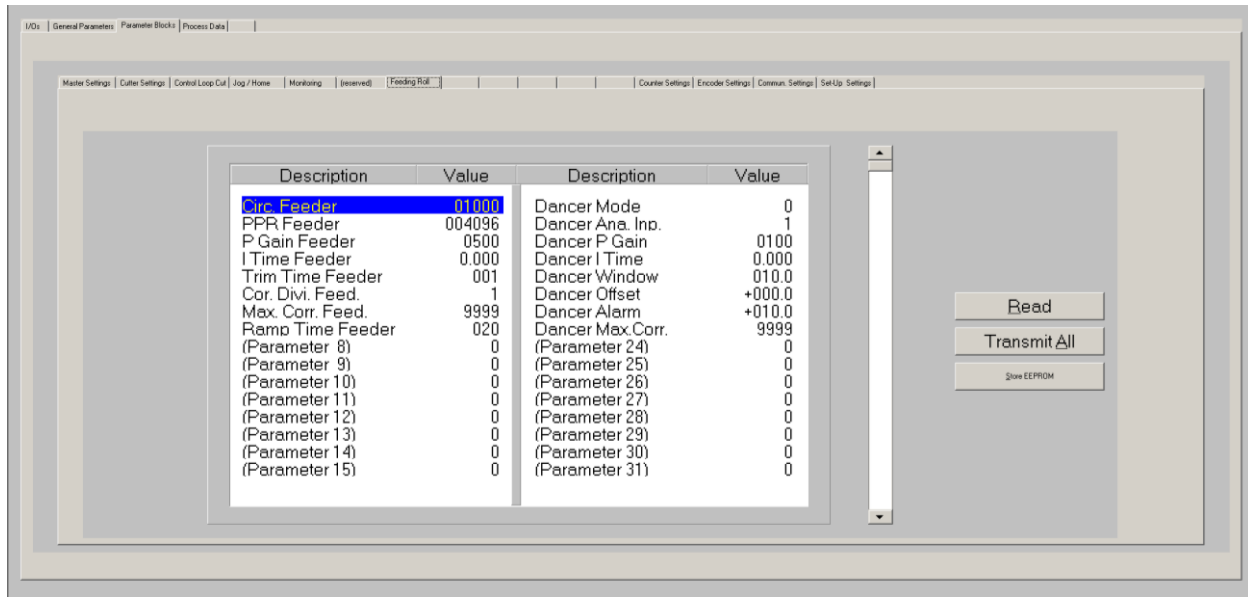
### 4.3.5. Monitoring



<b>Zero Speed Master</b>	Standstill definition for the line encoder. When the speed of the line encoder is higher than the setting of this register the referring output “Master in Motion” is switched ON. Setting range: 0 – 999 999 LU/min.
<b>Zero Speed Vir. Master</b>	Standstill definition for the virtual master. Output “Vir. M. in Motion” is switched ON when the speed generated by the virtual master is higher than the setting of this register. Setting range: 0 – 999 999 LU/min.
<b>(Parameter 02)</b>	Not in use
<b>Cut. Pulse Monit.</b>	Enables the cutting pulse monitoring during normal cutting operation 0: Cutting pulse monitoring disabled. A missing cutting pulse or cutting pulse at wrong position will not generate an error. 1: Cutting pulse monitoring enabled. If the cutting pulse is missing or occurs at an unexpected position, the cutting roll stops and an error is displayed. 2: Cutting pulse monitoring enabled If the cutting pulse is missing or occurs at an unexpected position, the cutting roll continues moving with synchronous speed Please note, the homing sequence always requires the cutting pulse. If the cutting pulse is missing during homing operation, an error is displayed anyway, independent of the setting of this parameter.
<b>Cut Tolerance</b>	Defines the threshold of the output „Waste Cut” and the waste counter. If the actual cutting length of a piece is more than the value of “Cut Tolerance” lower or higher than the preset cutting length the piece is counted as waste and the output “Waste Cut” is set to high. Range: 0 – 99999 length units.

<b>Alarm Cut. Roll</b>	<p>Defines the switching level of the output "Alarm Cutter" when the cutting roll is forced out of synchronization due to external events (drive fault or mechanical problem). Setting occurs in cutting roll encoder increments and the alarm output switches on when the positional error of the cutting roll in respect to the scheduled position overpasses the number of encoder pulses set.</p> <p>Range 1 – 9999 increments.</p>
<b>Mast. Rev. Limit</b>	<p>Master reverse movement limit (see also output "Master Reverse"). Setting range 0 – 99 999 LU.</p> <p>When the material line moves in reverse direction for a distance greater than the value set in this register, the master encoder pulses in reverse direction are blocked and no more counted. This prevents the cutting roll from moving backwards. Setting 0 disables the Master reverse movement monitoring.</p>
<b>Sel.Diag.Ana.Out</b>	<p><u>Only if additional feeding roll axis is not used and disabled (Parameter "Circ. Feeder" = 0 or "PPR Feeder" = 0):</u></p> <p>Selects the actual value from the menu "Process Data", which should appear at analogue output "ANALOG OUT 2" for diagnosis purpose.</p> <p>Setting range 0 - 31 (number of actual value)</p> <p>See chapter 4.4 and table in chapter 8 for selection.</p> <p>Parameter <b>Ana Out 2 Gain</b> from the Set-up register card (see chapter 4.3.10) allows the scaling of the analogue diagnosis signal:</p> $\text{Output voltage [V]} = (\text{Ana Out 2 Gain} \times \text{actual value}) / 10000$ <p>Example: Setting Ana Out 2 Gain to 10.000 means that a digital value of 1000 will cause an analogue output of 1 Volt.</p>
<b>Alarm Feed. Roll</b>	<p>Defines the switching level of the output "Alarm Feeder" when the feeding roll is forced out of synchronization due to external events (drive fault or mechanical problem). Setting occurs in feeding roll encoder increments and the alarm output switches on when the positional error of the feeding roll in respect to the scheduled position overpasses the number of encoder pulses set.</p> <p>Range 1 – 9999 increments.</p>
<b>(Parameter 09...15)</b>	-Not in use-
<b>Batch Counter</b>	Counts the number of cuts made with the normal cutting length during automatic operation.
<b>Waste Counter</b>	<p>Counts the number of waste pieces. Increments with every waste cut, immediate cut and test length cut.</p> <p>Hint: Batch counter and waste counter will not be saved automatically to the EEPROM upon power-down!</p>
<b>(Parameter 18...31)</b>	-Not in use-

### 4.3.6. Feeding Roll



<b>Circ. Feeder</b>	Circumference of the feeding roll. Range 0 – 99999 length units. Setting 0 disables the feeding roll axis.
<b>PPR Feeder</b>	Pulses per revolution of the feeding roll. Enter the number of pulses from the encoder for one revolution of the cutting roll with regard to the multiple edge count setting (x1, x2, x4). Range 0 - 999 999. Setting 0 disables the feeding roll axis.
<b>P Gain Feeder*</b>	Proportional gain for compensation of errors of the feeding roll position with respect to the scheduled position. Setting range: 0 – 9999 Recommended settings: 500 – 2500.
<b>I Time Feeder*</b>	Integration time (sec.) for compensation of errors of the feeding roll position with respect to the scheduled position. 0.000 = no integration, proportional control only 0.001 = time constant 1 ms (High integral gain, extremely fast compensation) ... 1.000 = time constant 1 s (Low integral gain, very slow compensation)
<b>Trim Time Feeder</b>	Adjustment time for position displacement of one feeding roll encoder increment with use of the Trim function (input "Trim forw. Feed." or "Trim rev. Feeder"). 001 = 1 ms for each increment unit (fast) 999 = 999 ms for each increment (slow)

\*) Only valid if parameter „Dancer Mode“ = 0

<b>Cor. Divi. Feeder*</b>	<p>Correction Divider for the feeding roll. This provides a digital attenuation of the position correction signal, when the drive for mechanical reasons (dead band or backlash) cannot respond. In such a case, it is not desirable to make corrections immediately. The Correction Divider provides a window for the drive "backlash", within which the controller produces no correction, and a division of the incremental error count.</p> <p>1: No window, Reaction to 1 error increment, no division.  2: Window +/- 1 increment, division :2  3: Window +/- 3 increments, division :4  4: Window +/- 7 increments, division :8  5: Window +/- 15 increments, division :16  etc.</p>
<b>Max. Corr. Feed.*</b>	<p>Upper limitation of the correction output of the proportional control loop of the feeding roll. With increasing position errors the correction voltage will no more increase beyond this setting, even though the error counter will continue to count in the background.</p> <p>Range 0 – 9999 mV  Recommended settings: higher than 1000 mV</p>
<b>Ramp Time Feeder</b>	<p>Ramp time to accelerate the feeding roll from standstill to maximum speed or vice-versa, when the feeding roll is started or stopped by command "Stop Feeder".</p> <p>Range 0 – 999 sec.</p>
<b>(Parameter 8 ... 15)</b>	-Not in use-
<b>Dancer Mode</b>	<p>Enables or disables the use of the dancer or tension control for the feeding roll and sets the correction direction for the dancer control.</p> <p>0: Dancer or tension control disabled.  Feeding roll is a normal slave axis, its position is controlled by counting pulses from feeding roll encoder.</p> <p>1 or 2: Dancer control or tension control enabled.  Feeding roll differential counter is disabled, feeding roll position is controlled by dancer or tension signal.</p> <p>1: An increasing input signal from the dancer forces the feeding roll to regain position by increasing its speed  2: A decreasing input signal from the dancer forces the feeding roll to regain position by increasing its speed</p> <p>Setting 1 or 2 depends on the polarity of the analogue signal of the dancer (higher signal when dancer goes up or when it goes down) and on the location of feeding roll and dancer (feeding roll located before dancer or after dancer).</p>

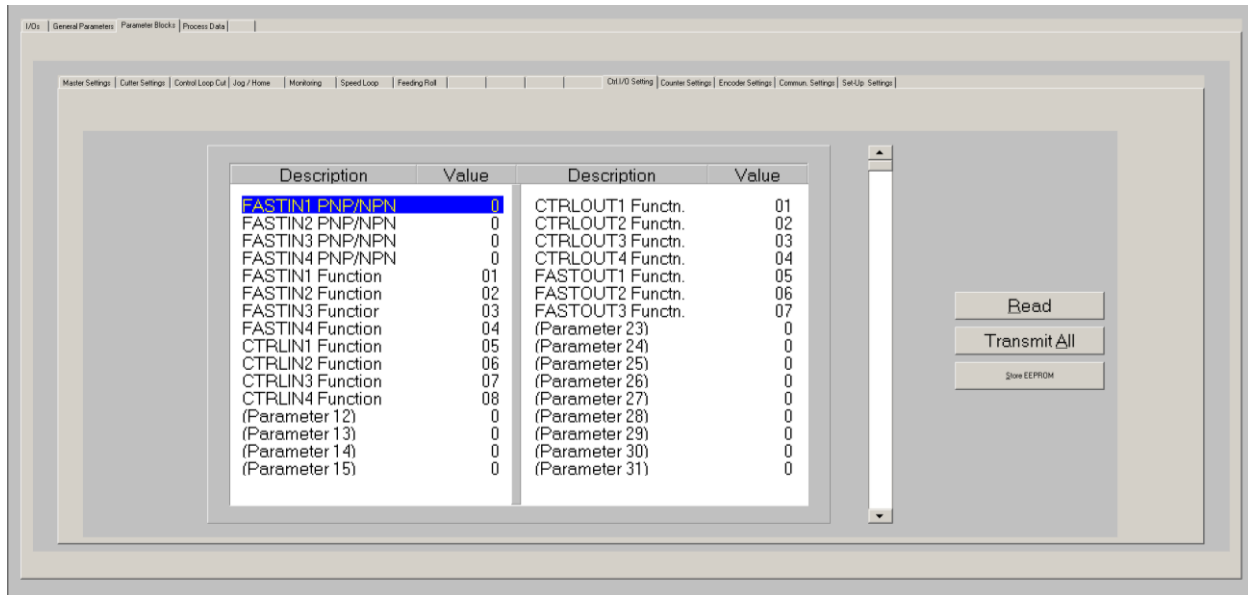
\*) Only valid if parameter „Dancer Mode“ = 0



<b>Dancer Ana. Inp.**</b>	Selects the type of the analogue dancer or tension signal 1: Dancer provides a voltage signal (max. range +/-10 V) Please connect dancer signal to ANALOG IN 1 (X12) pin 1 and 3 2: Dancer provides a current signal (max. range +/-20 mA) Please connect dancer signal to ANALOG IN 1 (X12) pin 1 and 4
<b>Dancer P Gain**</b>	Proportional gain of the dancer control loop. Range 0 – 9999
<b>Dancer I Time**</b>	Integration time to compensate proportional errors of the dancer control. 0.000 = no integration, proportional dancer control only 0.001 = time constant 1 ms (High integral gain, extremely fast compensation) ... 1.000 = time constant 1 s (Low integral gain, slow compensation)
<b>Dancer Window**</b>	Tolerance window where the dancer or tension signal is allowed to swing without immediate response of the controller. Serves for stabilization of the control loop. Range 0 – 100.0% of the max. dancer or tension input signal.
<b>Dancer Offset**</b>	Defines the desired dancer or tension target value in percent of the feedback signal. E. g. when a dancer provides a +/-10 V signal, a setting of Dancer Offset = 0 will force the control to keep the dancer in its middle position (target value for dancer signal is 0 V). Or when a tension sensor provides a signal of 0-20 mA for tensions of 0 – 5 N, a setting of Dancer Offset = 50% will tune the control loop for a tension of 2.5 N (target value for tension signal is 10 mA) Range +/- 100,0% of the max. dancer or tension input signal.
<b>Dancer Alarm**</b>	Preset value to activate output "Dancer Alarm". When register Dancer Alarm is set to X%, the output "Dancer Alarm" is set when the analogue dancer or tension signal exceeds +X% or underpasses -X% of its maximum value. Range +/-100.0% of the max. dancer or tension input signal.
<b>Dancer Max. Corr.**</b>	Upper limitation of the correction output of the dancer or tension control loop. Range 0 – 9999 mV Recommended settings: higher than 1000 mV
<b>(Parameter 24 ... 31)</b>	-Not in use-

\*\*\*) Only valid if parameter „Dancer Mode“ = 1 or 2

### 4.3.7. Control I/O Settings

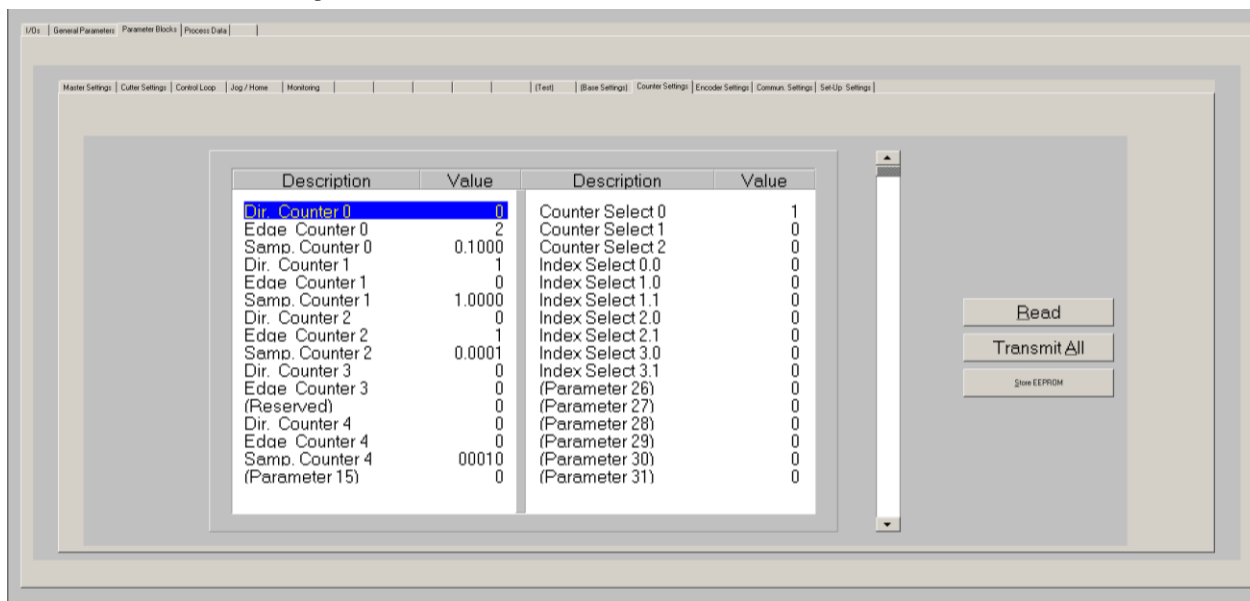


<b>FASTIN1 PNP/NPN</b>	Switching characteristics of control input FAST IN 1:  0: PNP (switch to +10 ... 30 V to set input, unconnected input is low) 1: NPN (switch to GND to reset input; unconnected input is high)
<b>FASTIN2 PNP/NPN</b>	Switching characteristics of control input FAST IN 2:  0: PNP (switch to +10 ... 30 V to set input, unconnected input is low) 1: NPN (switch to GND to reset input; unconnected input is high)
<b>FASTIN3 PNP/NPN</b>	Switching characteristics of control input FAST IN 3:  0: PNP (switch to +10 ... 30 V to set input, unconnected input is low) 1: NPN (switch to GND to reset input; unconnected input is high)
<b>FASTIN4 PNP/NPN</b>	Switching characteristics of control input FAST IN 4:  0: PNP (switch to +10 ... 30 V to set input, unconnected input is low) 1: NPN (switch to GND to reset input; unconnected input is high)
<b>FASTIN1 Function</b>	Fixed to 1 (FASTIN1 is used for printmark input. Function cannot be changed)
<b>FASTIN2 Function</b>	Fixed to 2 (FASTIN2 is used for cutting pulse input. Function cannot be changed)
<b>FASTIN3 Function</b>	Function assignment for input FAST IN 3  Set here the number of the input command you want to assign to input FAST IN 3 (see table in chapter 4.1.1). Setting 0 assigns no function, i.e. input FAST IN 3 is disabled.  Example: With FASTIN3 Function = 11 you can set the "Clear Error" command by input FASTIN3.  Range: 0 ... 30, factory default setting: 3

<b>FASTIN4 Function</b>	Function assignment for input FAST IN 4 (see explanation above) Range: 0 ... 30, factory default setting: 4
<b>CTRLIN1 Function</b>	Function assignment for input CTRL IN 1 (see explanation above) Range: 0 ... 30, factory default setting: 5
<b>CTRLIN2 Function</b>	Function assignment for input CTRL IN 2 (see explanation above) Range: 0 ... 30, factory default setting: 6
<b>CTRLIN3 Function</b>	Function assignment for input CTRL IN 3 (see explanation above) Range: 0 ... 30, factory default setting: 7
<b>CTRLIN4 Function</b>	Function assignment for input CTRL IN 4 (see explanation above) Range: 0 ... 30, factory default setting: 8
<b>(Parameter 12...15)</b>	-Not in use-
<b>CTRLOUT1 Functn.</b>	Function assignment for output CTRL OUT 1 Set here the number of the output signal you want to assign to output CTRL OUT 1 (see table in chapter 4.1.2) Setting 0 assigns no function, i.e. output CTRL OUT 1 is disabled. Example: When you set CTRLOUT1 Function = 08 then output CTRL OUT 1 provides the output signal "No Printmark". Range: 0 ... 32, factory default setting: 1
<b>CTRLOUT2 Functn.</b>	Function assignment for output CTRL OUT 2 (see explanation above) Range: 0 ... 32, factory default setting: 2
<b>CTRLOUT3 Functn.</b>	Function assignment for output CTRL OUT 3 (see explanation above) Range: 0 ... 32, factory default setting: 3
<b>CTRLOUT4 Functn.</b>	Function assignment for output CTRL OUT 4 (see explanation above) Range: 0 ... 32, factory default setting: 4
<b>FASTOUT1 Functn.*</b>	Function assignment for output FAST OUT 1 (see explanation above) Range: 0 ... 32, factory default setting: 5
<b>FASTOUT2 Functn.*</b>	Function assignment for output FAST OUT 2 (see explanation above) Range: 0 ... 32, factory default setting: 6
<b>FASTOUT3 Functn.*</b>	Function assignment for output FAST OUT 3 (see explanation above) Range: 0 ... 32, factory default setting: 7
<b>(Parameter 23...31)</b>	-Not in use-

**\*) Only valid if parameter Fast Output Sel. = 7 (see chapter 4.3.111)!**

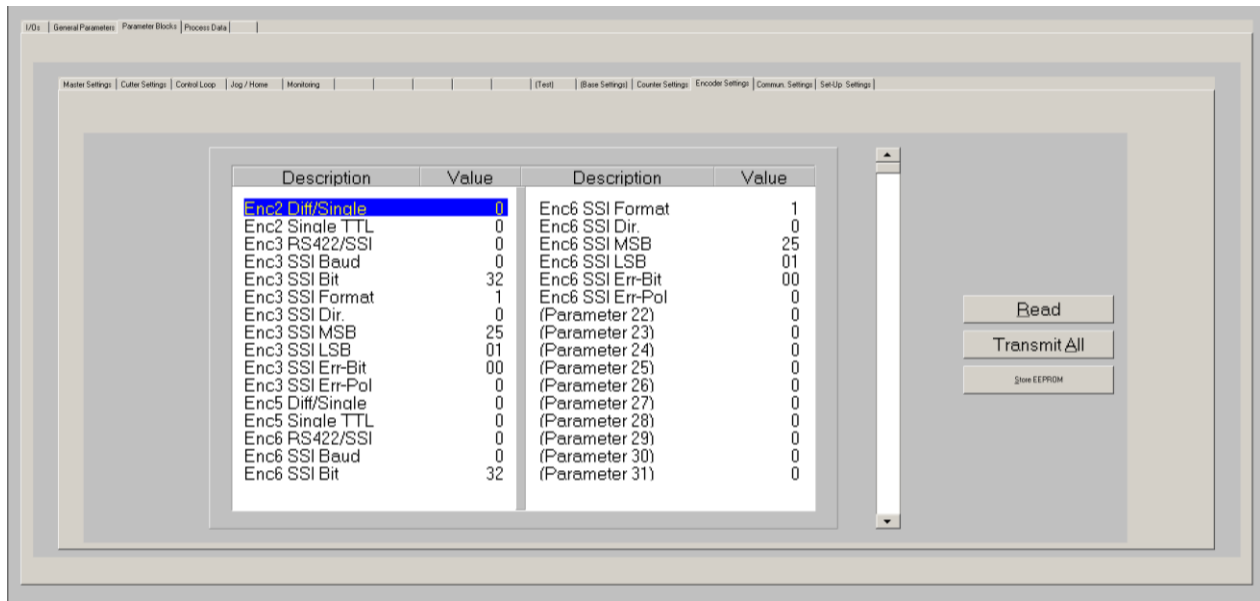
### 4.3.8. Counter Settings



Dir. Counter 0	
Edge Counter 0	Not in use with this application firmware
Samp. Counter 0	
Dir. Counter 1	Assigns the counting direction (up / down) of the line encoder input, depending on the quadrature A/B phase displacement. This parameter is found out and set best in the Adjust menu
Edge Counter 1	Determines the number of edges counted from the line encoder input: <b>0 = x1, 1 = x2, 2 = x4</b>
Samp. Counter 1	Provides digital filtering of the feed forward signal generated from the line encoder. Range 0.0001 – 9.9999 s; normal setting: 0.0010 (= 1 ms). For applications with unsteady line speed or bumpy motion of the measuring wheel, settings like 10 ms or even 100 ms can be advantageous for smoother motion of the cutting roll and increased accuracy.  Please note that higher settings result in lower response to actual changes of the line speed, i.e. you should consider increasing the ramp times of your line drive to ensure that your cutting accuracy remains good also during changes of the line speed.
Dir. Counter 2	Assigns the counting direction (up / down) of the cutting roll encoder input, depending on the quadrature A/B phase displacement. This parameter is found out and set best in the Adjust menu
Edge Counter 2	Determines the number of edges counted from the cutting roll encoder input: <b>0 = x1, 1 = x2 2 = x4</b>

Samp. Counter 2	Not in use with this application firmware
Dir. Counter 3	Assigns the counting direction (up / down) of the virtual master. <b>Should be set to 0.</b>
Edge Counter 3	Determines the number of edges counted from the virtual master. <b>Should be set to 0.</b>
(reserved)	Not in use
Dir. Counter 4	Assigns the counting direction (up / down) of the feeding roll encoder input, depending on the quadrature A/B phase displacement. This parameter is found out and set best in the Adjust menu
Edge Counter 4	Determines the number of edges counted from the feeding roll encoder input: <b>0 = x1, 1 = x2 2 = x4</b>
Samp. Counter 4	Not in use with this application firmware
(Parameter 15)	Not in use
Counter Select 0	Not in use with this application firmware
Counter Select 1	<b>Must be set to 0</b>
Counter Select 2	<b>Must be set to 1</b>
Index Select 0.0	Not in use with this application firmware
Index Select 1.0	This register selects the source of the print mark pulse. You are free to use either the RS422/TTL inputs on the encoder connectors or the 24V/HTL digital control input at terminal X4:  <b>0:</b> Print mark source is line encoder input X9, Pin 8 (Z) and 9 (/Z) <b>1:</b> Print mark source is FAST IN 1 at terminal X4 pin 2
Index Select 1.1	Not in use with this application firmware
Index Select 2.0	This register selects the source of the cutting pulse. You are free to use either the RS422/TTL inputs on the encoder connectors or the 24V/HTL digital control input at terminal X4:  <b>0:</b> Cutting pulse source is cutting roll encoder input X7, Pin 8 (Z) and 9 (/Z) <b>1:</b> Cutting pulse source is FAST IN 2 at terminal X4 pin 3
Index Select 2.1	Not in use with this application firmware
Index Select 3.0	Not in use with this application firmware
Index Select 3.1	Not in use with this application firmware
(Parameter 15...31)	Not in use

### 4.3.9. Encoder Settings

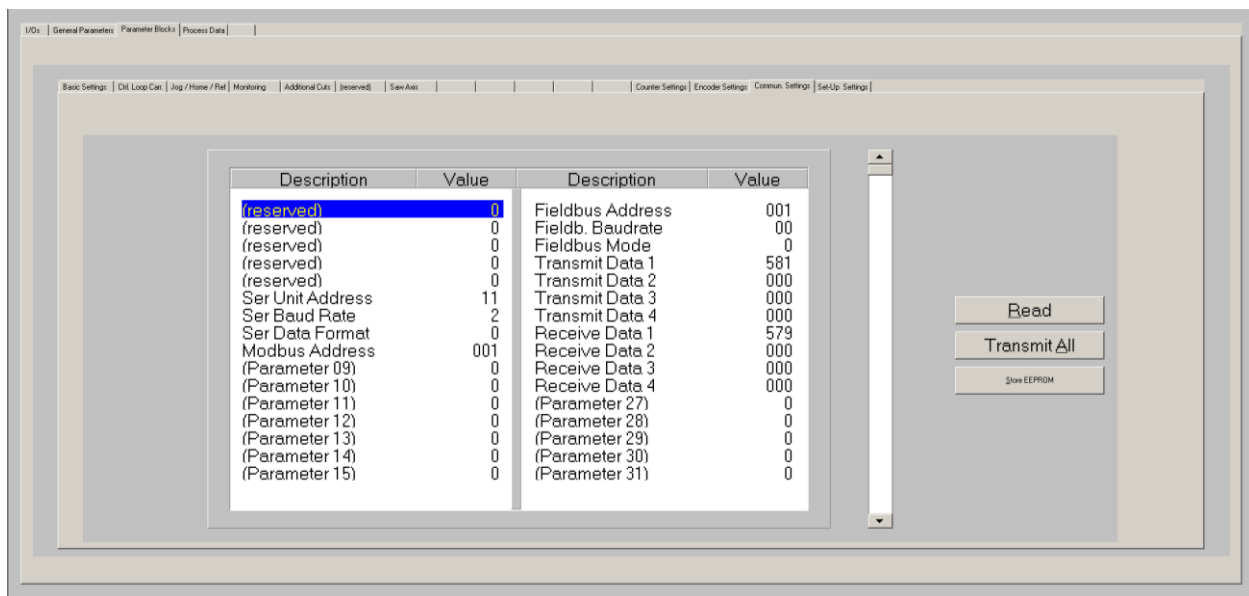


Enc2 Diff/Single	Line encoder pulse type: 0: Differential pulses (2x90° with inverted signals: A, /A, B, /B) 1: Single-ended pulses (2x90° without inverted signals: A, B)
Enc2 Single TTL	Line encoder pulse level: 0: RS422/TTL pulses (5V) 1: HTL (10...30V)
Enc3 RS422/SSI	Not in use with this application firmware
Enc3 SSI Baud	
Enc3 SSI Bit	
Enc3 SSI Format	
Enc3 SSI Dir.	
Enc3 SSI MSB	
Enc3 SSI LSB	
Enc3 SSI Err-Bit	
Enc3 SSI Err-Pol	
Enc5 Diff/Single	Cutting roll encoder pulse type: 0: Differential pulses (2x90° with inverted signals: A, /A, B, /B) 1: Single-ended pulses (2x90° without inverted signals: A, B)
Enc5 Single TTL	Cutting roll encoder pulse level: 0: RS422/TTL pulses (5V) 1: HTL (10...30V)

Enc6 RS422/SSI	Not in use with this application firmware
Enc6 SSI Baud	
Enc6 SSI Bit	
Enc6 SSI Format	
Enc6 SSI Dir.	
Enc6 SSI MSB	
Enc6 SSI LSB	
Enc6 SSI Err-Bit	
Enc6 SSI Err-Pol	-Not in use-
(Parameter 15...31)	

### 4.3.10. Communication settings

This register card sets the parameters for the communication interfaces

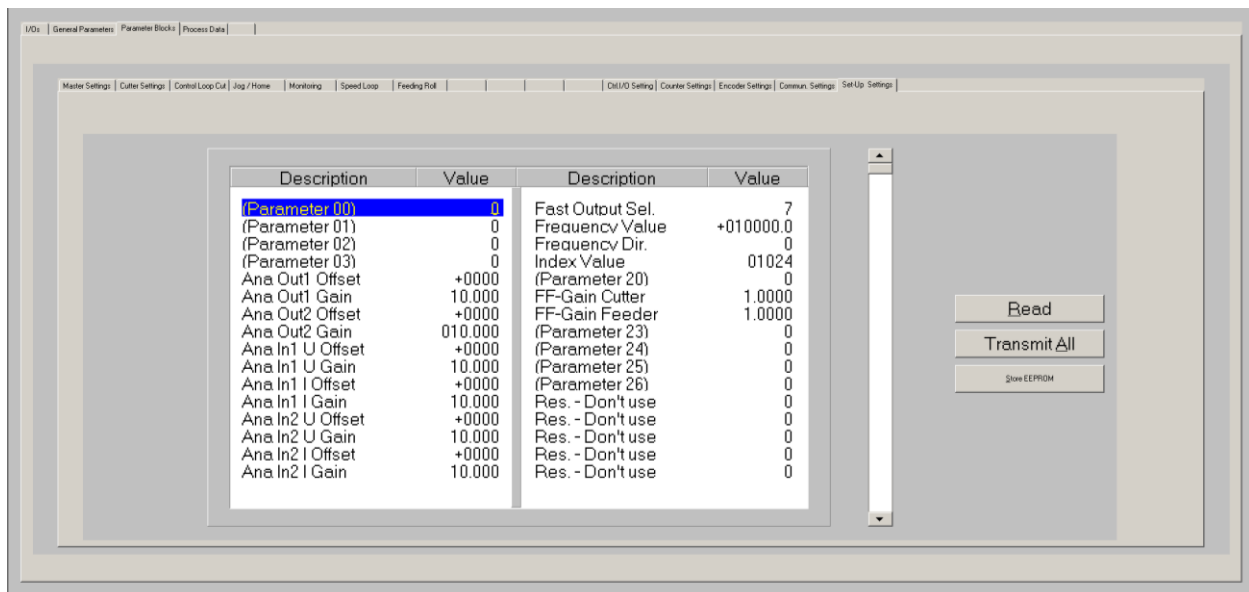


(reserved)	Parameters reserved for further use
Ser. Unit Address	Unit address for serial communication with standard Lecom protocol (used when DIL-switch 1 is set to off). Range 11 ... 99.  Address numbers containing zeros like 01, 02, 03, ..., 10, 20, etc. are not permitted because these are reserved for broadcast messages (collective addressing of several units). Factory default address is always 11.
Ser. Baud Rate	Transmission rate of the serial interface 0: 38400 Bit/s 1: 19200 Bit/s 2: 9600 Bit/s (factory default setting) 3: 4800 Bit/s 4: 2400 Bit/s

<b>Serial Data Format:</b>	Data format of the serial interface			
	<b>Setting:</b>	<b>Data bits</b>	<b>Stop bits</b>	<b>Parity</b>
	0	7	1	even
	1	7	2	even
	2	7	1	odd
	3	7	2	odd
	4	7	1	none
	5	7	2	none
	6	8	1	even
	7	8	1	odd
	8	8	1	none
	9	8	2	none
<b>Factory default setting: 0</b>				
<b>Modbus Address</b>	Node address for serial communication with Modbus RTU protocol (used when DIL-switch 1 is set to on). Range 1 ... 247.			
<b>(Parameter 09...15)</b>	-Not in use-			
<b>Fieldbus Address</b>	Parameters for the optional fieldbus interface module.			
<b>Fieldb. Baudrate</b>	If you are using a fieldbus interface module, please refer to the corresponding manual for the setting of these parameters.			
<b>Fieldbus Mode</b>				
<b>Transmit Data 1...4</b>				
<b>Receive Data 1...4</b>				
<b>(Parameter 27...31)</b>	-Not in use-			

### 4.3.11. Setup Settings

These settings define hardware properties of inputs and outputs of the MC800 controller. You must only make settings for those functions that are really used and wired with this application.



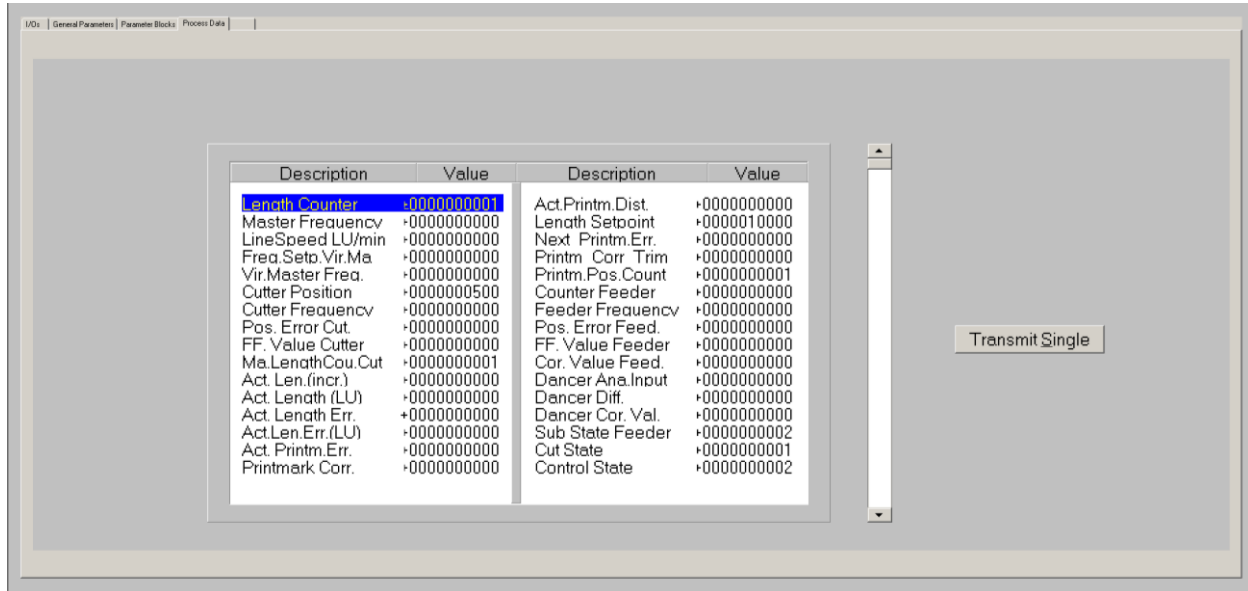


<b>(Parameter 00)</b>	-Not in use-	Parameters "FastIn...PNP/NPN" have been shifted to parameter block "Control I/O Settings" (see chapter 4.3.7)
<b>(Parameter 01)</b>	-Not in use-	
<b>(Parameter 02)</b>	-Not in use-	
<b>(Parameter 03)</b>	-Not in use-	
<b>Ana Out1 Offset</b>	Sets the zero position of the analog output ANALOG OUT 1 (cutting roll speed setpoint output) directly in Volts. Setting range -9999 mV ... + 9999 mV The default setting is 0.	
<b>Ana Out1 Gain</b>	Sets the full-scale output of the analog output ANALOG OUT 1 (cutting roll speed setpoint output) directly in Volts. Setting range 0 ... 99.999V, normal setting 10.000 V. (However, physically the max. output voltage is about 12 V)	
<b>Ana Out2 Offset</b>	Sets the zero position of the analog output ANALOG OUT 2 (feeding roll speed setpoint output or diagnosis output) directly in mV. Setting range -9999 mV ... + 9999 mV The default setting is 0.	
<b>Ana Out2 Gain</b>	Sets the full-scale output of the analog output ANALOG OUT 2 (feeding roll speed setpoint output or diagnosis output) directly in Volts. Setting range 0 ... 999.999V, normal setting 10.000 V. (However, physically the max. output voltage is about 12 V)	
<b>Ana In1 U Offset</b>	Sets the zero position of the voltage input of ANALOG IN 1 (voltage signal from dancer or tension sensor) directly in Volts. Setting range -9999 mV ... + 9999 mV The default setting is 0.	
<b>Ana In1 U Gain</b>	Should be set to 10.000.	
<b>Ana In1 I Offset</b>	Sets the zero position of the current input of ANALOG IN 1 (current signal from dancer or tension sensor) directly in $\mu$ A. Setting range -9999 $\mu$ A ... + 9999 $\mu$ A The default setting is 0.	
<b>Ana In1 I Gain</b>	Should be set to 10.000.	

Ana In2 U Offset	Not in use with this application firmware
Ana In2 U Gain	
Ana In2 I Offset	Not in use with this application firmware
Ana In2 I Gain	
Fast Output Sel.	<p>Selects the source of the output signal appearing at FAST OUT 1...3 at connector X6, used for cascading and other purpose:</p> <p><b>0: The output signal is the virtual master frequency</b></p> <p>1: The output signal is the signal applied to encoder input SINCOS IN 1 at connector X1 (not in use with this application firmware)</p> <p><b>2: The output signal is the signal applied to line encoder input INC IN 1 at connector X9</b></p> <p>3: The output signal is the signal applied to encoder input SSI IN 1 at connector X10 (not in use with this application firmware)</p> <p>4: The output signal is the signal applied to encoder input SINCOS IN 2 at connector X2 (not in use with this application firmware)</p> <p><b>5: The output signal is the signal applied to cutting roll encoder input INC IN 2 at connector X7</b></p> <p><b>6: The output signal is the signal applied to feeding roll encoder input SSI IN 2 at connector X8</b></p> <p><b>7: Control output signals as assigned by parameter "FASTOUT1 Functn.", "FASTOUT2 Functn." and "FASTOUT3 Functn." (see chapter 4.1.23.7)</b></p>
Frequency Value	-For factory testing purpose only-
Frequency Dir.	Not in use
Index Value	Index distance of the virtual master: Generates a virtual marker pulse every xxxxx virtual encoder pulses. Range 0 – 65535
(Parameter 20)	Not in use
FF-Gain Cutter	Gain for the feed forward speed signal of the cutting roll, calculated from the master encoder frequency. Range 0.0001...9.9999 <b>This parameter is found out and set in the Adjust menu.</b>
FF-Gain Feeder	Gain for the feed forward speed signal of the feeding roll, calculated from the master encoder frequency. Range 0.0001...9.9999 <b>This parameter is found out and set in the Adjust menu.</b>
(Parameter 23...26)	Not in use
Res. – Don't use	Reserved, please don't use!

## 4.4. Process data (actual 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.



The screenshot shows a software interface with a tabbed menu at the top containing 'General Parameters', 'Parameter Blocks', and 'Process Data'. The 'Process Data' tab is active, displaying a table with two columns: 'Description' and 'Value'. The table is split into two sections. The first section lists parameters such as 'Length Counter' (value: +0000000001), 'Master Frequency' (+0000000000), 'LineSpeed LU/min' (+0000000000), 'Frea.Setp.Vir.Ma' (+0000000000), 'Vir.Master Freq.' (+0000000000), 'Cutter Position' (+0000000500), 'Cutter Frequency' (+0000000000), 'Pos. Error Cut.' (+0000000000), 'FF. Value Cutter' (+0000000000), 'Ma.LengthCou.Cut' (+0000000001), 'Act. Len.(incr.)' (+0000000000), 'Act. Length (LU)' (+0000000000), 'Act. Length Err.' (+0000000000), 'Act.Len.Err.(LU)' (+0000000000), 'Act. Printm.Err.' (+0000000000), and 'Printmark Corr.' (+0000000000). The second section lists parameters such as 'Act.Printm.Dist.' (+0000000000), 'Length Setpoint' (+0000010000), 'Next. Printm.Err.' (+0000000000), 'Printm. Corr. Trim' (+0000000000), 'Printm.Pos.Count' (+0000000001), 'Counter Feeder' (+0000000000), 'Feeder Frequency' (+0000000000), 'Pos. Error Feed.' (+0000000000), 'FF. Value Feeder' (+0000000000), 'Cor. Value Feed.' (+0000000000), 'Dancer Ana.Input' (+0000000000), 'Dancer Diff.' (+0000000000), 'Dancer Cor. Val.' (+0000000000), 'Sub State Feeder' (+0000000002), 'Cut State' (+0000000001), and 'Control State' (+0000000002). A 'Transmit Single' button is located to the right of the table.

Description	Value	Description	Value
Length Counter	+0000000001	Act.Printm.Dist.	+0000000000
Master Frequency	+0000000000	Length Setpoint	+0000010000
LineSpeed LU/min	+0000000000	Next. Printm.Err.	+0000000000
Frea.Setp.Vir.Ma	+0000000000	Printm. Corr. Trim	+0000000000
Vir.Master Freq.	+0000000000	Printm.Pos.Count	+0000000001
Cutter Position	+0000000500	Counter Feeder	+0000000000
Cutter Frequency	+0000000000	Feeder Frequency	+0000000000
Pos. Error Cut.	+0000000000	Pos. Error Feed.	+0000000000
FF. Value Cutter	+0000000000	FF. Value Feeder	+0000000000
Ma.LengthCou.Cut	+0000000001	Cor. Value Feed.	+0000000000
Act. Len.(incr.)	+0000000000	Dancer Ana.Input	+0000000000
Act. Length (LU)	+0000000000	Dancer Diff.	+0000000000
Act. Length Err.	+0000000000	Dancer Cor. Val.	+0000000000
Act.Len.Err.(LU)	+0000000000	Sub State Feeder	+0000000002
Act. Printm.Err.	+0000000000	Cut State	+0000000001
Printmark Corr.	+0000000000	Control State	+0000000002

You find a description of the actual process data values in the corresponding table of chapter 8.

## 5. Error messages

Upon detection of an error, the cutting roll remains in a closed-loop standstill position after termination of the current cut. Output "Error" switches to HIGH. Where your PC with OS50 software is online, you can read the error message at the bottom of the screen.

To clear an error state (for exceptions see below):

- Activate command "Clear Error" or
- switch off the "Control Enable" input or
- cycle the power supply of the unit

Please note that the unit will immediately return to the error state if the cause for the error has not been eliminated.

<b>Error 00: Hardware Error</b>	An error was detected when checking the internal Hardware.  This error appears in the display only but will not stop the cutting roll. It can only be reset by cycling the power supply.
<b>Error 01: Power Low</b>	The power supply voltage is too low.  This error is reset automatically when the power supply voltage recovers and exceeds the minimum power supply voltage level.
<b>Error 02: No Cutting Pulse</b>	The cutting pulse is missing.  This error will be set if no cutting pulse appears within one revolution of the cutting roll during the homing sequence or if no cutting pulse appears within the synchronous zone of the cutting cycle in normal operation.
<b>Error 03: No Home Pos.</b>	The cutting roll is not in the home position when a cutting cycle is started.  This error appears in the display only but will not stop the cutting roll.
<b>Error 04 Printmark Buffer</b>	Overflow of the print mark buffer register.  This means too many print marks have been detected between the print mark sensor and the cutting roll position.
<b>Error 05: Val. Range exceed</b>	Internal overflow error during pre-calculation of the cutting profile. This error can occur by the following reasons: <ul style="list-style-type: none"> <li>▪ The ratio between the number of line encoder pulses and the number of cutting roll encoder pulses has exceeded the permitted range (see section 2.3 "system configuration" for details).</li> <li>▪ The value of "Home switchpoint" is too high.</li> <li>▪ The synchronous zone is greater than the cutting roll circumference</li> </ul>
<b>Error 06: Cut not possible</b>	The cut is not possible because the preset cutting length is too low.
<b>Error 07: Software Error</b>	Malfunction of firmware (Unexpected state of the firmware during operation)
<b>Error 08</b>	(reserved)
<b>Error 09: Watchdog Error</b>	Malfunction of firmware (Cycle time too long during operation, software probably stuck)
<b>Error 10...14: Supply Error</b>	Internal power supply voltage out of range
<b>Error 15: Over temperature</b>	Internal temperature too high
<b>Error 16 ... 30</b>	(reserved)
<b>Error 31: Anybus Error</b>	Error of optional fieldbus interface module

## 6. Steps 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 a proper and stable operation over the full speed range. The cutting roll drive and the feeding roll drive need a maximum of dynamics and response (set ramps to zero, switch of any integral or differential component of the internal speed control loop, operate the drive with proportional speed control only, with the proportional Gain as high as possible).**

For the set-up procedure the cutting roll and the feeding roll must be able to move in both directions without any mechanical limitations.

Before you start the Adjust menu, make sure that all parameters on the required register cards are set correctly.

The Adjust Program is used to set the directions of rotation of the encoders and to adjust the feed forward signal and the Proportional Gain. Also, the screen displays the actual encoder frequency.

**Please note: For the adjustment procedure, the cutting roll drive and the feeding roll drive always use the virtual master axis as reference, independent of the input “Select Virtual Master”.**

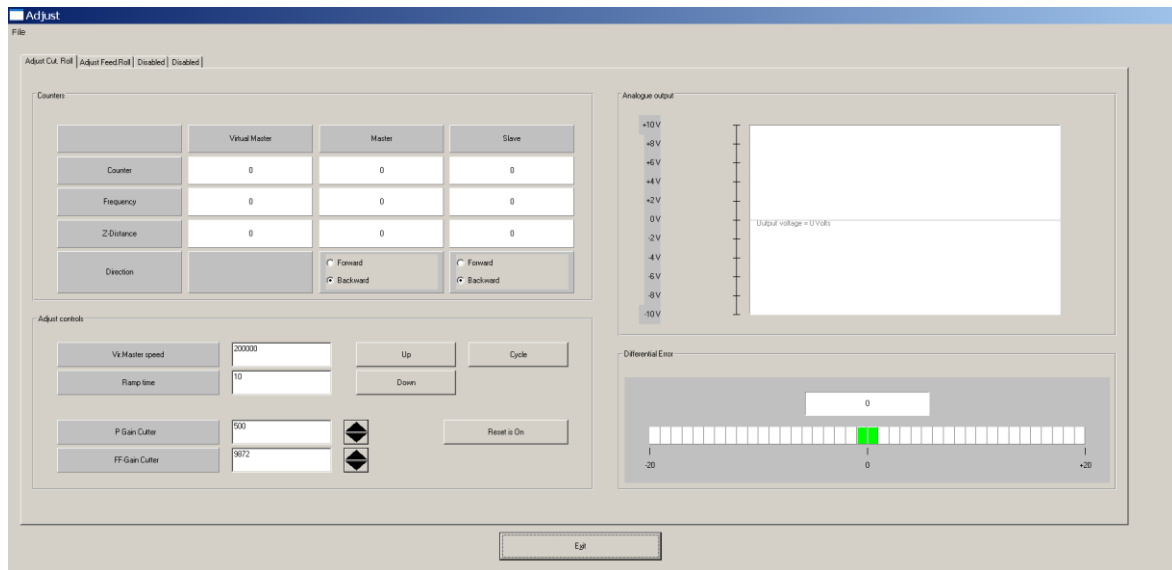
### 6.1. Preparations

Use register card “Adjust Cut. Roll” to set up the cutting roll drive and register card “Adjust Feed. Roll” to set up the feeding roll drive (all other register cards in the Adjust-menu are disabled). First do the complete set-up procedure for one axis, and then for the other axis.

The controller will generate the speed reference voltage to move the drive. For this, the following settings must be made:

The following settings must be made:

- **Vir. Master Speed:** Set the virtual speed that you would like to use for adjusting the Slaves. This setting is in LU/min. and the default value is 10% of the maximum line speed you have set before. We recommend using 50% of the maximum line speed for the 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.
- **FF-Gain:** Start with the default value of 10000.



## 6.2. Direction of Rotation

This definition must be met for the master (line encoder) and the slave (cutting roll encoder, feeding roll encoder).

### Master:

- Disable the cutting roll drive and feeding roll drive.
- Move your line encoder into **forward** direction (manually or by means of a remote speed signal to the line drive)
- Observe the counter in the **“Master”** column. It must **count up** (increment)! Where you find it counts down, please click to the unchecked direction box of the “Master” column (Forward or Reverse) to change the direction.

### Slave:

- Enable your slave drive, i. e cutting roll drive when using “Adjust Cut. Roll” or feeding roll drive when using “Adjust Feed. Roll”.
- 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 cutting roll or feeding roll, respectively: Does it move into forward direction? If it does not, the polarity of the analog speed reference is not correct or the direction setting of the drive is wrong and needs to be changed. The cutting roll or feeding roll, respectively, must run forward.
- Now observe the counter in the **“Slave”** column. It also must **count up** (increment). Where you find it counts down, please click to the other direction box (Forward or Reverse) to force it to upwards count.
- Once it counts up, click to the “Down” key to stop the drive again. The definition of direction of rotation is finished now.

**Only when both counters count up while the encoders are moving forward, the definition of the encoder directions is correct! This is essential for the correct function of the device.**

In "Adjust Cut. Roll" the window "Z-Distance" shows the number of encoder pulses between two marker pulses of the correspondent encoder:

- "Z-Distance" in the Master column shows the distance between two printmark pulses or between two Z-pulses of the line encoder (depends on setting of parameter "Index Select 1.0")
- "Z-Distance" in the Slave column shows the distance between two cutting pulses, i. e. the pulses per revolution of the cutting roll.

This provides a useful test for correct wiring of the encoder channels.

### 6.3. Tuning the feed forward signal

- Start the drive again by clicking "Up". Now switch the Reset to OFF by clicking to the Reset key showing actually "Reset 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 feed forward signal is too low. Please increase the setting of "FF-Gain" by overtyping the figures or by scrolling up with the arrow key.
  - b. The bar graph moves to the left and the counter counts down (-):  
This indicates that the feed forward signal is too high. Please decrease the setting of "FF-Gain" by overtyping the figures or by scrolling down with the arrow key.  
"Feed Forward Gain" is set correctly when the bar graph remains in its centre position and the differential counter swings around zero (e. g. +/-8)  
Hint: You can reset the differential counter to zero at any time between, by cycling the "Reset" command.

### 6.4. Setting of the proportional Gain

The setting of register "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 P 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.

**Once you have done these steps for both slaves, the cutting roll and the feeding roll, you can leave the Adjust menu by pressing the "Exit" button.**

## 6.5. Tuning the controller

Now the machine is ready for operation and you can run initial test cuts.

- Set the “Control Enable” input to HIGH to enable the controller
- Start a homing sequence by activating input “Homing”. The cutting roll performs a homing sequence and moves to the home position, which is located opposite to the centre of the synchronous zone.
- For the very first trials you should use a long length setting (“Cutting Length”) and a slow line speed.
- If you want to perform the initial test cuts without material you can use the virtual master to simulate the material line: Switch input “Select Virtual Master” ON while input “Start/Stop” is still LOW (Stop) and set the line speed to be simulated at register “Virt. Line Speed”. Then set input “Run Virtual Master” to HIGH to start the virtual master. The line simulation will work now and the feeding roll (if present) starts moving.
- Activate input “Immediate Cut” and see how the controller executes a first cutting cycle.
- Switch the Start/Stop input to HIGH. The cutting roll will wait for expiration of the length and then execute a cutting cycle
- Change over to register card “Process Data” to see actual values like the progress of the length, the virtual line speed and the position error of the cutting roll.

Observe the display of the “Position Error”. During the whole cutting cycle the position error should not exceed values like 30 and should oscillate around zero all the time. Increase the line speed step by step and continue the observations.

When you have achieved settings to keep the position error around zero at all line speeds and with all cutting length presets, there is nothing to improve.

If, despite of this, your cutting results should not satisfy you in terms of accuracy or synchronism, there are definitely mechanical problems or other external reasons outside of the control loop.

The following hints refer to improvements you can make when “Position Error” indicates unusual characteristics:

### **If the “Position Error” register shows very unstable values:**

The encoder resolution (pulses per length unit) could be much higher than the mechanical clearance of your gear tooth wheels etc.

- Reduce edge count setting from (x4) to (x2) or (x1)
- Increase the value of “Correction Divider” (see description of register “Correction Divider” for details)
- Reduce “P-Gain” setting if this eliminates the problem.



Remark: Even though "Position Error" can indicate a very unstable characteristic, your cutting accuracy and performance may be good. Then just accept this visual flaw.

**If the "Position Error" value moves up and down with the speed cycle of the cutter:**

- Try to increase the setting of register "P-Gain".
- Check for avoidable ramps and delays in your drive
- Possibly the cutter drive is not strong and dynamic enough to follow the speed profile and / or to generate enough torque at the time the tool penetrates the material
- Reduce the line speed for all length settings where you observe this problem.

Remark: This must not really affect your cutting performance. When the cutting accuracy is good, you can accept this visual flaw. Position errors will not affect the cutting accuracy, unless they occur directly during the cut and differ from cut to cut, because position errors repeating continuously from cut to cut may eliminate themselves.

**This concludes the procedure of commissioning of your rotary cutter system.** We recommend saving all parameter settings on hard disc or disc. In case of repeat applications (machine with similar specifications), or after exchange of the controller, you just need to download the settings and are immediately ready to go.

## 7. Physical Requirements and Limitations of the Cutting System

The possible range of cutting lengths depends on several mechanical and electrical parameters like roll diameter, maximum line speed, synchronous zone length, maximum speed and dynamics of the drive. There is no limitation of the cutting length from the CT803 controller within the physical range of the cutting system. This unit calculates at any time the longest ramps possible to achieve the desired cutting result.

**As soon as these ramps become so short that the drive is unable to follow the ramps due to deficiency of dynamics, the cutting system runs to its physical limit.**

The subsequent formulae should help you to design and to optimize the layout of your cutting system or to calculate what cutting lengths are possible or impossible with an existing machine.

The following abbreviations are used:

$U_{sync}$	Circumference of the cutting roll (in mm)
$v_0$	Maximum line speed (in mm per sec.)
$l_{sync}$	Length of the synchronous zone (in mm)
$t_L$	Shortest time the drive needs to accelerate the cutting roll from standstill to line speed or to decelerate the cutting roll from line speed to standstill (in sec.)
$t_H$	Shortest time the drive needs to accelerate the cutting roll from line speed to eight times line speed or to decelerate the cutting roll from eight times line speed to standstill (in sec.)
$L$	Preset cutting length (in mm)
$L_{min}$	Shortest cutting length possible (in mm)
$L_{max}$	Longest cutting length possible (in mm)
$t_1, t_2, L_1, L_2$	Reference values for calculation

For the calculations it is assumed that the cutter drive could run eight times faster than line speed ( $V_{max} / V_{line} = 8$ ). In situations where the cutting roll can only run lower maximum speeds, the required acceleration and deceleration times are lower, and the shortest possible cutting length is greater than given by the formulae.

## 7.1. Dynamic Requirements of the Cutting Roll Drive

The subsequent formulae show what the drive must be able to execute in terms of acceleration and deceleration time, when the cutting parameters are specified.

On principle, the drive must fulfill the following requirement, regardless of the cutting length:

$$t_L = \frac{U - I_{sync}}{v_0}$$

To differ between the different types of the cutting profile, it is necessary to calculate two reference length values:

$$L_1 = \frac{2U + 7I_{sync}}{9}$$

$$L_2 = 2U - I_{sync}$$

For all cutting lengths  $L \geq U$  only  $t_L$  as calculated above is required, there are no more additional requirements

If  $L \geq L_2$  the cutting roll comes to a standstill during the cutting profile.

The cutting length has no upper limit.

If  $L \leq L_1$  the cutting roll reaches its maximum speed during the cutting profile and you get:

$$t_H = \frac{8L - 7I_{sync} - U}{7v_0}$$

For all other cutting lengths  $L_1 < L < U$  you get:

$$t_H = \frac{7(L - I_{sync})^2}{4v_0(U - L)}$$

## 7.2. The Shortest Length Possible

The shortest length possible to cut depends, among other things, on the maximum speed of the cutting roll in comparison to the line speed. Again it is assumed that the cutter drive can run eight times faster than line speed ( $V_{max} / V_{line} = 8$ ). In situations where the cutter can only run lower maximum speeds, the shortest possible cutting length is greater than given by the formulae.

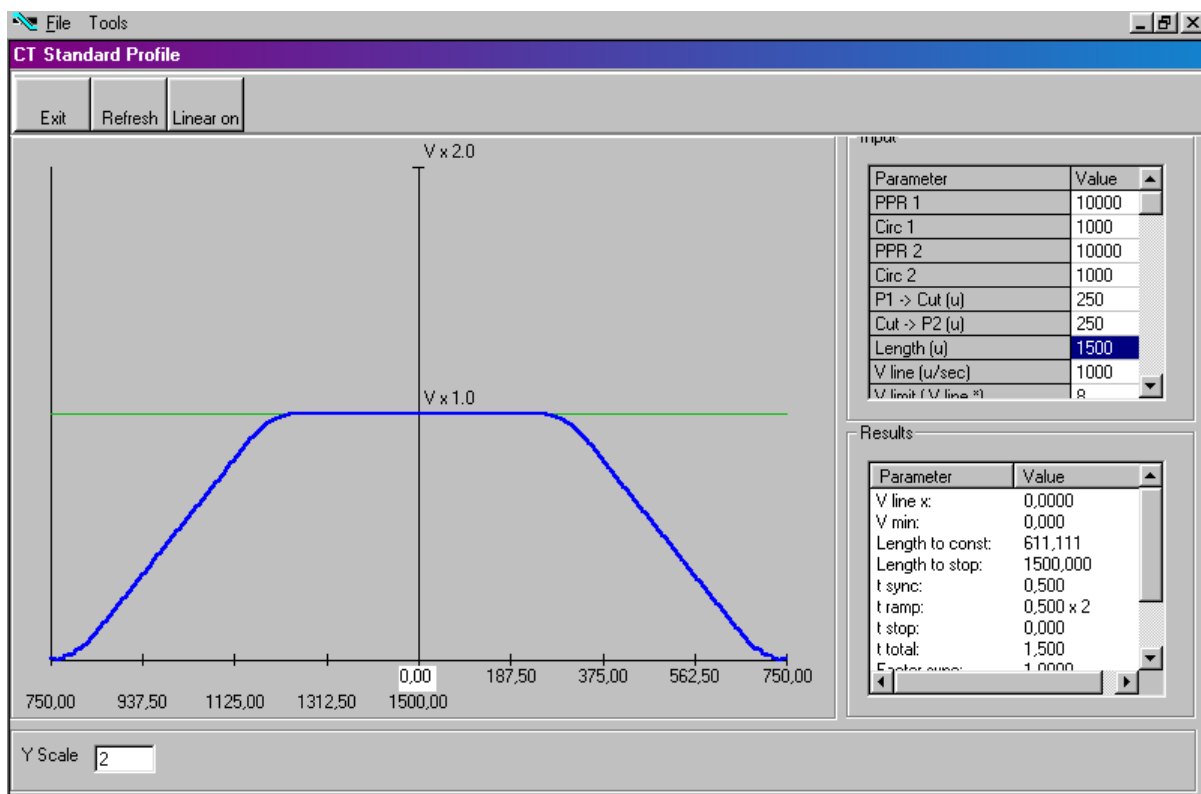
First you must calculate the reference time  $t_1$  :

$$t_1 = \frac{U - I_{sync}}{9 v_0}$$

If  $t_H \leq t_1$  : 
$$L_{min} = \frac{7(I_{sync} + v_0 t_H) + U}{8}$$

If  $t_H > t_1$  : 
$$L_{min} = I_{sync} - \frac{2}{7} v_0 t_H + \frac{2}{7} \sqrt{v_0^2 t_H^2 + 7(U - I_{sync}) v_0 t_H}$$

For calculation and display of speed profiles of the cutting roll, based on customer-programmable cutting parameters, motrona offers the users special PC software, suitable for easy judgment of demands and limits of rotating cutter systems.



## 8. Parameter Tables

General Parameters							
#	Name	Unit	Serial Code		Minimum	Maximum	Default
			(Hex)	(Dec)			
1	Cutting Length	Length units	0000	0	1	999999	10000
2	Test Cut. Length	Length units	0001	1	1	999999	10000
3	Virt. Line Speed	Length units/min.	0002	2	0	9999999	10000
4	(reserved)		0003	3	-999999	+999999	0
5	(Parameter 04)		0004	4	0	0	
...	...		...	...			
32	(Parameter 31)		001F	31	0	0	0

Parameter Blocks							
Master Settings							
#	Name	Unit	Serial Code		Minimum	Maximum	Default
			(Hex)	(Dec)			
33	Circ. Master	Length units	0100	256	1	99999	1000
34	PPR Master	Incr.	0101	257	1	999999	1000
35	(Parameter 02)		0102	258	0	0	0
36	(Parameter 03)		0103	259	0	0	0
37	Ramp Vir. Master		0104	260	0	999	1
38	(Parameter 05)		0105	261	0	0	0
...	...		...	...			
64	(Parameter 31)		011F	287	0	0	0

# = Consecutive register number for access via optional fieldbus interface

Subcodes for serial communication are always 0.

Cutter Settings							
#	Name	Unit	Serial Code		Minimum	Maximum	Default
			(Hex)	(Dec)			
65	Circ Cutter	Length units	0120	288	1	99999	1000
66	PPR Cutter	Incr.	0121	289	1	999999	1000
67	Trim Time Cutter	Ms	0122	290	1	999	100
68	Sync Before Cut	Length units	0123	291	0	9999	10
69	Sync After Cut	Length units	0124	292	0	9999	10
70	Cuts per Rev.		0125	293	1	99	1
71	V max / V linie		0126	294	2	8	8
72	(reserved)		0127	295	0	3	0
73	+ / - Sync. Rate	%	0128	296	-99.99	+99.99	00.00
74	Ramp Form		0129	297	0	1	0
75	Cutting Mode		012A	298	1	2	1
76	Marks per Length		012B	299	1	99	1
77	Photocell -> Cut	Length units	012C	300	1	999999	1000
78	Printmark Offset	Length units	012D	301	-9999	+9999	0
79	Max. Printm. Corr.	Length units	012E	302	1	9999	9999
80	Photocell Delay	ms	012F	303	0.0	500.0	0
81	Printmark Window	Length units	0130	304	0	9999	0
82	Missing Printmarks		0131	305	0	99	0
83	Length Correction		0132	306	0	5	0
84	Length Tolerance	Length units	0133	307	0	999	0
85	Gap Length	Length units	0134	308	0	9999	0
86	Cut. Pulse Offset	Incr.	0135	309	-999999	999999	0
87	Pm.Cor.Deadband	Incr.	0136	310	0	999	0
88	Pm.Cor.Prog.Trim		0137	311	0	9	0
89	Pm.Cor.Max.Trim	Incr.	0138	312	1	999	100
90	(Parameter 25)		0139	313	0	0	0
...	...		...	...			
96	(Parameter 31)		013F	319	0	0	0

Control Loop Settings							
#	Name	Unit	Serial Code		Minimum	Maximum	Default
			(Hex)	(Dec)			
97	P Gain Cutter		0140	320	0	9999	1000
98	Corr. Divi. Cut		0141	321	1	9	1
99	Max. Corr. Cut	mV	0142	322	1	9999	9999
100	Max. Line Speed	Len. Units/min.	0143	323	1	9999999	100000
101	P Gain Speed prop.		0144	324	0	1	0
102	P Gain Max Speed		0145	325	0	9999	1000
103	Application Mode		0146	326	0	1	1
104	Thickness Mode		0147	327	0	2	0
105	Startpos.Thickn.	Incr.	0148	328	0	999999	100
106	Endpos.Thickness	Incr.	0149	329	0	999999	900
107	(Parameter 10)		014A	330	0	0	0
...	...		...	...			
128	(Parameter 31)		015F	351	0	0	0

Jog / Home Settings							
#	Name	Unit	Serial Code		Minimum	Maximum	Default
			(Hex)	(Dec)			
129	Jog Speed	%	0160	352	0.1	100.0	10.0
130	Jog Ramp	s	0161	353	0	99	1
131	Home Speed High	%	0162	354	0.1	100.0	10.0
132	Home Speed Low	%	0163	355	0.1	100.0	5.0
133	Home Ramp	s	0164	356	0	99	1
134	Home Switchpoint	Length units	0165	357	1	99999	100
135	Home Window	Length units	0166	358	1	999	10
136	(Parameter 07)		0167	359	0	0	0
...	...		...	...			
160	(Parameter 31)		017F	383	0	0	0

Monitoring Settings							
#	Name	Unit	Serial Code		Minimum	Maximum	Default
			(Hex)	(Dec)			
161	Zero Speed Master	Len. Units/min.	0180	384	0	999999	0
162	Zero Speed Vir. Ma.	Len. Units/min.	0181	385	0	999999	0
163	(Parameter 02)		0182	386	0	0	0
164	Cut.Pulse Monit.		0183	387	0	2	1
165	Cut Tolerance	Length units	0184	388	0	99999	10
166	Alarm Cut. Roll	Incr.	0185	389	0	32000	100
167	Mast.Rev.Limit	Length units	0186	390	0	999999	0
168	Sel.Diag.Ana.Out		0187	391	0	31	0
169	Alarm Feed. Roll	Incr.	0188	392	0	32000	100
170	(Parameter 09)		0189	393	0	0	0
...	...		...	...			
176	(Parameter 15)		018F	399	0	0	0
177	Batch Counter		0190	400	0	999999999	0
178	Waste Counter		0191	401	0	999999999	0
179	(Parameter 18)		0192	402	0	0	0
...	...		...	...			
192	(Parameter 31)		019F	415	0	0	0



Feeding Roll Settings							
#	Name	Unit	Serial Code		Minimum	Maximum	Default
			(Hex)	(Dec)			
225	Circ. Feeder		01C0	448	0	99999	1000
226	PPR Feeder		01C1	449	0	999999	1000
227	P Gain Feeder		01C2	450	0	9999	1000
228	I Time Feeder		01C3	451	0	1.000	0
229	Trim Time Feeder		01C4	452	1	999	100
230	Cor. Divi. Feeder		01C5	453	1	9	1
231	Max. Corr. Feeder		01C6	454	0	9999	9999
232	Ramp Time Feeder		01C7	455	0	999	1
233	(Parameter 08)		01C8	456	0	0	0
...	...		...	...			
240	(Parameter 15)		01CF	463	0	0	0
241	Dancer Mode		01D0	464	0	2	0
242	Dancer Ana. Inp.		01D1	465	1	2	1
243	Dancer P Gain		01D2	466	0	9999	1000
244	Dancer I Time		01D3	467	0	1.000	0
245	Dancer Window		01D4	468	0	100.0	0
246	Dancer Offset		01D5	469	-100.0	100.0	0
247	Dancer Alarm		01D6	470	-100.0	100.0	10.0
248	Dancer Max. Corr.		01D7	471	1	9999	9999
249	(Parameter 24)		01D8	472	0	0	0
	...		...	...			
256	(Parameter 31)		01DF	479	0	0	0

Control I/O Settings							
#	Name	Unit	Serial Code		Minimum	Maximum	Default
			(Hex)	(Dec)			
385	FASTIN1 PNP/NPN		0260	608	0	1	0
386	FASTIN2 PNP/NPN		0261	609	0	1	0
387	FASTIN3 PNP/NPN		0262	610	0	1	0
388	FASTIN4 PNP/NPN		0263	611	0	1	0
389	FASTIN1 Function		0264	612	1	1	1
390	FASTIN2 Function		0265	613	2	2	2
391	FASTIN3 Function		0266	614	0	30	3
392	FASTIN4 Function		0267	615	0	30	4
393	CTRLIN1 Function		0268	616	0	30	5
394	CTRLIN2 Function		0269	617	0	30	6
395	CTRLIN3 Function		026A	618	0	30	7
396	CTRLIN4 Function		026B	619	0	30	8
397	(Parameter 12)		026C	620	0	0	0
398	(Parameter 13)		026D	621	0	0	0
399	(Parameter 14)		026E	622	0	0	0
400	(Parameter 15)		026F	623	0	0	0
401	CTRLOUT1 Functn.		0270	624	0	32	1
402	CTRLOUT2 Functn.		0271	625	0	32	2
403	CTRLOUT3 Functn.		0272	626	0	32	3
404	CTRLOUT4 Functn.		0273	627	0	32	4
405	FASTOUT1 Functn.		0274	628	0	32	5
406	FASTOUT2 Functn.		0275	629	0	32	6
407	FASTOUT3 Functn.		0276	630	0	32	7
408	(Parameter 23)		0277	631	0	0	0
...	...		...	...			
416	(Parameter 31)		027F	639	0	0	0

Counter Settings							
#	Name	Unit	Serial Code		Minimum	Maximum	Default
			(Hex)	(Dec)			
417	Dir. Counter 0		0280	640	0	1	0
418	Edge Counter 0		0281	641	0	2	0
419	Samp. Counter 0	s	0282	642	0.0001	9.9999	0.0010
420	Dir. Counter 1		0283	643	0	1	0
421	Edge Counter 1		0284	644	0	2	0
422	Samp. Counter 1	s	0285	645	0.0001	9.9999	0.0010
423	Dir. Counter 2		0286	646	0	1	0
424	Edge Counter 2		0287	647	0	2	0
425	Samp. Counter 2	s	0288	648	0.0001	9.9999	0.0010
426	Dir. Counter 3		0289	649	0	1	0
427	Edge Counter 3		028A	650	0	2	0
428	(Reserved)		028B	651	0	0	0
429	Dir. Counter 4		028C	652	0	1	0
430	Edge Counter 4		028D	653	0	2	0
431	Samp. Counter 4	s	028E	654	0.0001	9.9999	0.0010
432	(Parameter 15)		028F	655	0	0	0
433	Counter Select 0		0290	656	0	1	0
434	Counter Select 1		0291	657	0	1	0
435	Counter Select 2		0292	658	0	1	0
436	Index Select 0.0		0293	659	0	3	0
437	Index Select 1.0		0294	660	0	1	0
438	Index Select 1.1		0295	661	0	3	0
439	Index Select 2.0		0296	662	0	1	0
440	Index Select 2.1		0297	663	0	3	0
441	Index Select 3.0		0298	664	0	3	0
442	Index Select 3.1		0299	665	0	1	0
443	(Parameter 26)		029A	666	0	0	0
...	...		...	...			
448	(Parameter 31)		029F	671	0	0	0

Encoder Settings							
#	Name	Unit	Serial Code		Minimum	Maximum	Default
			(Hex)	(Dec)			
449	Enc2 Diff/Single		02A0	672	0	1	0
450	Enc2 Single TTL		02A1	673	0	1	0
451	Enc3 RS422/SSI		02A2	674	0	1	0
452	Enc3 SSI Baud		02A3	675	0	3	0
453	Enc3 SSI Bit		02A4	676	8	32	32
454	Enc3 SSI Format		02A5	677	0	1	1
455	Enc3 SSI Dir.		02A6	678	0	1	0
456	Enc3 SSI MSB		02A7	679	2	32	25
457	Enc3 SSI LSB		02A8	680	1	31	01
458	Enc3 SSI Err-Bit		02A9	681	0	32	0
459	Enc3 SSI Err-Pol		02AA	682	0	1	0
460	Enc5 Diff/Single		02AB	683	0	1	0
461	Enc5 Single TTL		02AC	684	0	1	0
462	Enc6 RS422/SSI		02AD	685	0	1	0
463	Enc6 SSI Baud		02AE	686	0	3	0
464	Enc6 SSI Bit		02AF	687	8	32	32
465	Enc6 SSI Format		02B0	688	0	1	1
466	Enc6 SSI Dir.		02B1	689	0	1	0
467	Enc6 SSI MSB		02B2	690	2	32	25
468	Enc6 SSI LSB		02B3	691	1	31	01
469	Enc6 SSI Err-Bit		02B4	692	0	32	0
470	Enc6 SSI Err-Pol		02B5	693	0	1	0
471	(Parameter 22)		02B6	694	0	0	0
...	...		...	...			
480	(Parameter 31)		02BF	703	0	0	0

Communication Settings							
#	Name	Unit	Serial Code		Minimum	Maximum	Default
			(Hex)	(Dec)			
481	(reserved)		02C0	704	001	127	001
	...						
485	(reserved)		02C4	708	000	255	000
486	Ser Unit Address		02C5	709	11	99	11
487	Ser Baud Rate		02C6	710	0	4	2
488	Ser Data Format		02C7	711	0	9	0
489	Modbus Address		02C8	712	1	247	1
490	(Parameter 09)		02C9	713	0	0	0
...	...		...	...			
496	(Parameter 15)		02CF	719	0	0	0
497	Fieldbus Address		02D0	720	1	127	1
498	Fieldb. Baudrate		02D1	721	0	63	6
499	Fieldbus Mode		02D2	722	0	1	0
500	Transmit Data 1		02D3	723	0	594	581
501	Transmit Data 2		02D4	724	0	594	0
502	Transmit Data 3		02D5	725	0	594	0
503	Transmit Data 4		02D6	726	0	594	0
504	Receive Data 1		02D7	727	0	594	579
505	Receive Data 2		02D8	728	0	594	0
506	Receive Data 3		02D9	729	0	594	0
507	Receive Data 4		02DA	730	0	594	0
508	(Parameter 27)		02DB	731	0	0	0
...	...		...	...			
512	(Parameter 31)		02DF	735	0	0	0

Setup-Up Settings							
#	Name	Unit	Serial Code		Minimum	Maximum	Default
			(Hex)	(Dec)			
513	(Parameter 00)		02E0	736	0	0	0
514	(Parameter 01)		02E1	737	0	0	0
515	(Parameter 02)		02E2	738	0	0	0
516	(Parameter 03)		02E3	739	0	0	0
517	Ana Out1 Offset	mV	02E4	740	-9999	+9999	0
518	Ana Out1 Gain		02E5	741	0	99.999	10.000
519	Ana Out2 Offset	mV	02E6	742	-9999	+9999	0
520	Ana Out2 Gain		02E7	743	0	99.999	10.000
521	Ana In1 U Offset	mV	02E8	744	-9999	+9999	0
522	Ana In1 U Gain		02E9	745	0	99.999	10.000
523	Ana In1 I Offset	μA	02EA	746	-9999	+9999	0
524	Ana In1 I Gain		02EB	747	0	99.999	10.000
525	Ana In2 U Offset	mV	02EC	748	-9999	+9999	0
526	Ana In2 U Gain		02ED	749	0	99.999	10.000
527	Ana In2 I Offset	μA	02EE	750	-9999	+9999	0
528	Ana In2 I Gain		02EF	751	0	99.999	10.000
529	Fast Output Sel.		02F0	752	0	7	7
530	Frequency Value	Hz	02F1	753	1	500000	100000
531	Frequency Dir.		02F2	754	0	1	0
532	Index Value		02F3	755	10	65535	1024
533	(Parameter 20)		02F4	756	0	0	0
534	FF-Gain Cutter		02F5	757	0.0001	1.0000	9.9999
535	FF-Gain Feeder		02F6	758	0.0001	1.0000	9.9999
536	(Parameter 23)		02F7	759	0	0	0
	...		...	...			
539	(Parameter 26)		02FA	762	0	0	0

Process Data (Actual values)						
#	Name	No.*	Unit	Serial Code		Explanation
				(Hex)	(Dec)	
545	Length Counter	0	Incr.	0800	2048	Material length counter (line encoder)
546	Master Frequency	1	Hz	0801	2049	Actual frequency of line encoder
547	Line Speed	2	LU/min	0802	2050	Line speed
548	Freq.Setp.Vir.Ma.	3	Hz	0803	2051	Frequency setpoint of virtual master
549	Vir. Master Freq.	4	Hz	0804	2052	Actual frequency of virtual master
550	Cutter Position	5	Incr.	0805	2053	Actual position of cutting roll
551	Cutter Frequency	6	Hz	0806	2054	Actual frequency of cutting roll encoder
552	Pos. Error Cut	7	Incr.	0807	2055	Actual cutting roll position error
553	FF.Value Cutter	8	mV	0808	2056	Internal value of feed forward signal of cutting roll
554	Ma.Lenth Cou. Cut	9	Incr.	0809	2057	Material length counter from cut to cut
555	Act. Len (incr.)	10	Incr.	080A	2058	Calculated actual cutting length
556	Actual Length (LU)	11	LU	080B	2059	Calculated actual cutting length
557	Act. Length Err.	12	Incr.	080C	2060	Calculated actual cutting length error
558	Act. Len.Err.(LU)	13	LU	080D	2061	Calculated actual cutting length error
559	Act. Printm. Error	14	Incr.	080E	2062	Actual cutting error with respect to printmark
560	Printmark Corr.	15	Incr.	080F	2063	Actual correction with respect to printmark
561	Act.Printm.Dist.	16	Incr.	0810	2064	Actual measured printmark distance
562	Length setpoint	17	Incr.	0811	2065	Cutting length setpoint
563	Next Printm. Err.	18	Incr.	0812	2066	Next cutting error with respect to printmark
564	Printm.Corr.Trim	19	Incr.	0813	2067	Actual correction with respect to printmark in Cutting Mode 3
565	Printm.Pos.Count.	20	Incr.	0814	2068	Position counter for printmark window
566	Counter Feeder	21	Incr.	0815	2069	Counter for feeding roll position
567	Feeder Frequency	22	Hz	0816	2070	Actual frequency of feeding roll encoder
568	Pos. Error Feed.	23	Incr.	0817	2071	Actual feeding roll position error
569	FF. Value Feeder	24	mV	0818	2072	Internal value of feed forward signal of feeding roll
570	Cor. Value Feed.	25	mV	0819	2073	Correction signal of feeding roll
571	Dancer Ana.Input	26	mV	081A	2074	Analogue input signal from Dancer
572	Dancer Diff.	27	mV	081B	2075	Difference of actual dancer position and target position of dancer
573	Dancer Cor. Value	28	mV	081C	2076	Correction signal of dancer control
574	Sub State Feeder	29		081D	2077	Actual state of feeding roll
575	Cut State	30		081E	2078	Actual state of cutting roll
576	Control State	31		081F	2079	Actual main state of controller

\*) Used for setting of parameter "Sel.Diag.Ana.Out" in parameter block "Monitoring"

Status of Commands, Outputs and Errors				
#	Description	Serial Code		Bit No. see tables below
		(Hex)	(Dec)	
577	Hardware Inputs	0B00	2816	
578	Serial Commands	0B01	2817	
579	Fieldbus Commands	0B02	2818	
580	All Commands	0B03	2819	
581	Output Status	0B04	2820	
582	Error Status	0B05	2821	
583	(reserved)	0B06	2822	
...				
592	(reserved)	0B0F	2831	

Errors			
Error No.	Description	Bit No. of "Error Status" (Code 0B05 Hex / Register # 582)	Explanation → Chapter 4
00	Hardware Error	0	
01	Power Low	1	
02	No Cutting Pulse	2	
03	No Home Position	3	
04	Printmark Buffer Overflow	4	
05	Value Range Exceed	5	
06	Cut not possible	6	
07	Software Error	7	
08	(reserved)	8	
09	Watchdog Error	9	
10	Supply 3V3 Error	10	
11	Supply 5V0 Error	11	
12	Supply 5V2 Error	12	
13	Supply+12V Error	13	
14	Supply-12V Error	14	
15	Over temperature	15	
16	(reserved)	16	
...		...	
30	(reserved)	30	
31	Fieldbus interface module Error	31	



Input signals (Commands)					
Name of Command	Serial Code for single Command		Bit # of "Serial Commands" (Code 0B01 Hex) and "Fieldbus Commands" (Register # 579)	Hardware input (X4)	Explanation → Chapter 3.1.1
	(Hex)	(Dec)			
Printmark	–	–	–	FAST IN 1	
Cutting Pulse	–	–	–	FAST IN 2	
Immediate Cut	0902	2306	2	*	
Start / Stop	0903	2307	3	*	
Control Enable	0904	2308	4	*	
Jog / Trim fw. Cut	0905	2309	5	*	
Jog / Trim rv. Cut	0906	2310	6	*	
Homing	0907	2311	7	*	
Select Vir. Master	0908	2312	8	*	
Run Virt. Master	0909	2313	9	*	
Clear Error	090A	2314	10	*	
Cut Test-Length	090B	2315	11	*	
Teach Printmark	090C	2316	12	*	
Thickness Select	090D	2317	13	*	
Reset Diff. Cut.	090E	2318	14	*	
Reset Diff. Feed	090F	2319	15	*	
Stop Feeder	0910	2320	16	*	
Trim Forw. Feed.	0911	2321	17	*	
Trim rev. Feeder	0912	2322	18	*	
(Command 19)	0913	2323	19	*	
(Command 20)	0914	2324	20	*	
(Command 21)	0915	2325	21	*	
(Command 22)	0916	2326	22	*	
(Command 23)	0917	2327	23	*	
(Command 24)	0918	2328	24	*	
(Command 25)	0919	2329	25	*	
(Command 26)	091A	2330	26	*	
(Command 27)	091B	2331	27	–	Don't use!
Select Test Var.	091C	2332	28	–	Don't use!
Store to EEPROM	091D	2333	29	*	
Adjust Program	091E	2334	30	–	Don't use!
Test Program	091F	2335	31	–	Don't use!

\*) Function can be assigned to FAST IN 3...4 or CTRL IN 1...4

Output signals					
Name	Serial Code for single output		Bit No. of "Output Status" (Code 0B04 Hex / Register # 581)	Hardware output (X5, X6)	Explanation → Chapter 3.1.2
	(Hex)	(Dec)			
Ready	0A00	2560	0	*	
Alarm Cutter	0A01	2561	1	*	
Home	0A02	2562	2	*	
Error	0A03	2563	3	*	
Homing done	0A04	2564	4	*	
Autom. Operation	0A05	2565	5	*	
Vir. Cutting Pulse	0A06	2566	6	*	
No Printmark	0A07	2567	7	*	
Printmark teached	0A08	2568	8	*	
Printmark Window	0A09	2569	9	*	
Master in motion	0A0A	2570	10	*	
Vir. M. in motion	0A0B	2571	11	*	
Master Reverse	0A0C	2572	12	*	
Max. Corr. Cut	0A0D	2573	13	*	
Thickness Window	0A0E	2574	14	*	
Waste Cut	0A0F	2575	15	*	
Speed Control	0A10	2576	16	*	
Max. Torque	0A11	2577	17	*	
Max. Speed	0A12	2578	18	*	
Max. Accelerat.	0A13	2579	19	*	
(reserved)	0A14	2580	20	*	
Alarm Feeder	0A15	2581	21	*	
Max. Corr. Feed.	0A16	2582	22	*	
Dancer Alarm	0A17	2583	23	*	
Dancer Max. Corr.	0A18	2584	24	*	
(Output 25)	0A19	2585	25	*	
(Output 26)	0A1A	2586	26	*	
(Output 27)	0A1B	2587	27	*	
(Output 28)	0A1C	2588	28	*	
(Output 29)	0A1D	2589	29	*	
(Output 30)	0A1E	2590	30	*	
(Output 31)	0A1F	2591	31	*	

\*) Function can be assigned to CTRL OUT 1...4 or FAST OUT 1...3