

CT340 and CT641

High Performance Low Cost Controller
for Rotating Cutters and Printing Rolls



- Precision controller for Rotating Cutters and Printing Rolls
- Easy parameter setting and immediately ready to work with minimum commissioning time
- High accuracy due to high feedback frequency range (300 kHz with TTL encoders and 200 kHz with HTL encoders)
- Extremely smooth motion by optimized S-shape profiles
- High dynamic response by means of short cycle time, therefore accurate cutting results also during change of line speed
- Most compact unit including operator panel for direct access and RS232 interface for remote access
- PROFIBUS DP interface available (option)

Operating Instructions



Safety Instructions

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

Version:	Description:
CT34001a / July 12 / TJ	First edition
CT34002a / March 15 / TJ	New parameter F03.029 ... 031, new master speed display

Table of Contents

1.	Available Models	4
2.	Introduction.....	5
3.	Electrical Connections.....	6
3.1.	Power Supply	8
3.2.	Auxiliary Outputs for Encoder Supply	8
3.3.	Impulse Inputs for Incremental Encoders	8
3.4.	Control Inputs Cont.1 – Cont.4	9
3.5.	Switching Outputs K1 – K4.....	9
3.6.	Serial Interface	9
3.7.	Analogue Outputs	9
4.	Functional description	10
4.1.	Principle of operation.....	10
4.2.	System Configuration	11
5.	Keypad Operation	12
5.1.	Normal Operation	12
5.2.	General Setup Procedure	12
5.3.	Direct Fast Access to Cutting Length Setting	13
5.4.	Change of Parameter Values on the Numeric Level	14
5.5.	Code Protection against Unauthorized Keypad Access	15
5.6.	Return from the Programming Levels and Time-Out Function	15
5.7.	Reset all Parameters to Factory Default Values	15
6.	Menu Structure and Description of Parameters	16
6.1.	Summary of the Menu	16
6.2.	Description of the Parameters.....	18
7.	Description of Commands and Outputs	29
7.1.	Commands	29
7.2.	Outputs.....	31
7.3.	Display of Actual Values.....	32
7.4.	Error Messages	33
8.	Steps for Commissioning	34
8.1.	Running the Adjust menu	35
8.2.	Set Directions of Rotation	36
8.3.	Tuning the Analogue Output.....	36
8.4.	Setting of the Proportional Gain.....	37
8.5.	Tuning the controller.....	37
9.	Appendix for model CT 641	39
9.1.	Relay Outputs.....	39
9.2.	Front Thumbwheel Switches	39
10.	Specifications and Dimensions	40

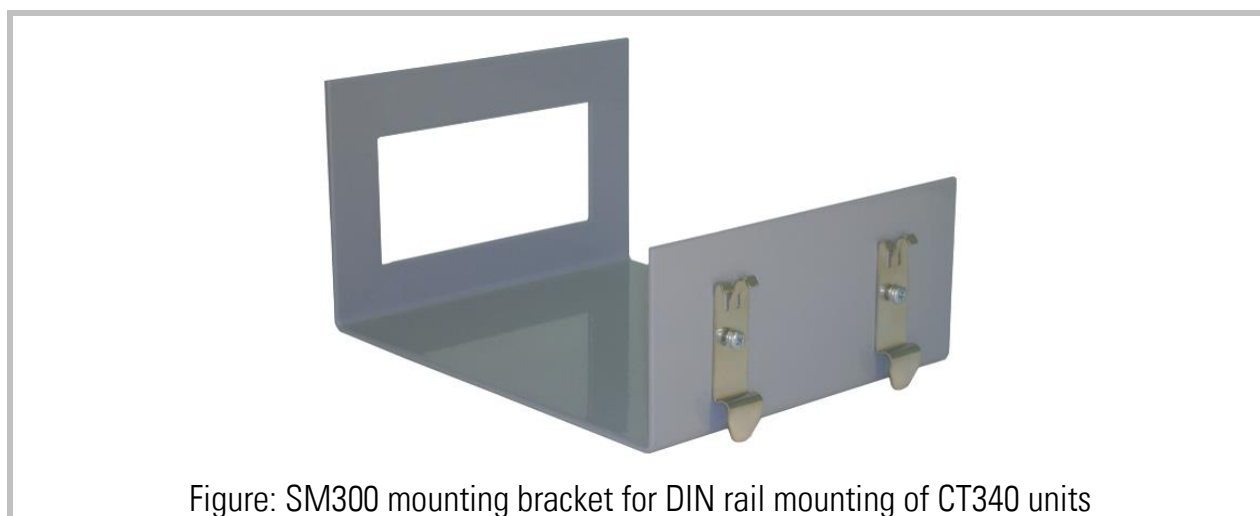
1. Available Models

The two models as shown below are available. Both models are fully similar in terms of function and performance; however there is some difference with the size, the alert outputs and the speed ratio setting.

	CT340: ▪ Front size 96 x 48 mm (3.780" x 1.890") ▪ Cutting length setting by keypad ▪ Analogue output 14 bits ▪ 4 power transistor outputs (alert)
	CT641: ▪ Front size 96 x 96 mm (3.780" x 3.780") ▪ Cutting length setting by keypad or by front thumbwheel switches ▪ Analogue output 14 bits ▪ 4 power transistor outputs (alert) ▪ and 4 relay outputs (alert)

Both models are suitable for front panel or operator desk mounting, by means of the included mounting clamps.

Where you desire to mount the units on DIN rails inside a cabinet, please refer to the mounting brackets type SM 300 and SM 600 available as accessories.



2. Introduction

The CT340 / CT641 units are suitable for control of rotating cutter systems, partial printing screens and rotating punching or sealing applications.

The CT340 / CT641 units have 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.

The units are very easy to set up. All settings can be made either by keypad and display at the unit or by PC, with use of the motrona operator software OS3.2.

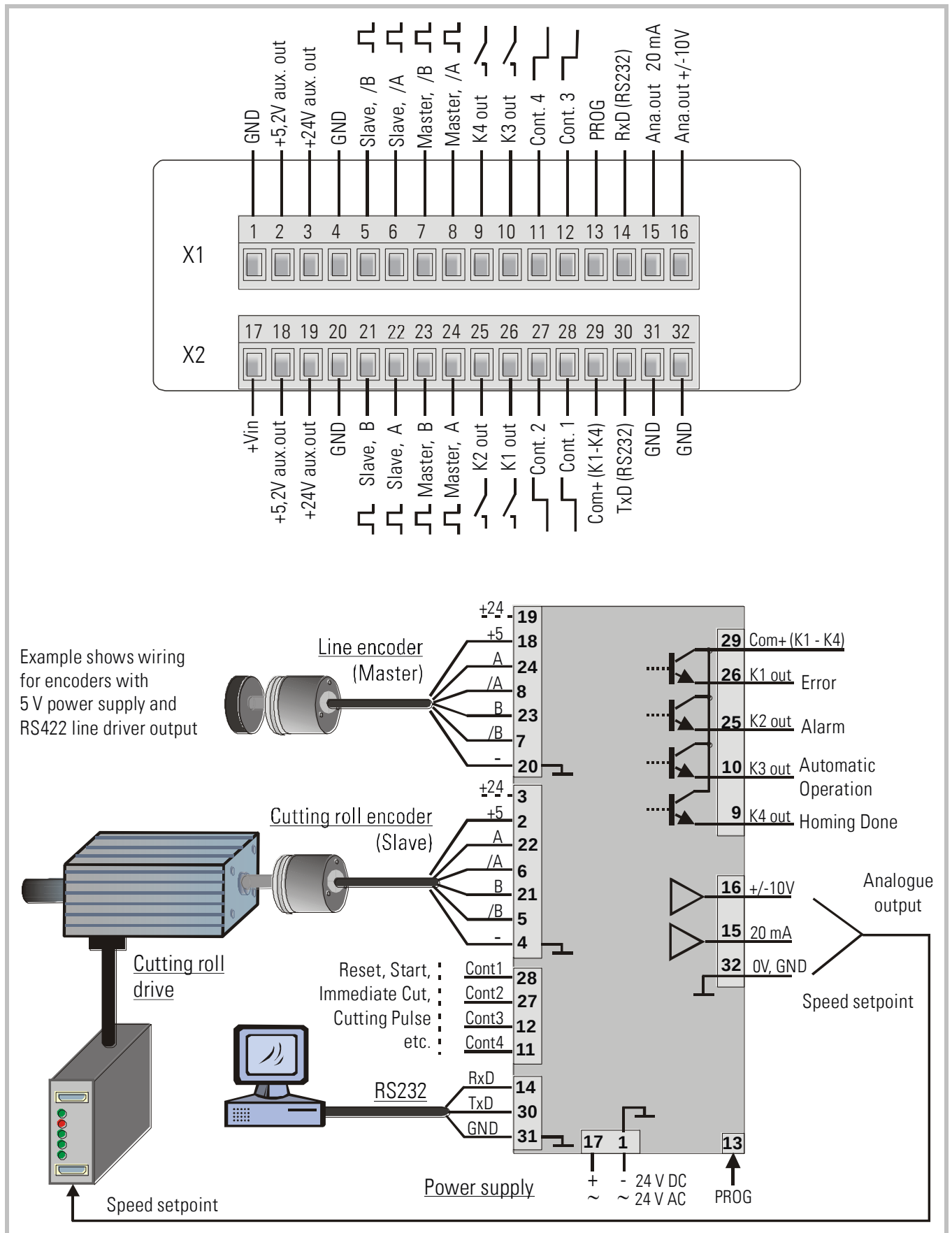
All relevant operational parameters and variables are accessible by RS232/RS485 interface. For PROFIBUS applications, our PB251 gateway is available. Therefore the user has multiple possibilities for remote control of all batch and cutting parameters via operator terminals, PC or PLC systems.

The units are suitable for control of cutting applications as well as for partial printing screens and rotating punching or sealing applications. This manual always says "cutting" or "cut" and the reader may replace this by "printing", "punching" or "sealing" when applicable.



- This manual first provides all basic instructions for operation of model CT340
- For operation of relays and thumbwheels with model CT 641 see appendix
- For PC setup our "OS32" software is available on the CD included to delivery, or on our homepage www.motrona.com
- For communication by PLC or IPC or by a remote operator terminal, please observe the serial protocol details described in our separate manual "Serpro".
- PROFIBUS communication is possible with use of our gateway PB251.

3. Electrical Connections



Terminal	Name	Function
01	GND	Common Ground Potential (0V)
02	+5,2V out	Aux. output 5.2V/150 mA for encoder supply
03	+24V out	Aux. output 24V/120 mA for encoder supply
04	GND	Common Ground Potential (0V)
05	Slave, /B	Cutting roll encoder, channel /B (B inverted)
06	Slave, /A	Cutting roll encoder, channel /A (A inverted)
07	Master, /B	Line encoder, channel /B (B inverted)
08	Master, /A	Line encoder, channel /A (A inverted)
09	K4 out	Digital output K4, transistor PNP 30 volts, 350 mA
10	K3 out	Digital output K3, transistor PNP 30 volts, 350 mA
11	Cont.4	Programmable control input
12	Cont.3	Programmable control input
13	(PROG)	(for download of new firmware only, not for general use)
14	RxD	Serial RS232 interface, input (Receive Data)
15	Ana.out 20 mA	Analogue output 0 – 20 mA (Slave speed reference) **)
16	Ana.out +/-10V	Analogue output -10V ... 0 ... +10V (Slave speed reference) **)
17	+Vin	Power supply input, +17 – 40 VDC or 24 VAC
18	+5,2V out	Aux. output 5,2V/150 mA for encoder supply
19	+24V out	Aux. output 24V/120 mA for encoder supply
20	GND	Common Ground Potential (0V)
21	Slave, B	Cutting roll encoder, channel B (non-inverted)
22	Slave, A	Cutting roll encoder, channel A (non-inverted)
23	Master, B	Line encoder, channel B (non-inverted)
24	Master, A	Line encoder, channel A (non-inverted)
25	K2 out	Digital output K2, transistor PNP 30 volts, 350 mA
26	K1 out	Digital output K1, transistor PNP 30 volts, 350 mA
27	Cont.2	Programmable control input
28	Cont.1	Programmable control input
29	Com+ (K1-K4)	Common positive input for transistor outputs K1-K4
30	TxD	Serial RS232 interface, output (Transmit Data)
31	GND	Common Ground Potential (0V)
32	GND	Common Ground Potential (0V) for DC or AC power supply

*) 120 mA and 150 mA are per encoder, i.e. total maximum currents are 240 mA and 300 mA

**) In general, the voltage output terminal 16 should be used for the slave speed signal

3.1. Power Supply

The CT340 synchronizer accepts both, a 17 – 40 volts DC power or a 24 volts AC power for supply via terminals 17 and 1. The current consumption depends on the level of the input voltage and some internal conditions; therefore it can vary in a range from 100 – 200 mA (auxiliary currents taken from the unit for encoder supply not included).

3.2. Auxiliary Outputs for Encoder Supply

Terminals 2 and 18 provide an auxiliary output with approx. +5.2 volts DC (300 mA totally).
Terminals 3 and 19 provide an auxiliary output with approx. +24 volts DC (240 mA totally)

3.3. Impulse Inputs for Incremental Encoders

All input characteristics of the impulse inputs can be set by the parameter menu, for each of the encoders separately. The unit works with quadrature information (A / B, 90°) only. In theory, any of the following encoder characteristics would be applicable:

- Symmetric differential signals according to RS422 standard, however 1V min. as differential voltage.
- TTL inputs at a level of 3.0 to 5 volts (differential, with inverted signal)
- TTL inputs at a level of 3.0 to 5 volts (single-ended) *)
- HTL signals at a 10 – 30 volts level
(alternatively differential A, /A, B, /B, or single-ended A, B only)
- Impulses from photocells or proximity switches etc. providing a HTL level (10 – 30 volts)
- Proximity switches according to NAMUR (2-wire) standard
(may need additional remote resistor)

*) requires special settings of the threshold parameters, see "Special parameters F08"



- For trouble-free operation it is mandatory to use quadrature encoders with channels A and B or with channels A, /A, and B, /B (90° phase displacement).
- Where the impulse level is HTL (10 – 30 volts) you can use either single-ended signals (A and B only) or differential signals (A, /A, B, /B)
- Where the impulse level is TTL or RS422, it is strictly recommended to use symmetric differential signals (with inverted channels /A and /B).
Under industrial environment conditions, single-ended TTL signals may cause serious problems due to insufficient EMC immunity of the signal lines
- All encoder input lines are internally terminated by pull-down resistors (8.5 kΩ). Where encoders with pure NPN outputs are used, corresponding pull-up resistors must be available inside the encoder or externally to ensure proper function (1 kΩ ... 3.3 kΩ).

3.4. Control Inputs Cont.1 – Cont.4

These inputs can be configured for remote functions like Reset, Start, Cutting Pulse, Immediate cut or display selection purpose.

All control inputs require HTL level. They can be individually set to either NPN (switch to -) or PNP (switch to +) characteristics. For applications where edge-triggered action is needed, the menu allows to set the active edge (rising or falling). The Control inputs will also accept signals with Namur (2-wire) standard.



For reliable operation of the Control Inputs a minimum impulse duration of 50 μ s must be ensured. Especially when using the Z marker pulse of a HTL encoder as cutting pulse, please verify that this minimum duration can be kept even with maximum speed of the machine

3.5. Switching Outputs K1 – K4

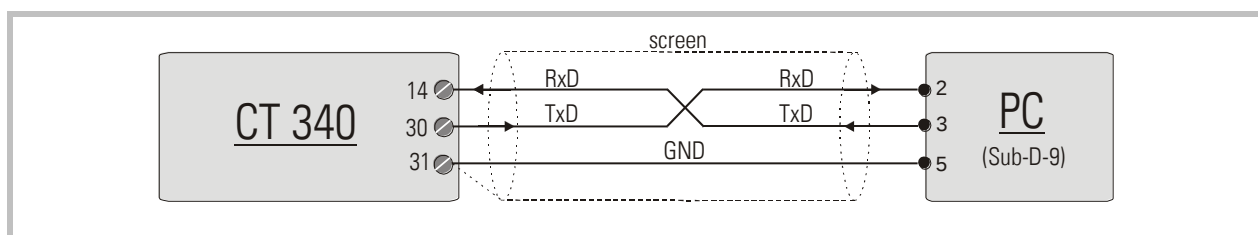
CT340 provides four digital outputs to signal control states like Homing Done, Alarm or Error. K1 – K4 are fast-switching and short-circuit-proof transistor outputs with a switching capability of 5 – 30 volts / 350 mA each. The switching voltage of the outputs must be applied remotely to the Com+ input (terminal 29)

3.6. Serial Interface

The serial RS232 interface can be used for the following purposes:

- Set-up of the unit by PC with use of the OS32 PC software
- Remote change of parameters during operation
- Remote readout of actual values by PLC or PC

The figure below explains the connection between the CT340 unit and a PC using the standard Sub-D-9 serial connector



For details of the serial communication protocol, please refer to the special "Serpro" manual.

3.7. Analogue Outputs

The unit provides a voltage output of +/- 10 volts (load = 3 mA), and a current output of 0 – 20 mA (load = 0 – 270 Ohms), both at a resolution of 14 bits (13 bits + sign).

With most standard applications the voltage output is used as a speed reference signal, connected to the speed input of the cutting roll drive.

4. Functional description

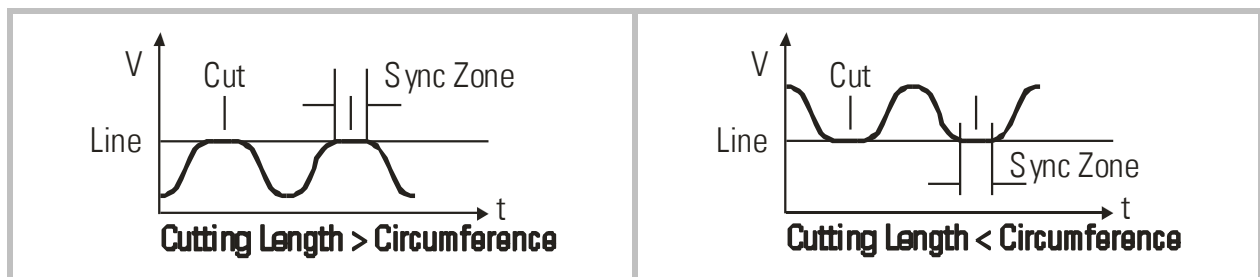
4.1. Principle of operation

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 CT340 and CT641 controllers use 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 CT340 / CT641 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.

4.2. System Configuration

As a master drive, either the motor of a feed roll or a measuring wheel equipped with an incremental encoder is used.

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

At maximum line speed, the master encoder frequency should be at least about 1 kHz, for best resolution of the analogue output. Moreover, the input frequency must not exceed the maximum level of 300 kHz (RS422 and TTL differential encoder) or 200 KHz (HTL and TTL single-ended encoders).

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

5:1 ... 1:1 ... 1:5

Mismatching beyond 1:16 and 16:1 are not allowed. Where applicable, the (x1), (x2) or (x4) hardware multiplication of the Master channel or the Slave channel may be used to adapt the frequencies

The line encoder must be connected to input $\square$ 1 (Master) and the cutting roll encoder to input $\square$ 2 (Slave).

For speed reference of the cutting roll drive the analogue output is used.

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 it is an HTL encoder and if the encoder is fitted directly to the cutting roll with no gear ratio between.



- **Please observe the minimum duration of 50 μ s for the cutting pulse!**

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 CT340 and CT641 will generate the ramps which the drive has to follow with no additional delay

Two inputs "Jog / Trim" 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.

5. Keypad Operation

An overview of all parameters and explanations can be found under section 7.

The menu of the unit uses four keys, hereinafter named as follows:

			
PROG	UP	DOWN	ENTER

Key functions depend on the actual operating state of the unit. Essentially we have to describe three basic states:

- Normal operation
- General setup procedure
- Direct fast access to scaling factors

5.1. Normal Operation

In this mode the unit operates to the settings defined upon setup. All front keys may have customer-defined functions according to the specifications met in the keypad definition menu F06 (e.g. Display scroll, Immediate Cut or else)

5.2. General Setup Procedure

The unit changes over from normal operation to setup level when keeping the  key down for at least 2 seconds. Thereafter you can select one of the parameter groups F01 to F09.



**Setup operation is disabled while the cutting roll is within a cutting cycle.
I. e. the setup procedure cannot be started before the Start command has been released and the cutting roll has returned to its home position.**

Inside the group you can now select the desired parameter and set the value according to need. After this you can either set more parameters or return to the normal operation.

The adjoining sequence of key operations explains how to change

Parameter number 052 of group F06 from the original value of 0 to a new value of 8

Step	State	Key action		Display	Comment
00	Normal operation			Actual Error	
01			> 2 sec.	F01	Display of the Parameter group
02	Level: Parameter group		5 x	F02 ... F06	Select group # F06
03				F06.050	Confirmation of F06. The first parameter of this group is F06.050
04	Level: Parameter numbers		2 x	F06.051 ... F06.052	Select parameter 052
05				0	Parameter 052 appears in display, actual setting is 0
06	Level: Parameter values		8 x	1 8	Setting has been modified from 0 to 8
07				F06.052	Save the new setting (8)
08	Level: Parameter numbers			F06	Return to level parameter groups
09	Level: Parameter groups			Actual Error	Return to normal operation
10	Normal operation				



During the general setup procedure all control activities remain disabled. New parameter settings become active after return to normal operation only.

5.3. Direct Fast Access to Cutting Length Setting

To get to the fast access routine, please press both



and



at the same time

This will access the parameter group F01 right away. To change the cutting length setting follow the same procedure as already described above.

Besides the advantage of direct access, the fundamental difference to general setup is the following:



- Direct fast access is enabled when the cutting roll is within a cutting cycle.
- During the fast access procedure all control functions remain fully active.
- Access is limited to cutting length setting; no other parameters can be changed.

5.4. Change of Parameter Values on the Numeric Level

The numeric range of the parameters is up to 6 digits. Some of the parameters may also include a sign. For fast and easy setting of these values the menu uses an algorithm as shown subsequently. During this operation the front keys have the following functions:

			
PROG	UP	DOWN	ENTER
Saves the actual value shown in the display and returns to the parameter selection level	Increments the highlighted (blinking) digit	Decrements the highlighted (blinking) digit	Shifts the cursor (blinking digit) one position to the left, or from utmost left to right

With signed parameters the left digit scrolls from **0 to 9** and then shows “-” (negative) and “-1” (minus one). The example below shows how to change a parameter from the actual setting of 1024 to the new setting of 250 000.

This example assumes that you have already selected the parameter group and the parameter number, and that you actually read the parameter value in the display.

Highlighted digits appear on colored background.

Step	Display	Key action		Comment
00	001024			Display of actual parameter setting, last digit is highlighted
01			4 x	Scroll last digit down to 0
02	001020			Shift cursor to left
03	001020		2 x	Scroll highlighted digit down to 0
04	001000		2 x	Shift cursor 2 positions left
05	001000			Scroll highlighted digit down to 0
06	000000			Shift cursor left
07	000000		5 x	Scroll highlighted digit up to 5
08	050000			Shift cursor left
09	050000		2 x	Scroll highlighted digit up to 2
10	250000			Save new setting and return to the parameter number level

5.5. Code Protection against Unauthorized Keypad Access

Parameter group F09 allows to define an own locking code for each of the parameter menus. This permits to limit access to certain parameter groups to specific persons only.

When accessing a protected parameter group, the display will first show "CODE" and wait for your entry. To continue keypad operations you must now enter the code which you have stored before, otherwise the unit will return to normal operation again.

After entering your code, press the ENTER key and keep it down until the unit responds. When your code was correct, the response will be "YES" and the menu will work normally. With incorrect code the response will be "NO" and the menu remains locked.

5.6. Return from the Programming Levels and Time-Out Function

At any time the PROG key sets the menu one level up and finally returns to normal operation. The same step occurs automatically via the time-out function, when during a period of 10 seconds no key has been touched.

Termination of the menu by automatic time-out will not store new settings, unless they have already been stored by the PROG key after editing.

5.7. Reset all Parameters to Factory Default Values

Upon special need it may be desirable to set all parameters back to their original factory settings (e.g. because you have forgotten your access code, or by too many change of settings you have achieved a complex parameter state). Default values are indicated in the parameter tables shown later.

To reset the unit to default, please take the following steps:

- Switch power off
- Press  and  simultaneously
- Switch power on while you keep down both keys



Where you decide to take this action, please note that all parameters and settings will be lost, and that you will need to run a new setup procedure again.

6. Menu Structure and Description of Parameters

All parameters are arranged in a reasonable order of functional groups (F01 to F09)
You must only set those parameters which are really relevant for your specific application.
Unused parameters can remain as they actually are.

6.1. Summary of the Menu

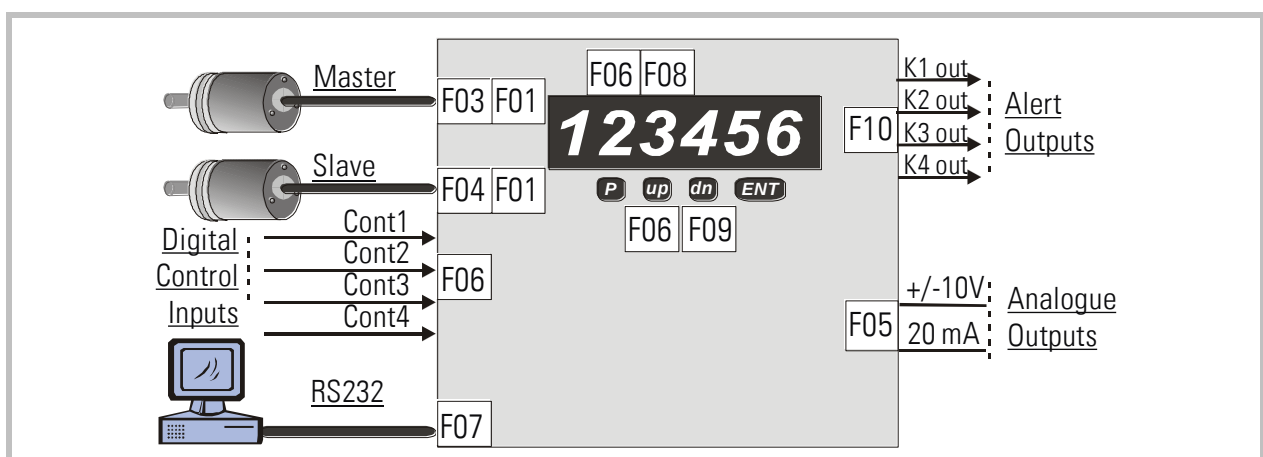
This section shows a summary of the parameter groups, with an assignment to the functional parts of the unit.

Group	Function	Group	Function
F01	Length Setting	F03	Definitions for the Master Encoder
000	Cutting Length	026	Encoder Properties
001	Reserved	027	Edge Counting
F02	Operational Setting	028	Counting Direction
002	Circ. Master	029	Speed Display Factor
003	PPR Master	030	Speed Display Divider
004	Circ. Cutter	031	Speed Display Dec.Point
005	PPR Cutter	F04	Definitions for the Slave Encoder
006	Trim Time	032	Encoder Properties
007	Correction Divider	033	Edge Counting
008	Ramp Form	034	Counting Direction
009	Sync. Before Cut	035	Reserved
01	Sync. After Cut	036	Reserved
011	Sampling Time	037	Reserved
012	Wait Time	F05	Analogue Output Settings
013	Max. Master Frequency	038	Analogue Format
014	Cuts per Revolution	039	Offset Correction
015	Vmax/Vline	040	Gain Correction
016	Home Window	041	Max. Correction
017	Jog Speed	042	Offset Total
018	Jog / Home Ramp	043	Gain Total
019	Home Speed High	044	Reserved
020	Home Speed Low	045	Reserved
021	Home Switchpoint		
022	+/- Sync. Rate (%)		
023	Alarm Level		
024	Cutting Pulse Offset		
025	Reserved		

F06	Command Assignment
046	Key Up Function
047	Key Down Function
048	Key Enter Function
049	Input 1 Configuration
050	Input 1 Function
051	Input 2 Configuration
052	Input 2 Function
053	Input 3 Configuration
054	Input 3 Function
055	Input 4 Configuration
056	Input 4 Function
057	Reserved
F07	Serial communication
058	Unit Number
059	Serial Baud Rate
060	Serial Format
061	Reserved
062	Reserved
063	Reserved
F08	Special functions
064	Input Filter
065	Trigger Threshold 1
066	Trigger Threshold 2
067	Brightness
068	Frequency Control
069	Length Store Configuration
070	Display Time
071	Default Display

F09	Keypad protection codes
072	Protect Group F01
073	Protect Group F02
074	Protect Group F03
075	Protect Group F04
076	Protect Group F05
077	Protect Group F06
078	Protect Group F07
079	Protect Group F08
080	Protect Group F09
081	Reserved
082	Reserved
083	Reserved
084	Reserved
085	Reserved
086	Reserved
087	Reserved

The following schematics shows how in principle the parameter blocks are assigned to the various elements and functions of the controller.



6.2. Description of the Parameters

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.

6.2.1. Length Setting

F01		Range	Default
F01.000	Cutting Length: Preset of the desired cutting length scaled in length units.	1 ... 999999	10000

6.2.2. Operational Settings

F02		Range	Default
F02.002	Circ. Master: 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.	1 ... 99999	1000
F02.003	PPR Master: 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).	1 ... 999999	1000
F02.004	Circ. Cutter: Circumference of the cutting roll scaled in length units.	1 ... 99999	1000
F02.005	PPR Cutter: 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).	1 ... 999999	1000
F02.006	Trim Time: Adjustment time for one increment of cut position displacement with use of the Trim function. To be entered as number of cycles (1 cycle = 250 µsec) per increment. 001 = Displacement of one increment each 250 µs (fast) 999 = Displacement of one increment each 0.25 s (slow)	1 ... 999	100

F02		Range	Default
F02.007	Correction Divider: Function to provide a digital attenuation of the phase correction signal that is produced, 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 differential error count. 0 = No window, Reaction to 1 increment, no division 1 = Window +/- 1 increments, error division by 2 2 = Window +/- 2 increments, error division by 4 3 = Window +/- 4 increments, error division by 8 etc.	0 ... 9	0
F02.008	Ramp Form: Selects the shape of the ramps of the cutting roll speed profile: 0: Parabolic s-ramps (recommended in general with standard servo drives) 1: Linear ramps (recommended with less dynamic systems, e.g. DC drives) 2: sin ² shaped ramps (recommended with extremely dynamic servo systems)	0 ... 2	0
F02.009	Sync. Before Cut: This register defines, how long before the cut (edge of the virtual cutting pulse) the cutting roll must be synchronous to the line. Setting scaled in length units.	1 ... 9999	10
F02.010	Sync. After Cut: This register defines, how long after the cut (edge of the virtual cutting pulse) the cutting roll must remain synchronous before the speed profile starts to change speed. Setting scaled in length units. Sync before cut Sync after cut Line speed Cutting roll speed Cutting pulse	1 ... 9999	10

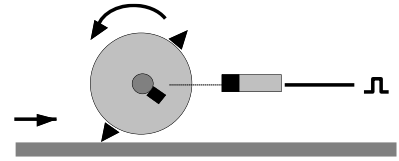
F02		Range	Default												
F02.011	Sampling Time: Sets the internal digital feed forward control with respect to dynamics and resolution. Lower set values result in faster response, but less accuracy of the feed forward signal. Higher set values result in better accuracy, but slower response with sudden speed changes. Feed forward signals with lower accuracy do not at all affect speed accuracy of the synchronizing process, but only might cause slight angular errors. Depending of the maximum Master encoder frequency, the subsequent setting can be recommended: <table><tr><th>fmax</th><th>Sampling -Time</th></tr><tr><td>1 kHz</td><td>0.100 s</td></tr><tr><td>3 kHz</td><td>0.033 s</td></tr><tr><td>10 kHz</td><td>0.010 s</td></tr><tr><td>30 kHz</td><td>0.003 s</td></tr><tr><td>≥ 100 kHz</td><td>0.001 s</td></tr></table>	fmax	Sampling -Time	1 kHz	0.100 s	3 kHz	0.033 s	10 kHz	0.010 s	30 kHz	0.003 s	≥ 100 kHz	0.001 s	0.001 ... 9.980 (seconds)	0.001
fmax	Sampling -Time														
1 kHz	0.100 s														
3 kHz	0.033 s														
10 kHz	0.010 s														
30 kHz	0.003 s														
≥ 100 kHz	0.001 s														
F02.012	Wait Time: Not applicable, leave at default setting.	0.01 ... 9.99	9.99												
F02.013	Max. Master Frequency: Sets the expected maximum input frequency on the Master encoder input, i. e. the line encoder frequency at maximum line speed. You should add a 10% reserve to the real maximum frequency. The unit will not process frequencies higher than this setting.	0.1 ... 300000.0 (Hz)	30000.0												
F02.014	Cuts per Revolution: Number of cuts per revolution of the cutting roll. Set this register to 1 when your cutting roll has only one tool at its circumference to perform one single cut per revolution. When you have mounted two or more tools around the cutting roll, there are two different ways of setting this register to perform two or more cuts by every revolution of the cutting roll:	1 ... 99	1												

- a. 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.

Example:

Two cuts per revolution but only one cutting pulse

→ "Set Cuts per Revolution" = 2



- b. If you perform several cuts per revolution of the cutting roll and each cut generates its own separate cutting pulse, then proceed as follows:
- Set register "Cuts per Revolution" to 1.
 - Do not set register "Circ. Cutter" to the real circumference of the cutting roll but set it to the partial circumference between two tools.
 - Also set register "PPR Cutter" to the number of pulses between two tools at the cutting roll.

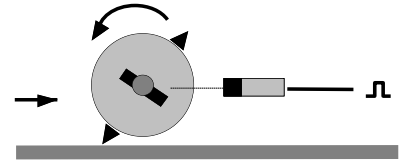
Example:

Two cuts per revolution and also two cutting pulses

→ Set "Cuts per Revolution" = 1,

"Circ. Cutter" = $\frac{1}{2}$ cutting roll circumference and

"PPR Cutter" = $\frac{1}{2}$ number of pulses per revolution.



F02		Range	Default
F02.015	Vmax / V line: 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. 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 is recommended.	2...8	8
F02.016	Home Window: Sets a window scaled in length units around the home position of the cutting roll, which is located opposite to the centre point of the synchronous zone. The output "Home" indicates that the cutting roll position is inside this window.	1 ... 999	100

F02		Range	Default
F02.017	Jog Speed: Speed setpoint in Volt for Jog operations by use of input "Jog forward" or "Jog reverse".	0.01 ... 10.00	1.00
F02.018	Jog / Homing Ramp: Ramp time in seconds for Jog operations and homing sequence with respect to speed changes between standstill and maximum speed (setpoint 10 V)	0 ... 99	1
F02.019	Home Speed High: Fast Homing speed setpoint in Volts. Every homing cycle will start with this speed.	0.01 ... 10.00	2.00
F02.020	Home Speed Low: Slow Homing speed setpoint in Volt. A Homing cycle will end with this speed.	0.01 ... 10.00	0.50
F02.021	Home Switchpoint: Distance from the final home position where the speed changes over from high speed to low speed within a homing cycle. Setting scaled in length units.	1 ... 99999	100
F02.022	+/- Sync. Rate (%): This register allows a percental adaption of the synchronous speed in a range of +/- 99.99%. In general, this register will be set to 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. This setting affects the synchronous speed only, but not the cutting length!	-99.99 ...+99.99	0
F02.023	Alarm Level: Defines the switching threshold of the output "Alert" when the system is forced out of synchronization due to external events (drive fault or mechanical problem). Setting occurs in cutting roll encoder increments and the Alert output switches on when the positional error of the roll in respect to the scheduled position overpasses the number of encoder pulses set.	0 ... 9999	100

F02		Range	Default
F02.024	Cutting Pulse Offset: 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).	-999999 ... +999999	0

6.2.3. Definitions for the Master Encoder

F03		Range	Default
F03.026	Encoder properties	0 ... 3	1
	0= Differential Impulses A, /A, B, /B (2 x 90°) incl. inv.		
	1= Single-ended Impulses A, B (2 x 90°) without inv.		
F03.027	Edge counting	0 ... 2	0
	0= Simple edge evaluation (x1)		
	1= Double edge evaluation (x2)		
	2= Full quadrature edge evaluation (x4)		
F03.028	Counting direction	0 ... 1	0
	0= Up when A leads B		
	1= Down when A leads B		
F03.029	Speed Display Factor Multiplication factor to calculate the speed display value from the master frequency (see chapter 7.3)	1 ... 999999	1
F03.030	Speed Display Divider Divider to calculate the speed display value from the master frequency (see chapter 7.3)	1 ... 999999	1
F03.031	Speed Display Dec.Point Position of decimal point for the speed display value (see chapter 7.3)	0 ... 5	0

6.2.4. Definitions for the Slave Encoder

F04		Range	Default
F04.032	Encoder properties	0 ... 3	1
	0= Impulses A, /A, B, /B (2 x 90°) incl. inv.		
	1= Impulses A, B (2 x 90°) without inv.		
F04.033	Edge counting	0 ... 2	0
	0= Simple (x1)		
	1= Double (x2)		
	2= Full quadrature (x4)		
F04.034	Counting direction	0 ... 1	0
	0= Up when A leads B		
	1= Down when A leads B		
F04.035	n.a.		

n.a. = not applicable

6.2.5. Analogue output definitions

F05		Range	Default
F05.038	Control characteristics and analogue format	0 ... 3	0
	0= Output scaled for a -10 volts ... +10 volts signal		
	1= Output scaled for a -10 volts ... +10 volts signal		
	2= Output scaled for a -20 mA ... +20 mA signal		
	3= Output scaled for a -20 mA ... +20 mA signal		
F05.039	Offset Correction: Digital setting of analogue offset on correction signal.	-10.000 ... +10.000 (volts)	0.000
F05.040	Gain Correction: Digital setting of the proportional gain of the control loop. Setting to 2.048 results in a response of 1 mV per error bit. Recommended setting: 0.500...5.000 (Gain Correction / 2048 = x.xxx volts per error bit).	0 ... 51.200	2.000
F05.041	Max. Correction: Limitation of the output voltage of the correction signal (correction will not exceed this setting)	0 ... 10.000 (volts)	2.000
F05.042	Offset Total: Digital setting of analogue offset of the overall analogue output signal.	-10.000 ... +10.000 (volts)	0.000
F05.043	Gain Total: Sets the full-scale output voltage at maximum master frequency (see parameter F02.013 Max. Master Frequency), i.e. 9,000 means 9 volts at max. frequency	0 ... 99.999* (volts)	10.000

*) The real analogue output voltage is physically limited to 10 V

6.2.6. Key command assignments

F06			Range	Default
F06.046	Function assignment to key „UP“		0 ... 16	0
	0=	No function		
	1=	Reset		
	2=	Start		
	3=	Immediate Cut		
	4=	Homing		
	5=	n.a.		
	6=	n.a.		
	7=	Store to EEPROM		
	8=	Scroll Display		
	9=	n.a.		
	10=	Jog / Trim forward		
	11=	Jog / Trim backward		
	12=	Clear Batch Counter		
	13=	n.a.		
	14=	Read front thumbwheels (model CT 641 only)		
	15=	Clear Error		
	16=	n.a.		
F06.047	Function assignment to key „DOWN“		0 ... 16	0
		See key „UP“		
F06.048	Function assignment to key „ENTER“		0 ... 16	0
		See key „UP“		

n.a. = not applicable

6.2.7. Characteristics and functions of the Control Inputs

F06		Range	Default
F06.049	Switching characteristics of input „Cont.1“		0 ... 7 0
	0=	NPN (switch to -), function active LOW	
	1=	NPN (switch to -), function active HIGH	
	2=	NPN (switch to -), rising edge	
	3=	NPN (switch to -), falling edge	
	4=	PNP (switch to +), function active LOW	
	5=	PNP (switch to +), function active HIGH	
	6=	PNP (switch to +), rising edge	
	7=	PNP (switch to +), falling edge	
F06.050	Function assignment to input „Cont.1“		0 ... 16 6 For more details about these functions see section 7.1
	0=	No function	
	1=	Reset	
	2=	Start	
	3=	Immediate Cut	
	4=	Homing	
	5=	n.a.	
	6=	Cutting Pulse	
	7=	Store to EEPROM	
	8=	Scroll Display	
	9=	Parameter Input Disable	
	10=	Jog / Trim forward	
	11=	Jog / Trim backward	
	12=	Clear Batch Counter	
	13=	n.a.	
	14=	Read front thumbwheels (model CT 641 only)	
	15=	Clear Error	
	16=	n.a.	
F06.051	Switching characteristics of input „Cont.2“		See „Cont.1“ (F06.049)
F06.052	Function assignment to input „Cont.2“		See „Cont.1“ (F06.050)
F06.053	Switching characteristics of input „Cont.3“		See „Cont.1“ (F06.049)
F06.054	Function assignment to input „Cont.3“		See „Cont.1“ (F06.050)
F06.055	Switching characteristics of input „Cont.4“		0 – 3
	0=	NPN (switch to -) function active LOW	 no edge-triggered functions are possible with Cont.4
	1=	NPN (switch to -) function active HIGH	
	2=	PNP (switch to +), function active LOW	
	3=	PNP (switch to +), function active HIGH	
F06.056	Function assignment to input „Cont.4“		See „Cont.1“ (F06.050)

n.a. = not applicable



- Unconnected NPN inputs are always HIGH (internal pull-up resistor)
- Unconnected PNP inputs are always LOW (internal pull-down resistor)
- It is mandatory to assign the Cutting Pulse to one of the inputs 1, 2 or 3 (F06.050 or F06.052 or F06.054 = 6). The selected input is no more available for other purpose.
- The Cutting Pulse input must always be edge-triggered, i.e. the corresponding parameters F06.049, F06.051 or F06.053 be either 2 or 3 or 6 or 7
- Where you like visualize the Cutting Pulse Signal on your PC screen by means of the OS32 Operator Software, you must temporary set the inputs to static operation as the corresponding light boxes on the screen are not suitable to display dynamic signals. Please do not forget to return to edge-triggered operation after the test!

6.2.8. Serial communication parameters

F07		Range	Default
F07.058	Serial device address (unit number)	11 ... 99	11
F07.059	Serial baud rate	0 ... 6	0
	0= 9600 Baud		
	1= 4800 Baud		
	2= 2400 Baud		
	3= 1200 Baud		
	4= 600 Baud		
	5= 19200 Baud		
	6= 38400 Baud		
F07.060	Serial data format	0 ... 9	0
	0= 7 Data, Parity even, 1 Stop		
	1= 7 Data, Parity even, 2 Stop		
	2= 7 Data, Parity odd, 1 Stop		
	3= 7 Data, Parity odd, 2 Stop		
	4= 7 Data, no Parity, 1 Stop		
	5= 7 Data, no Parity, 2 Stop		
	6= 8 Data, Parity even, 1 Stop		
	7= 8 Data, Parity odd, 1 Stop		
	8= 8 Data, no Parity, 1 Stop		
	9= 8 Data, no Parity, 2 Stop		

6.2.9. Special functions

F08		Range	Default
F08.064	Digital input filter: <u>must be set to "0"</u> .	0 ... 3	0
F08.065	Trigger threshold for encoder1 inputs *)	30 ... 250	166
F08.066	Trigger threshold for encoder2 inputs *)	30 ... 250	166
F08.067	Brightness of the 7-segment LED display	0 ... 4	0
	0= 100% of maximum brightness		
	1= 80% of maximum brightness		
	2= 60% of maximum brightness		
	3= 40% of maximum brightness		
	4= 20% of maximum brightness		
F08.068	Frequency Control: <u>must be set to "0"</u>	0 ... 1	0
F08.069	Length Storage	0 ... 1	0
	0= Cutting length set by the "Direct Fast Access" menu (see chapter 5.3) is only temporary active until next power-down.		
	1= Cutting length set by the "Direct Fast Access" menu (see chapter 5.3) is stored to EEPROM for enduring use.		
F08.070	Display Time: Update time (sec.) for display only	0.005 ... 9.999	0.050
F08.071	Default Display: Number of actual value displayed by the unit after power up (see table in chapter 7.1 at description of Scroll Display command)	0 ... 8	0

*) Must be set to the default value (166) for any kind of input signals, except for single-ended TTL signals which require a setting of 35.

6.2.10. Keypad protection codes

F09		Range	Default
F09.072	Protected group F01	0 = no protection 1 – 999 999 = Protection code for the actual parameter group	0
F09.073	Protected group F02		
F09.074	Protected group F03		
F09.075	Protected group F04		
F09.076	Protected group F05		
F09.077	Protected group F06		
F09.078	Protected group F07		
F09.079	Protected group F08		
F09.080	Protected group F09		

7. Description of Commands and Outputs

7.1. Commands

No.	Command	Description	Assignment to	
			Keypad	Input
1	Reset	Sets the internal differential counter and the analogue correction signal to zero. The cutting roll drive runs solely in analogue synchronization (open loop control) whilst activated	yes	yes
2	Start	Start of the automatic cutting procedure. The unit cuts automatically to preset cutting length. When this command is not set, the cutting roll is held in its home 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".	yes	yes
3	Immediate Cut	This command will immediately start the cutting roll for 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. This function e.g. allows the operator to cut out bad parts of the material. An immediate cut can also be performed when the material is in standstill or when Start command is reset.	yes	yes
4	Homing	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. Before starting the automatic cutting operation, we recommend performing a homing cycle if the cutting roll is not yet in its home position.	yes	yes
5	n.a.		no	no
6	Cutting Pulse	Sensor input for the 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 an HTL encoder.	no	yes

No.	Command	Description	Assignment to	
			Keypad	Input
7	Store to EEPROM	Stores actual operational settings to the EEPROM, so they remain available also after power down.	yes	yes
8	Scroll Display	Selects the source of the digital display. See chapter 7.3 Display for details.	yes	yes
9	Parameter Disable	Disables the keypad for any parameter access. Only commands assigned to the keypads will be accessible	no	yes
10	Jog / Trim Forward	When command "Start" is released: In stop state the inputs Jog / Trim forward and Jog / Trim reverse move the cutting roll in one or the other direction (Jog speed register settable). After termination of a Jog command, the cutting roll will be held again in its new position in closed-loop control. When command "Start" is set: At automatic cutting cycles the inputs Jog / Trim forward and Jog / Trim reverse 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 set.	yes	yes
11	Jog / Trim Backward		yes	yes
12	Clear Batch Counter	Resets the internal batch counter to zero.	yes	yes
13	n.a.		no	no
14	Read Thumbwheels	Reads and activates the cutting length setting from the front thumbwheel switches (model CT641 only)	yes	yes
15	Clear Error	Resets error states and clears the corresponding error messages (see also chapter 7.4 Error Messages)	yes	yes
16	n.a.		no	no

n.a. = not applicable

7.2. Outputs

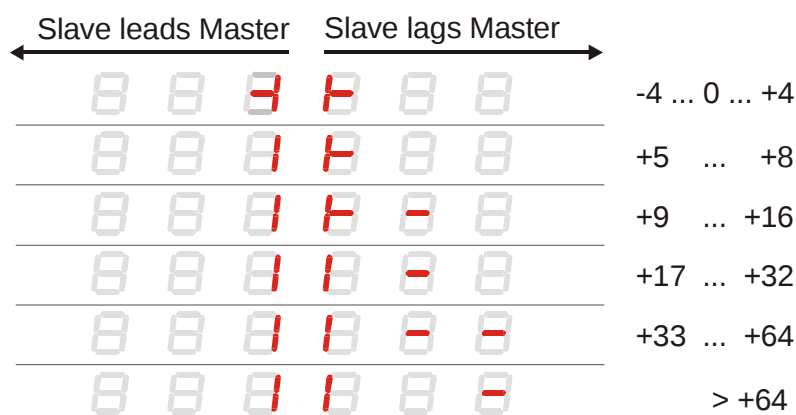
No.	Output	Terminal
K1	Error: This output goes high when an error is detected during operation (see section 7.4 "Error Messages").	X2 / 26
K2	Alert: Indicates that the cutting roll, with respect to its profile position set point, actually runs with a positive or negative position error higher than the limit set at parameter „Alarm Level“.	X2 / 25
K3	Automatic Operation: Set to on during automatic cutting operation while command "Start" is set. When the "Start" command is released, this output is set to off not before the actual cut is finished and the cutting roll has come to standstill at its home position.	X1 / 10
K4	Homing Done: 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, parameter set up or power down).	X1 / 9
—	Home*: Indicates that the cutting roll is in its home position like defined by register "Home Window".	—
—	Virt. Cutting Pulse*: The rising edge of this signal 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").	—
—	Max. Frequency*: Indicates that the line speed (line encoder frequency) has exceeded its maximum value as defined by parameter "Max. Master Frequency".	—
—	Unit Ready*: Indicates that the unit is ready to operate after power-up, initialization and successful self-test.	—

*) Serial readout only (displayed at PC by OS3.2 operator software)

7.3. Display of Actual Values

During normal operation it is possible to display an actual value. Two LEDs at the front panel indicate the actual value displayed. You can scroll the actual value on the display by Scroll Display command, which can be assigned either to a key or to an input. Parameter F08.071 "Default Display" selects the actual value to be displayed after power up of the unit.

Nr.	Display	L1 (red)	L2 (yellow)
0	Display OFF (only two decimal points are lit to indicate operation state)	OFF	OFF
1	Position error (differential counter)	OFF	OFF
2	Position error (bar graph display, see diagram below)	OFF	OFF
3	Actual Master speed The speed display can be scaled by the two parameters F03.029 Speed Display Factor and F03.030 Speed: $\text{Display value} = \frac{\text{Master frequency [Hz]} \cdot F03.029}{F03.030}$ If you want to display a decimal point with the speed value you can select the position of the decimal point by parameter F03.031 Speed Display Dec.Point.	ON	OFF
4	Master encoder pulse counter	OFF	ON
5	Cutting roll position scaled in encoder increments	ON	ON
6	Cutting pulse distance scaled in encoder increments	Flashing	OFF
7	Actual cutting length scaled in length units	OFF	Flashing
8	Batch counter	Flashing	Flashing



Bar graph display with reference to the actual position error

The diagram shows positive errors only (Slave lags Master). Negative errors are mirror-inverted.

7.4. Error Messages

Upon detection of an error, the cutting roll remains in a closed-loop standstill at home position after termination of the current cut. Output "Error" switches to high and the unit displays a flashing error message "Error..." indicating the error number.

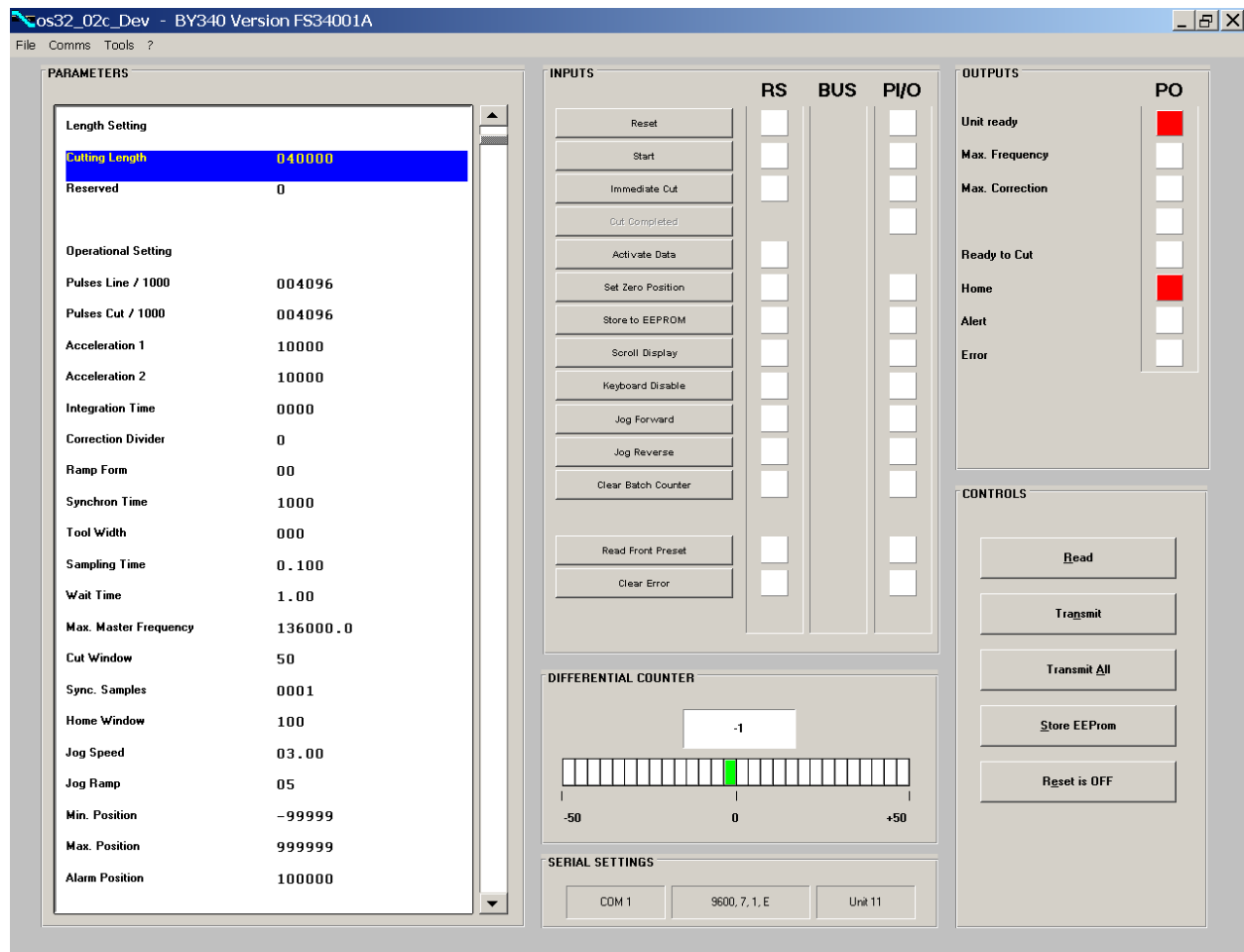
To clear an error state either set "Clear Error" command or cycle the power supply of the unit. Please note that the unit will immediately return to the error state if the cause for the error has not been eliminated.

Error No.	Error Description
Error 0	The reason for the error has been rectified (e. g. parameter value amended after Value Range Error) but the error has not yet been cleared by input "Clear Error".
Error 1	Cut not possible: The cut is not possible because the preset cutting length is too low.
Error 2	No Cutting Pulse: The cutting pulse is missing. This error will be set if no cutting pulse appears within one revolution of the cutting roll.
Error 3	Power Low: The power supply voltage is too low. This error cannot be cleared before the power supply voltage has recovered and exceeds the minimum power supply voltage level.
Error 4	Val. Range exceed: Internal overflow error during pre-calculation of the cutting profile. This error can occur by the following reasons among others: ▪ The ratio between the number of line encoder pulses and the number of cutting roll encoder pulses has exceeded the permitted range (see section 4.2 "system configuration" for details). ▪ The value of "Home switchpoint" is too high. ▪ The synchronous zone (sum of "Sync. Before Cut" and "Sync. After Cut") is greater than the cutting roll circumference

8. Steps for Commissioning

For easy and uncomplicated commissioning of the CT340 / 641 controllers you need a PC with the actual operator software OS3.x. You can download this software and full instructions, free of charge, from our homepage www.motrona.com.

Connect your PC to the synchronizer as shown in section 3.6 and start the OS3.x software. The following screen will appear:



Where instead you find the mask blank with the indication „OFFLINE“ in the top bar, please click to the „Comms“ menu and check the serial settings of your PC.



Edge triggered events (e.g. Cutting Pulse) cannot be displayed in the OS3.x, due to the slow serial data transmission.

Set all parameters in the Edit filed according to your needs, following the hints given in this manual. The following parameters should initially be set to the values as shown:

Number	Register	Initial Setting
F02.007	Correction Divider	0
F05.040	Correction Gain	1.000
F05.041	Max. Correction	10.000

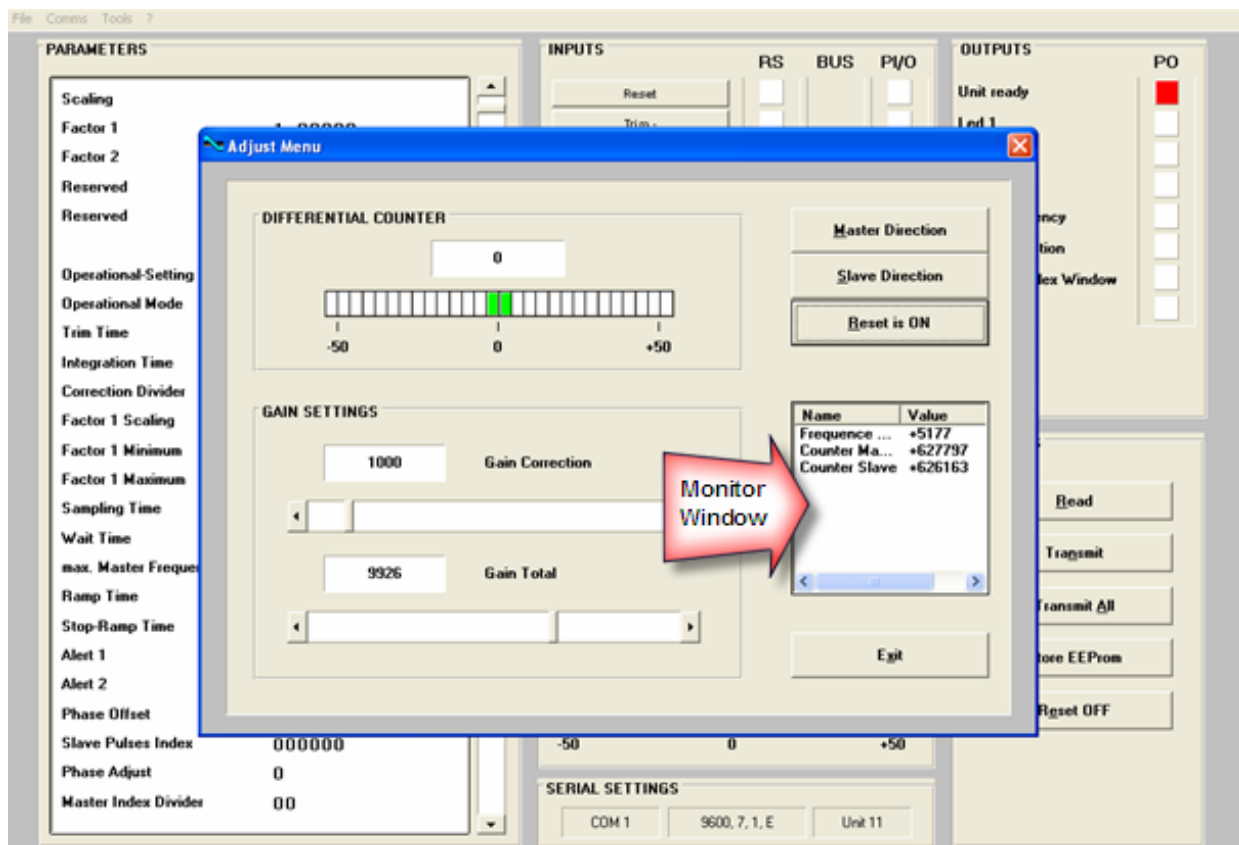
After entry of all parameters click to “Transmit All” followed by “Store EEPROM” to store all parameters to the CT340 or CT641 controller.



- At this time, both drives (line and cutting roll) must be adjusted to proper and stable operation over the full speed range. Cutting roll drive settings must provide a maximum of dynamics and response (set ramps to zero, switch off any integral or differential component of the internal speed control loop, i.e. operate the drive with proportional speed control only, with the proportional Gain set as high as possible).
- For the set-up procedure the cutting roll must be able to move in both directions without any mechanical limitations.

8.1. Running the Adjust menu

For adjustments of directions and control gains of the slave drive, you need to open the “Adjust” menu available under “Tools” in the main menu of the screen. To start the Adjust menu the first time, the Slave drive should be disabled for reasons of safety.



8.2. Set Directions of Rotation

The direction of rotation must be defined for both, master and slave encoder. Make sure the Reset is switched on when you do this (the softkey must show "Reset is ON")

- Move the Master encoder into forward direction (manually or by means of a remote speed signal to the Master drive). Observe the "Counter Master" value shown in the monitor window on the right. It must count up to positive values. Where you find it counts down or to negative, please click to button "Master Direction" to change the counting direction.
- Move the Slave encoder into forward direction (manually or by enabling the Slave drive while the Master is moving forward). Observe the "Counter Slave" value. It must again count up to positive values. Where you find it counts down or to negative, please click to button "Slave Direction" to change the counting direction.

8.3. Tuning the Analogue Output

- Switch Reset to ON by clicking to the corresponding softkey on the screen.
- Enable both, Master and Slave drive. Turn the speed signal for the Master to approximate 25% of the maximum speed. The Slave should now move, too. As a next step, switch the Reset to OFF by clicking to the Reset button (showing actually "Reset On"). This will activate the closed loop control.
- Observe the color bar and the value of the differential counter. There are the following two possibilities:
 - a. The bar graph moves to the right and the differential counter shows positive values. This indicates that the analogue output is too low. Please increase the setting of "Gain Total" by scrolling up with the arrow key on the right, or by shifting the slider into a more right position.
 - b. The bar graph moves to the left and the differential counter shows negative values. This indicates that the analogue output is too high. Please decrease the setting of "Gain Total" by scrolling down with the arrow key on the left, or by shifting the slider into a more left position.

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

- Turn speed signal for the master to approximately 80% of maximum speed. Continue to observe the color bar and the value of the differential counter and adjust "Gain Total" again if necessary.



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

8.4. Setting of the Proportional Gain

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

Please try to increase the setting of Correction Gain from 0.500 to 1.000, 1500, 2.000, 2.500, 3.000 etc. However, as soon as you find unsteady operation, noise or oscillation, you must reduce the setting again correspondingly.

We also recommend to ramp up and down the master while checking the color bar and the differential counter for stable operation.



Actual value no. 6 displays the distance between the cutting pulses (see chapter 7.3). Thereby you can check the proper operation of the cutting pulse.

Once you have successfully concluded these steps, you can exit the Adjust menu.

Now your machine is ready for operation and you can run initial test cuts without material (see next chapter).

8.5. Tuning 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.
- Start the line drive or move the measuring wheel at the line encoder to simulate the moving material.
- Set "Immediate Cut" command and see how the controller executes a first cutting cycle.
- Set the "Start" command. The cutting roll will wait for expiration of the length and then continuously execute cutting cycles.
- By actual value no. 7 you can display and check the actual cutting length (see chapter 7.3).
- Observe the position error at the differential counter or the bar graph display. During the whole cycle the position error should not exceed values like 30 and the bar graph should remain in the centre area all the time. Increase the line speed step by step and continue the observations.

When you have achieved settings to keep the bar graph at the centre position 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 bar graph display and differential counter indicate unusual characteristics:

If many segments of the bar graph display are lit at the same time and the differential counter 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 "Gain Correction" setting if this eliminates the problem.

Remark: Even though the bar graph display can indicate a very unstable characteristic, your cutting accuracy and performance may be good. Then just accept this visual flaw.

If the bar graph display and the differential counter value move up and down with the speed cycle of the cutter:

- Try to increase the setting of register "Gain Correction".
- 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.

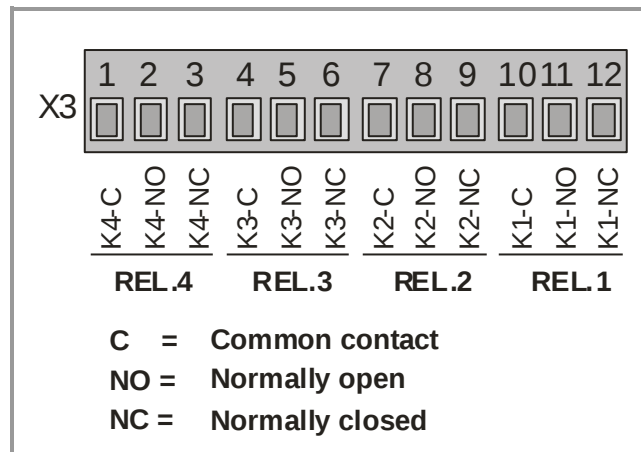
This concludes the procedure of commissioning of your rotating cutter system. We recommend saving all parameter settings on hard disc or disc. In case of repeat applications (machine with similar specifications), or after exchange of the controller, you just need to download the settings and are immediately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

9. Appendix for model CT 641

9.1. Relay Outputs

While model CT340 provides high-speed transistor outputs only, model CT641 provides four additional relay outputs, operating in parallel to the high-speed transistor outputs K1 – K4.

All electrical connections of CT 641 are fully similar to CT 340, except that with CT 641 models the back plane is equipped with an additional terminal strip X3 providing the relay connector:



9.2. Front Thumbwheel Switches

Moreover, the CT 641 models provide thumbwheel switches on the front panel, for simple and easy setting of the cutting length.

This is how the front switches work:

- Upon power-up the unit will read the thumbwheel settings and overwrite the internal cutting length setting correspondingly, i.e. the system cuts the length set by the front thumbwheels.
- When during operation you change the thumbwheel setting, this will not affect the cutting length until you apply a "Read Thumbwheel" command to the unit. You can assign this command to either one of the front keys or to one of the Control Inputs, as shown under sections 6.2.6 and 6.2.7
- When the front thumbwheels are all set to zero, the controller will automatically use the internal cutting length as entered by menu.

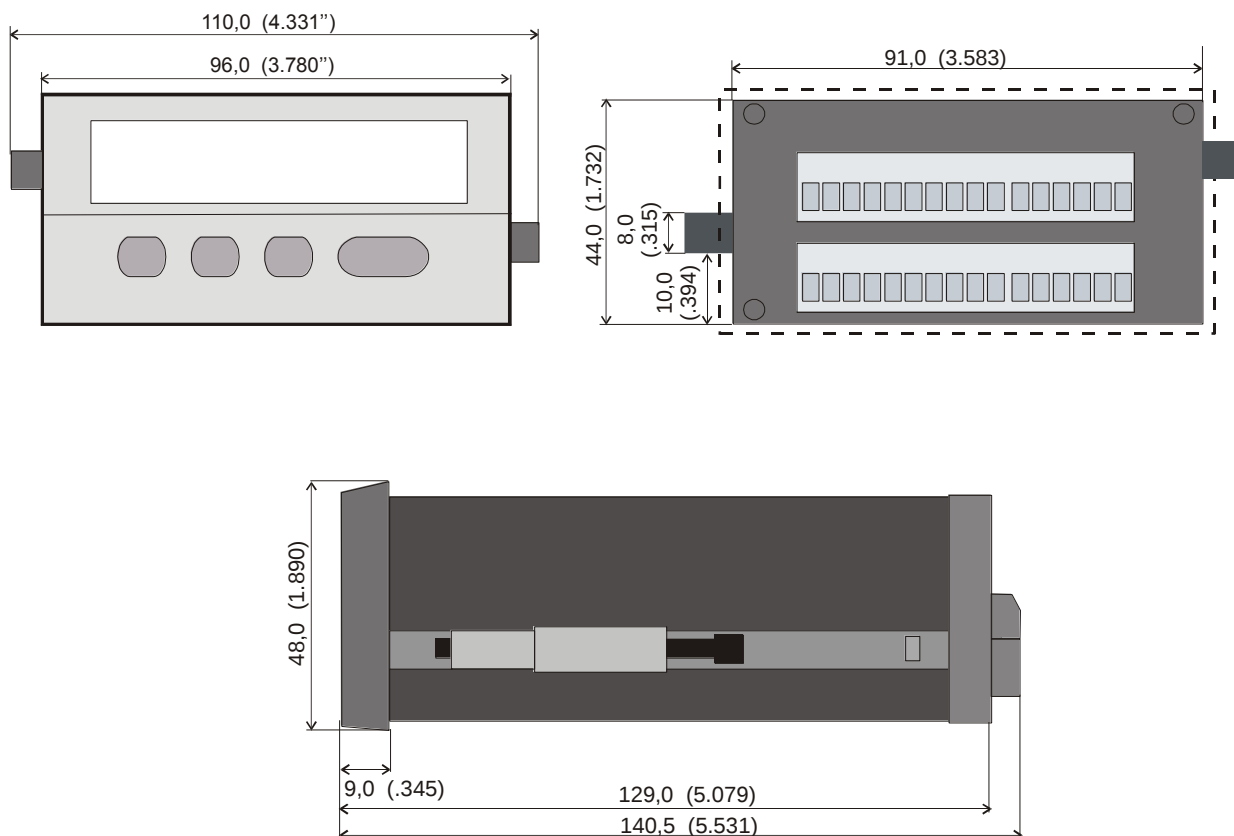
10. Specifications and Dimensions

AC power supply	:	24 V~ +/-10%, 15 VA
DC power supply	:	24V- (17 – 40V), approx. 100 mA (+ encoders)
Aux. encoder supply outputs:		2 x 5,2 VDC, 150 mA each 2 x 24V DC, 120 mA each
Inputs	:	2 universal encoder inputs 4 digital control inputs HTL ($R_i = 3.3\text{ k}\Omega$) Low < 2.5 V, High > 10 V, min. pulse width 50 μsec .
Counting frequency (per encoder)	:	RS422 and TTL differential: 300 kHz HTL single ended: 200 kHz TTL single-ended: 200 kHz
Switching outputs (all models)	:	4 fast power transistors 5 - 30V, 350 mA (b) Response time < 1 ms (a),
Relay outputs (models CT641 only)	:	4 relays (dry changeover contacts) (b) AC switching capability max. 250 V/ 1 A/ 250 VA DC switching capability max. 100 V/ 1A/ 100 W
Serial link	:	RS232, 2400 – 38400 Bauds
Analogue outputs	:	0...+/- 10V (load max. 2 mA) 0...20mA (load max.270 Ohm) Resolution 14 bits, Accuracy 0.1% Overall response time < 1 ms (a)
Ambient temperature	:	Operation: 0 - 45°C (32 – 113°F) Storage: -25 - +70°C (-13 – 158°F)
Housing	:	Norly UL94 – V-0
Display	:	6 Digit, LED, high- efficiency red, 15mm
Protection class (front side only)	:	CT 340: IP65 CT 641: IP20 (with use of the plexiglass cover part # 64026 also IP65)
Protection class rear side	:	IP20
Screw terminals	:	Cross section max. 1.5 mm ² ,
Conformity and standards:		EMC 89/336/EEC: EN 61000-6-2 EN 61000-6-3 LV73/23/EEC: EN 61010-1

(a) Continuous serial communication may temporary increase response times

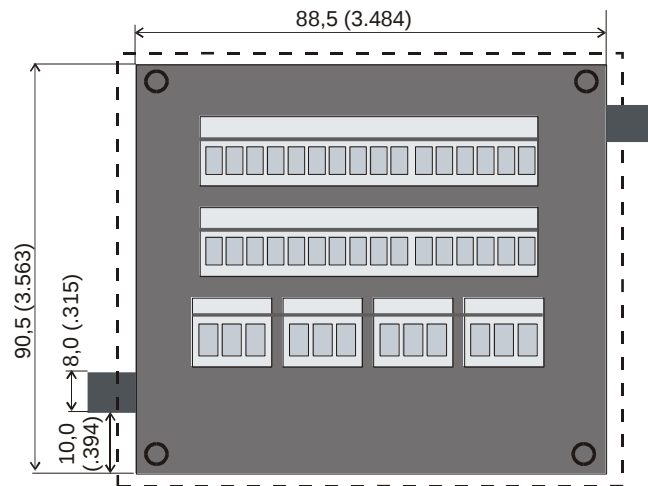
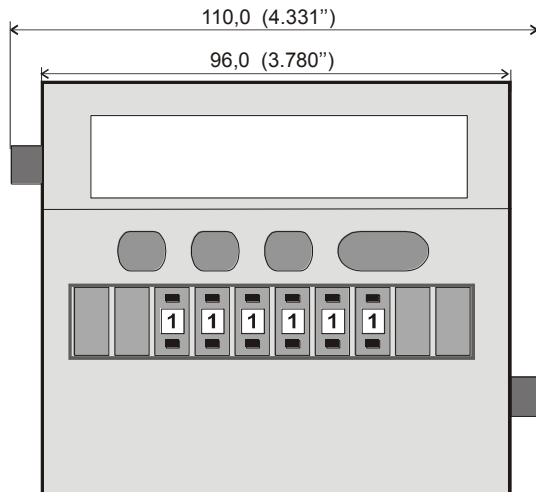
(b) Diode or RC filtering is mandatory when switching inductive loads

Dimensions of model CT340:

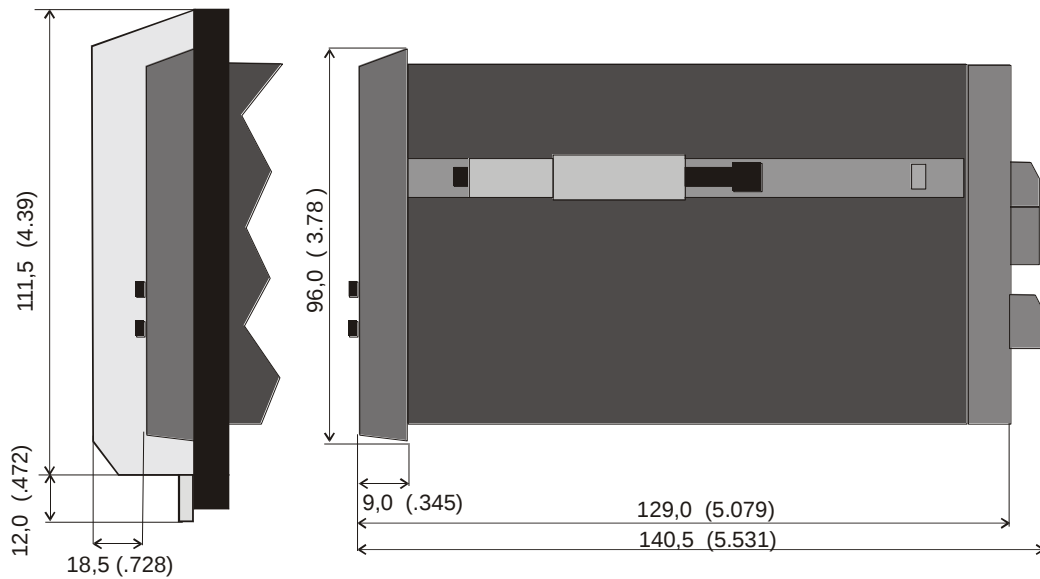


Panel cut out: 91 x 44 mm (3.583 x 1.732")

Dimensions of model CT641:



**With optional plexi glass cover
for protection class IP65
(motrona part # 64026)**



Panel cut out (b x h): 89 x 91 mm (3.504" wide x 3.583" high)