Applicantions Tde Macno

User's Manual

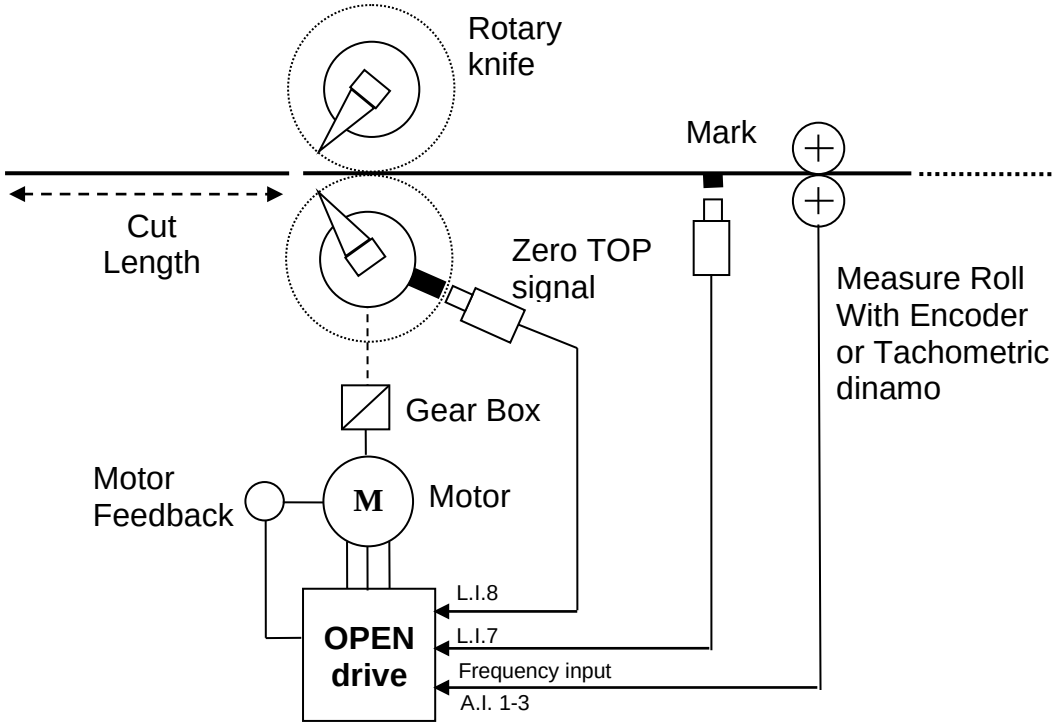
Rotary cutter n° 01

Cod. MW00701E00 V_1.4

INDEX

VERSION APPLICATION 1.03

This OPEN DRIVE application has been developed to obtain the Rotary Cut features, with the best profile for minimizing RMS motor torque.
The drive controls a knife mounted on a roller synchronizing it with the speed line, read by Encoder or tachometric dynamo.
Position , Velocity and Torque profiles are automatically calculated by drive to obtain the best dynamic response.
User can set up two Cut lengths, the Synchronous zone (before and after cut point) and the working mode cutting prescribed lengths with or without marks on material (read with real-time fast-capture input L.I.7).
There is a real-time fast-capture for cut point input (L.I.8) and it's possible to choose if refresh the absolute position every turn or if read it only in the homing state and then estimate the absolute position using the motor feedback and gear ratio.
There are many other functions: homing, minimum velocity admitted in the Synchronous zone, test material presence, immediately cut …….
In the OPDExplorer are available some pages very useful in machine start-up.



1. APPLICATION CONFIGURATION

1.1. APPLICATION SPECIFIC PARAMETERS

Name	Description	Min	Max	Default	u.m.	scale
RC_CIRC	E00 - Knife circumference	0.1	3000.0	300.0	mm	10
GEAR_BOX_NUM	E01 - Reduction ratio NUM	0	30000	100		1
GEAR_BOX_DEN	E02 - Reduction ratio DEN	0	30000	100		1
SYCH_OVR_SPD	E03 - Over speed synchronous zone	89.9	159.9	100.0	%	10
SYNCH_ZONE_PRE_CUT	E04 - Synchronous zone before cutting	0.1	159.9	30.0	degrees	10
SYNCH_ZONE_POST_CUT	E05 - Synchronous zone after cutting	0.1	159.9	30.0	degrees	10
LINE_SPD_MAX	E06 - Maximum line speed	1	3000	300	m/min	1
LINE_SPD_MIN	E07 - Minimum line speed	0.00	30.00	0.00	m/min	100
LINE_SPD_TF	E08 - Line speed filter time constant	0.0	3000.0	10.0	ms	10
S_RAMPS_TIME	E09 - Time for torque gradient to reach its nominal value	0.0	3000.0	4.0	ms	10
PRC_LONG_CUT_T_MAX	E10 - Maximum motor torque for long lengths	0.0	400.0	130.0	% MOT_T_NOM	10
PRC_SHORT_CUT_T_MAX	E11 - Maximum motor torque for short lengths	0.0	400.0	130.0	% MOT_T_NOM	10
ZERO_TOP_OFFSET	E12 - Zero TOP signal offset from Cut	-180.0	180.0	0.0	degrees	10

	point					
FIRST_CUT_LENGTH	E13 - First Cut Length from stop point at 180°	0.0	3000.0	130.0	mm	10
EN_MARK	E14 - Enable marker synchronization	0 NO 1 YES		NO		1
MARK_WND	E15 - Window to enabled the detecting mark	0.0	3000.0	10.0	mm	10
MARK_OFFSET	E16 - Mark offset position	-1999.9	19999	0.0	mm	10
MARK_REF	E17 - Mark position	0.0	3000.0	0.0	mm	10
MARK_RSP_T	E18 - Response time mark photoelectric switch	0	2000	50	us	1
MARK_REG_KP	E19 - Mark error correction speed	0.01	9.99	0.01		100
EN_INV_SPD_LINE	E20 - Line input signal inversion	0 NO 1 YES		NO		1
LINE_SPD_SEL	E21 - Input line selection	0 Simulated 1 Encoder 2 InAn1 3 InAn2 4 InAn3		0		1
LINE_SPD_SIM	E22 - Simulated speed line	0	3000	50	m/min	1
EN_TIME_DEC_LINE_SPD	E23 - Enable time decoding of line speed	0 NO 1 YES		YES		1
SYNCH_ZONE_SPD_MIN	E24 - Minimum speed line in synchronous zone	0	3000	10	m/min	1
EN_ZERO_TOP_EST	E25 - Enable cut point estimation after first reading	0 NO 1 YES		NO		1
HOME_SPD	E26 - Homing motor speed	0.00	100.0	5.0	% MOT_SPD_MAX	100
ZERO_TOP_MAX_ERR	E27 - TOP maximum error	0.0	360.0	2.0	degrees	10
EN_LAST_ERR_COMP	E28 - Enable last cut error compensation	0 NO 1 YES		NO		1
EN_STOP_POINT_SET	E29 - Enable stop point setting	0 NO 1 YES		0		1
STOP_POINT_REF	E30 - Knife stop point (referred to Synchronous zone centre)	140.0	220.0	180.0	Degrees	10
AVR_SAMPLES_NUM	E31 - Samples number to calculate average cut length error	1	99	99		1
RESET_ERROR	E32 - Reset max and min cut length error	0 NO 1 YES		NO		1
AI_SEL	E33 - Meaning of analog input A.I.	0 A.I.1 Speed Ref. 1 A.I.1 Torque Ref 2 A.I.2 Speed Ref. 3 A.I.2 Torque Ref 4 A.I.3 Speed Ref. 5 A.I.3 Torque Ref		0		1
EN_AI	E34 - Enable analog reference value A.I.	0 NO 1 YES		NO		1
PRC_SPD_JOG	E35 - Digital speed reference value (JOG)	100.0	-100.0	0	% MOT_SPD_MAX	100
EN_LIN_RAMP	E36 - Enable linear ramp	0 NO 1 YES		NO		1
EN_SPD_JOG	E37 - Enable Digital speed reference value (JOG)	0 NO 1 YES		NO		1
EN_HOME_SYNC	E38 - Enable homing speed synchronous with line	0 NO 1 YES		NO		1
EN_SPD_AFT_SYNC	E39 - Enable control min line speed after synchronous zone	0 NO 1 YES		NO		1
TF_TRQ_REF_AN	E40 - Filter time constant for analog torque reference value	0.0	20.0	0	ms	10
EN_CTRL_TRQ	E41 - Enable Torque control	0 NO 1 YES		NO		1
TIME_MIN_TOP	E42 - Min Time of TOP Zero Input	20	200	26	us	1
MAX_FLW_ERR	E43 - Max following error	0.0	180.0	10.0	Degrees	10
WND_STOP_POINT	E44 - Window knife at Stop Position	0.0	180.0	5.0	Degrees	10
POS_KP	E45 - Kv Position loop proportional gain	0.0	100.0	4.0		10
LINE_PPM	E48-E49 Pulses per meter	99	180000	1024	ie	1
A_CUT_LENGTH	E50-E51 - A cut length	1	9999.9	120.0	mm	10
B_CUT_LENGTH	E52-E53 - B cut length	1	9999.9	130.0	mm	10
STR_POS_CRUSH	E54 - Start Position Cut of Anti-crushed	0.0	359.9	0.0	degrees	10
END_POS_CRUSH	E55 - End Position Cut of Anti-crushed	0.0	359.9	0.0	degrees	10
MAX_TRQ_CRUSH	E56 - Set Torque of Anti-crushed	0.0	400.0	0.0	% MOT_TRQ_MAX	10
EN_ALR_CRUSH	E57 - Enable alarm crushing	0 NO 1 YES		NO		1
HOM_MAX_TRQ_CRUSH	E58 - Set Homing Torque of Anti-crushed	0.0	400.0	0.0	%MOT_T_NOM	10

MARK_TLR	E60 - Cut tollerance mark phasing	0.0	1999.9	0.0	mm	10
NR_MARK_LT	E61 - Nr. marks between two cuts	1	9	1	Nr.	1
NR_MARK_LNG_COR	E62 - Nr. marks for overwrite length setting					

1.2. APPLICATION LOGIC INPUTS (unchangeable)

Inputs	Description
L.I.7	Mark input
L.I.8	Zero TOP point input

1.3. APPLICATION LOGIC INPUT FUNCTIONS

Function	Description
I00	Run command
I01	Torque control
I03	Enable analog reference A.I.
I05	Enable speed jog
I08	Alarm reset
I22	Enable linear ramps (for reference speed)
I26	Enable mark synchronization
I27	Reset mark counter
I28	Cutting length selector (0= Cut Length A)
I29	Immediately cut
I30	Material presence
I31	Cut Enable

1.4. APPLICATION LOGIC OUTPUT FUNCTIONS

Function	Description
O32	Excessive speed line with active Cut Length
O33	Cut point error greater than threshold E27
O34	Real Cut point
O35	Homing procedure is completed successfully
O36	Knife at stop position (Top position)
O37	Knife in synchronous zone
O39	Max following error
O40	Warning Crushing
O41	Zone Control Crushing
O42	Cut too short with marker phasing
O43	Cut too long with marker phasing
O44	Mark inside of window

1.5. APPLICATION ANALOG OUTPUTS AND MONITOR

Output	Description	u.m.	Internal Rappr.
O70	Filtered speed line	% Vline_max	16383
O71	Knife Position Reference (less significant word)	Motor pulses	1
O72	Knife Actual Position (less significant word)	Motor pulses	1
O73	Knife position error	Motor pulses	1
O74	Zero TOP error	Motor pulses	1
O75	Cut length error	Motor pulses	1
O76	Cut point	0,1	4095
O77	Line count (less significant word)	Line pulses	1
O78	Mark error	Line pulses	1
O79	Input Top Zero Edge	0,1	4095
O80	Input Marker Edge	0,1	4095

1.6. APPLICATION INTERNAL VALUES

Name	Description	u.m	Internal Rappr.	scale
LINE_SPD	D64 - Filtered speed line	m/min	16	10
LINE_SPD_MAX_ACT	D65 - Maximum speed line	m/min	16	10
TOP_CNT	D66 - Zero Top counter	Nr.		1
ZERO_TOP_ERR	D67 - Zero Top error	Degrees	128	100

CUT_LENGHT_ERR	D68 - Cut length error	mm	128	100
MARK_ERR	D69 - Mark error	mm	128	100
STOP_POINT	D70 - Knife stop point	Degrees	64	10
CUT_LENGTH_AVR_ERR	D71 - Average cut length error	mm	128	100
CUT_LENGTH_MAX_ERR	D72 - Max cut length error	mm	128	100
CUT_LENGTH_MIN_ERR	D73 - Min cut length error	mm	128	100
MARK_CNT	D74 - Mark count	Nr.		1
ACT_SLAVE_POS	D75 - Actual knife (Slave) position	Degrees		10
PRC_SPD_REF_JOG	D76 - Digital speed reference (JOG)	%MOT_SPD_MAX		100
PRC_SPD_REF_AN	D77 - Analog Speed reference	%MOT_SPD_MAX		100
PRC_T_REF_AN	D78 - Analog torque reference from application	%MOT_TRQ_MAX		10
CUT_LENGTH_ACT	D80-D81 - Actual cut length	mm	100	100
LENGTH_2_MARK	D82-D83 - Distance between the last two valid mark	mm	100	100
ACT_MARK_LT_CNT	D84 - Nr. marks between two cuts count	Nr.	1	1
ACT_CUT_OWR_LT	D85 - Actual cuts outside tollerance for overwrite length	Nr.		1

1.7. APPLICATION ALARMS

ALL	Code	Description
A04	0	Max motor speed (P65) too low compared to max speed line (E06)
A04	1	Rounding time too high
A04	2	Cut Crushing

2. SETTING BASIC PARAMETERS

In the Rotary cut is very important to estimate the machine limit working points that is the maximum speed line admitted according to different cut lengths.

In order to obtain the limit curves it's necessary to know the max acceleration available and the frictions. The easiest way to obtain this data is to use the **Autotuning function for the motor starting time measure**. For more details on this test see pag 14 the manuals MOPDE-OPDE_QUICK START_EN (or IT) rev 1.3 on our website.
At the end of this test are available this data:

P136	Load frictions	% MOT_T_NOM
P169	Starting time	ms

The starting time is the time needed for the motor with full load, to reach the maximum motor speed (P65) with the nominal motor torque.

The following parameters are involved in the curve limit calculation:

Standard:

P65	Maximum motor speed	rpm
P136	Load frictions	% MOT_T_NOM
P169	Starting time	ms

Application:

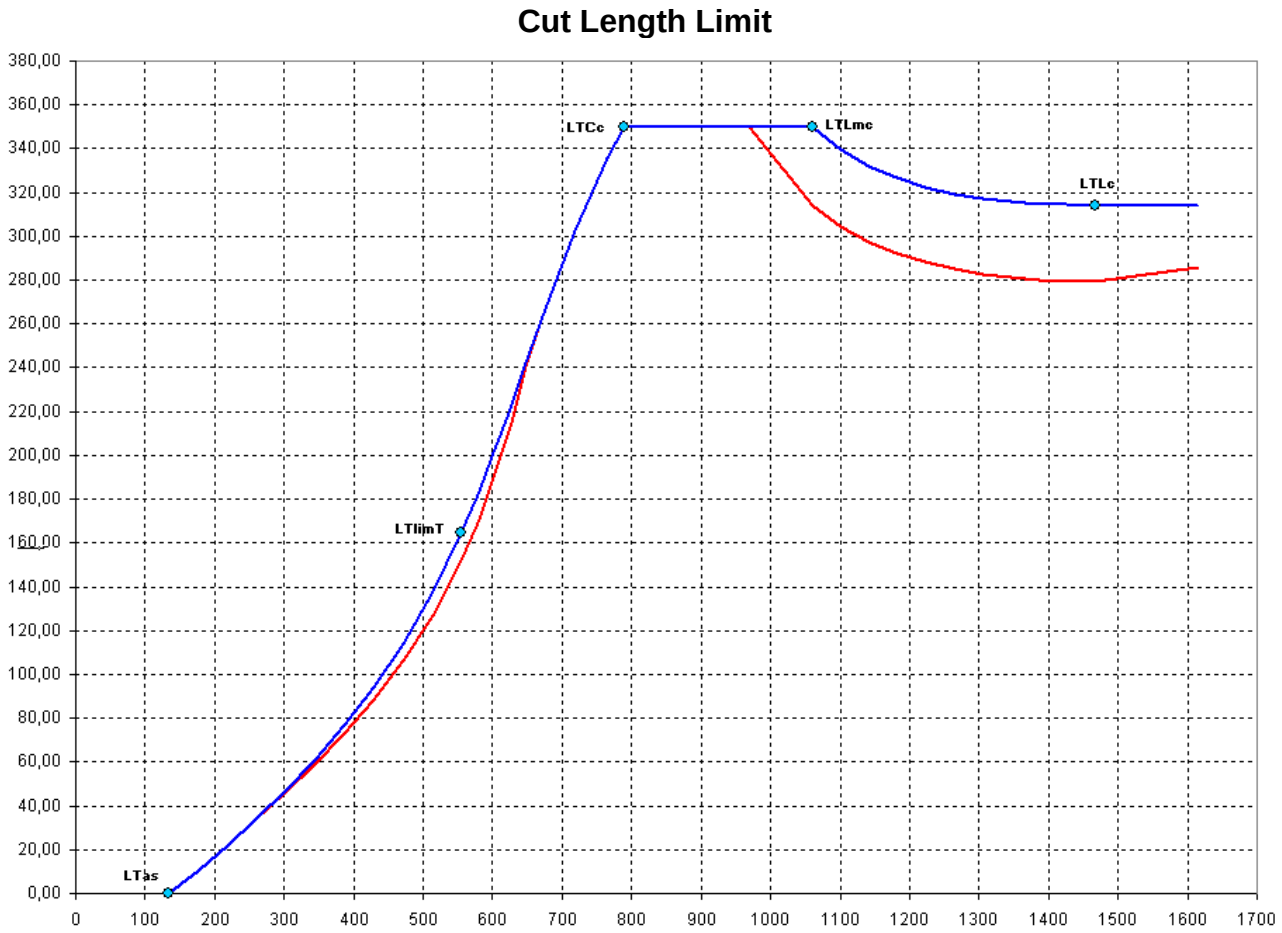
E00	Knife circumference	mm
E01	Reduction ratio NUM	
E02	Reduction ratio DEN	
E03	Over speed synchronous zone	%
E04	Synchronous zone before cutting	degrees
E05	Synchronous zone after cutting	degrees
E06	Maximum line speed	m/min
E09	Time for torque gradient to reach its nominal value	ms
E10	Maximum motor torque for long lengths	% MOT_T_NOM
E11	Maximum motor torque for short lengths	% MOT_T_NOM
E29	Enable stop point setting	
E30	Knife stop point (referred to Synchronous zone centre)	degrees

It's necessary to set:

- Physical machine data like, knife circumference (E00), gear box ratio (E01 e E02).
- Synchronous zone amplitude (E04 e E05) in which the linear knife speed is equal to the speed line. It's also possible to define a synchronous over-speed for compensate the linear knife speed function of knife-line angle.
- The maximum machine speed line in [m/min] (E06).
- The S-ramp rounding time with parameter E09
- The maximum torque available in the long lengths (E10) and in the short lengths (E11). Can be useful to have this two different parameters if a rotary cut machine works always with long or short lengths but sometime are done some cuts with very different lengths.
- In order to use always the same current in dynamic speed variation, frictions are used to set acceleration /deceleration ramps and the stop point. If the user want to set the stop point in the long cut lengths it's necessary to set E29=1 and write in E30 the stop position referred to the centre of synchronous zone.

The drive goes in alarm with the following wrong setting:

Alarm A04 with **Code 0** = the max motor speed (P65) is too low compared with the maximum line speed (E06) with the current gear box ratio.
Alarm A04 with **Code 1** = the S-ramp rounding time (E09) are too high compared with acceleration ramps needed. Reduce the rounding time.
All this data are used by OPD to calculate the Cut Length Limit Characteristic with the Cut Length [mm] in the x-axis and the maximum speed line [m/min] in the y-axis.
The blue line represents the machine maximum working points and the red line represents the motor thermal limit.



The maximum speed line, function of cut length set, is available in the internal value **D65** [m/min], and the actual speed line is available in the internal value **D64** [m/min].

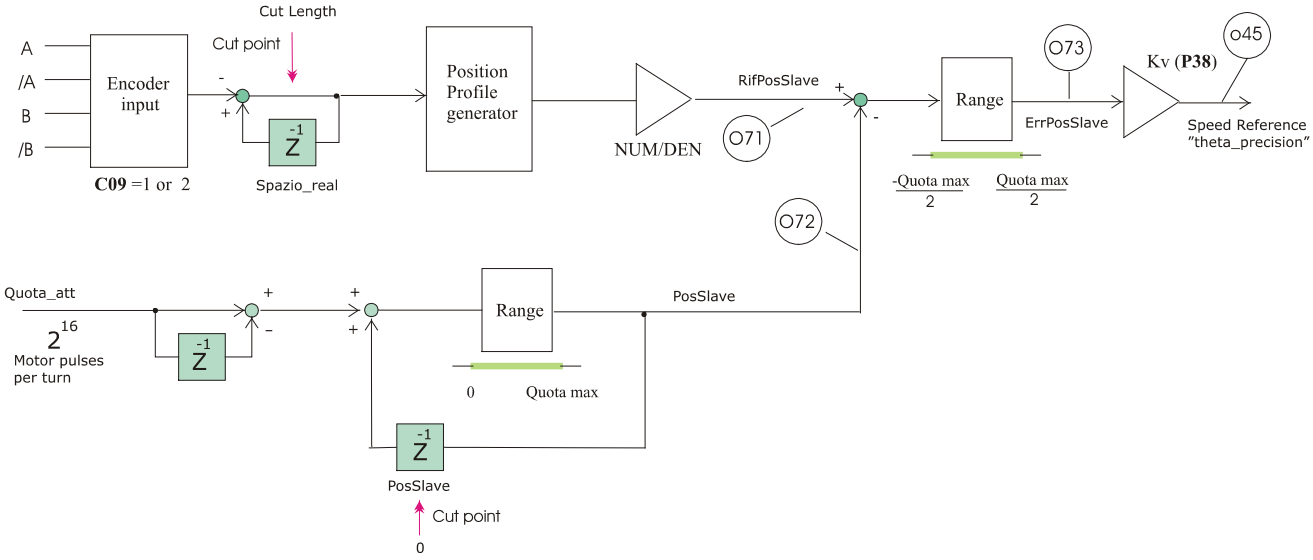
The actual speed cannot exceeds the maximum value admitted, on the contrary the cut doesn't be precise. The logic output function **o32** goes in active state if the speed line is too high and this is a critical warning signal.

2.1. SPEED AND TORQUE REFERENCES STANDARD FUNCTIONS

When the cut function is not enable and the drive is in run-state is possible to activate some basic functions like torque and speed reference.
Set the parameter **E34** (or activate **I03**) to enable the analog input, and **E33** to choose the meaning of the analog input (speed or torque reference for one of the analog inputs).
To enable the torque control the parameter **E41 (**or **I01**) must be set to yes, and working with **E40** is possible to change the torque reference filter time constant.
Jog speed reference can be enabled with the parameter **E37** (or **I05**) and speed reference jog value parameter is **E35.**

3. ROTARY CUT APPLICATION

The speed line is read by an incremental encoder that can be with four tracks (C09=1) or can be like frequency/sign (C09=2). Counted pulses are stored in the counter "**Spazio_real**" and are used by Profile generator to produce the position reference after gear box. Taking in account the gear box ratio, it's obtained the motor position reference "**RifPosSlave**" in motor pulses (65536=1 motor turn), available, at least in its less significant word, on monitor **O71** value.



The counter "**PosSlave**" store pulses read from motor feedback, limiting the range admitted between 0 and the maximum value (65536 x gear box ratio). It's possible to read the less significant word if this counter on monitor **O72**.

The motor position error "**ErrPosSlave**" is brought in the correct range (± a half of maximum value) and it's multiply to proportional gain **Kp = E45**, expressed with the following normalization:

"With Kp=1 the speed reference will be equal to maximum speed (P65) with a position error equals to the space course in one second at the maximum speed".

The position error is available in motor pulses on monitor **O73.**

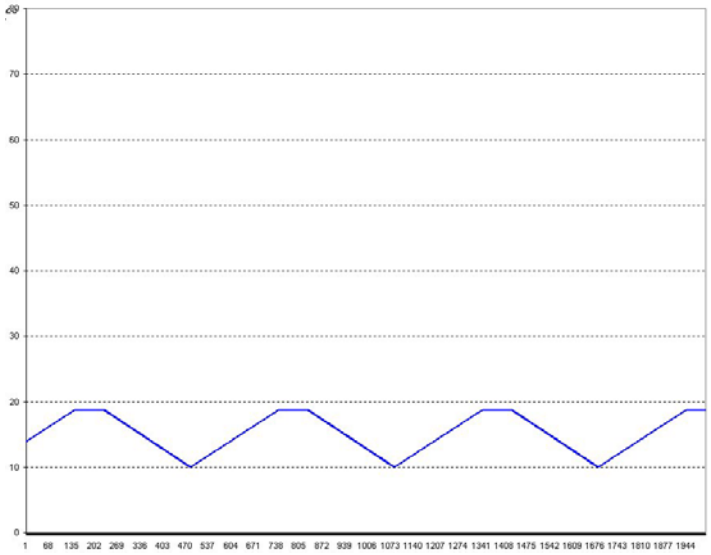
In order to minimize the position error it's very important to set in the best way also the speed regulator gains Kp=P31, Ta=P32 e Tf=P33 .

3.1. PROFILE GENERATOR

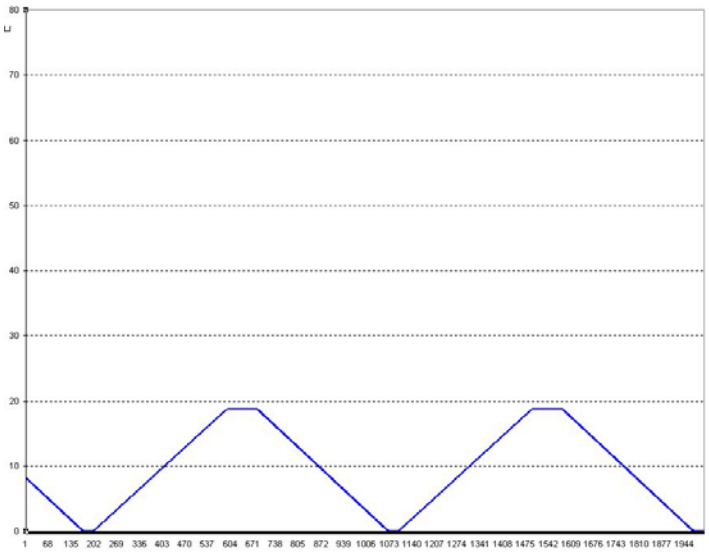
The “**Synchronous Cut Length**” correspond to knife circumference (**E00**) divided by synchronous over-speed (**E03**).

3.1.1. LONG LENGHTS

Cut lengths greater than Synchronous Cut Length are defined “**Long lengths**” and in this case the knife decelerates out of synchronous zone up to stop for very long lengths.
The point where the knife waits that material flow is defined “Stop point”.
The maximum line speed can be automatically reduced by the drive if the maximum acceleration available isn’t enough to stop the motor in the space available.



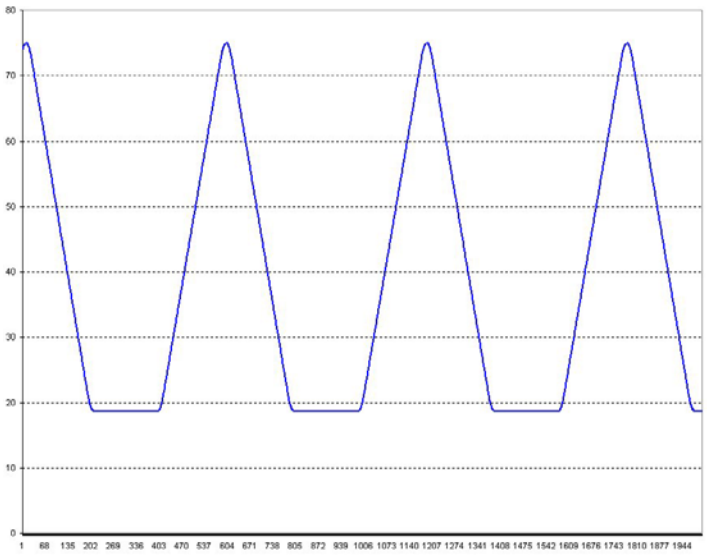
Long lengths without stop



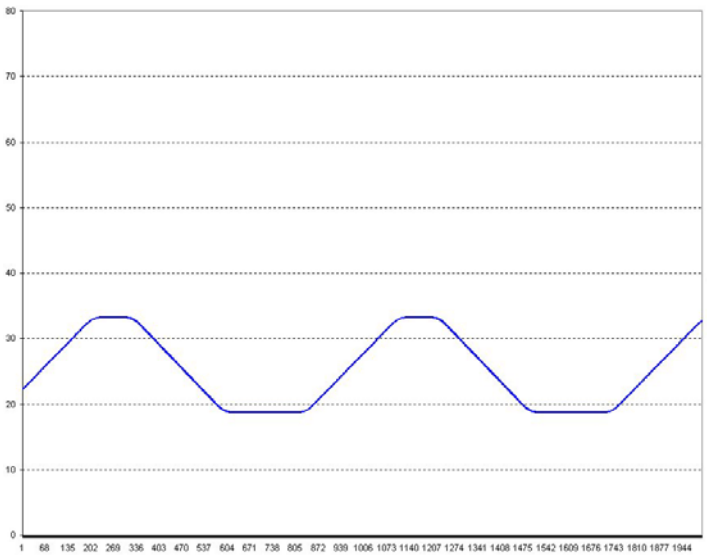
Long lengths with stop

3.1.2. SHORT LENGHTS

Cut lengths less than Synchronous Cut Length are defined "**Short lengths**" and in this case the knife accelerates out of synchronous zone up to maximum motor speed admitted (P65)..
Depending of maximum acceleration available the drive calculates the maximum speed line function of cut length.
There are two possible speed profile: one triangular and one trapezoidal. The second one is active if with the maximum line speed the motor reach the maximum motor speed admitted (P65).



Triangular short length



Trapezoidal short length

3.1.3. SPEED AND TORQUE

The drive produce always position, speed and torque profiles.
Position profile is necessary to give the reference to position loop (see par.3).
The speed and torque profiles are feedforward useful to increase the dynamic performance and therefore reduce the position error.

3.2. CUT TYPE

If the cut is only at constant length isn't necessary to synchronize the cut with material.
Clear **E14=0** to disable marker handling.
In the constant length cut is very important to be repeatable, for this reason after every cut the line counter "**Spazio_real**" starts again without memory of the past.
Like option is possible take into account the cut length error to compensate the next cut, setting **E28=1**.

3.3. MARK HANDLING

To enable the marker control set the parameter **E14=Yes** or **I26**

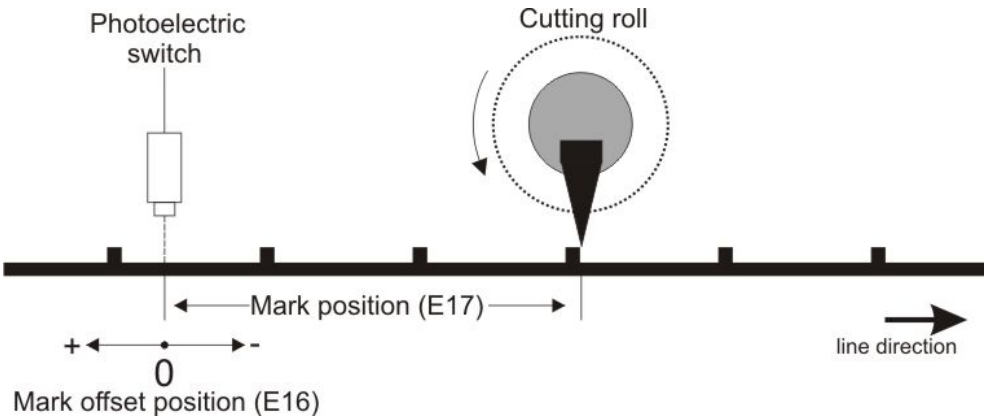
The drive cuts a specific position in relation to every mark detected but the cut length (E50-E51 or E52-E53) has to be the same of the current length detected by the mark (displayed in D82,D83).

E61 - Nr. marks between two cuts
With this parameter you decide how many marks there must be between two cuts. It should be set to "1" when there is only one mark on the cutting length. D84 displays the marks passed, once D84 reaches the set value of E61, the mark is considered valid for the phasing control and D84 is reset to 0.

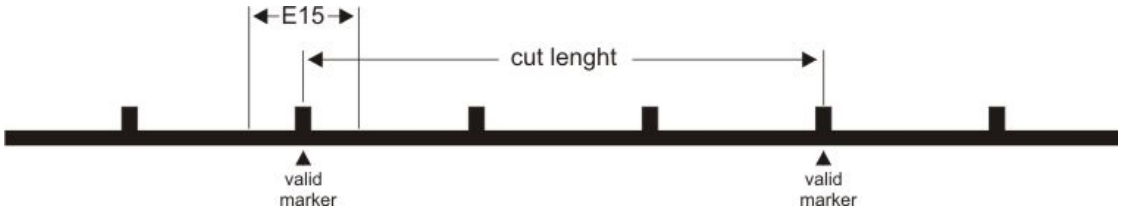
I27 - Reset mark counter
In case only a particular mark, must be considered valid, the unit can automatically neglect all the others marks. As long as the signal remains high is not considered no signal generated by the photocell (P.I.7 Marker Input); once the signal returns low the first marker is passed as valid.

E17 - Mark position
It is the position of the photoelectric switch (that read the marker) respect to the cut position. Range 0 ÷ 3000 mm.

E16 - Mark offset position
This parameter expresses you can make a precise correction of the cut position and the valid mark. Set in **E16** value in negative or positive, expressed in mm, of displacement from the zero photocell. Range between -1999.9 ÷ 1999.9.



E15 - Window to enable the detecting mark
With this parameter you define a window around the edge of the photocell. If the mark appears in this window is recorded. All this is viewed on the output O44. You must set this parameter (E15) to 0 if you do not use. See also the entry "Reset Counter Mark" (I27). Range 0 ÷ 3000.



Clarification:
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. also the cutting length) will change and no more exactly match the preset length, would also cause a slight displacement of the real cutting position with respect to the print mark. The **E62** parameter sets a number of cutting cycles where the cut must be out of tolerance (parameter **E60**) in always the same direction and consecutively. When reached, the length preset is automatically overwritten by the real length measured between the print marks and proportional position errors are eliminated.

E60 - Cut tolerance mark phasing
If the cut length is different from the marks length (D82-D83) a digital output is set “Cutting too short” (o42) or “Cutting too long” (o43), in this case a counter is incremented (D85). Every time D85 reaches the value of **E62** (**E62** and if greater than zero) an overwriting of the cut length is made with the new distance on D82-D83. Range 0 ÷ 1999.9. With D69 is possible to detect the error phasing mark.

E62 - Nr. Marks for overwrite length setting
This parameter defines the number of marks to be passed before the automatic overwriting. The range of values is from 0 to 9, if set to 0 there is no overwriting, if it is set 1, there’s an overwriting after one mark, etc…….

3.4. SPEED LINE MEASURE OR SIMULATION

With parameter **E21** it’s possible to select the speed line input:

E21	Speed line	Source
0	simulation	parameter **E22**
1	read by Encoder	Frequency input
2	read by tachometric dynamo	A.I.1
3	read by tachometric dynamo	A.I.2
4	read by tachometric dynamo	A.I.3

When the speed line is measured there is a first order filter on the measure.
The filter time constant can be set in milliseconds in parameter **E08**.

When the speed line measured is negative, the motor is stopped and the moving back space is accumulated, waiting that the line moves forward recovering this space.

3.4.1. SIMULATION

In this case it’s possible to set directly the speed line with parameter **E22** in m/min.

3.4.2. SPEED LINE READ FROM ENCODER

In this case the frequency input is used to read the speed line.

It's necessary to set in parameter **E48** the number of Encoder pulses per material meter. With connection C09 it's possible to choose a four tracks signal (**C09=1**) or frequency/sign (**C09=2**).
With parameter **E20** it's possible to invert the encoder input count.
It's also possible to enable the frequency input time decode with **E23=1.**
This function increases the speed line resolution allowing to reduce the first order filter (E08).

3.4.3. SPEED LINE READ FROM TACHOMETRIC DYNAMO

In this case the speed line is read from analog input A.I.3.
At maximum voltage input 10V corresponds the maximum speed line set in parameter **E06**.

3.5. REAL-TIME FAST-CAPTURE INPUT L.I.8

Are available two real-time fast-capture inputs for read the absolute position after gearbox and the marker to synchronize the cut with material

It's possible to see in the internal value **d69** the error measured when the marker is detected in degrees.

3.5.1. ZERO TOP CAPTURE WITH L.I.8

It's necessary to know exactly the absolute position after gearbox. For this reason it's used a zero TOP signal connected to logic input **L.I.8**.

Zero TOP will be detect on the rising edge of L.I.8 input. The zero TOP pulse width has to be at least 26us.

When the zero TOP is detected the position counter "**PosSlave**" is loaded with the value set in parameter **E12** in [degrees], that defines the Offset from zero TOP and cut point.

Read every turn the zero TOP position is the best and robust solution but sometimes the sensor used could be slow, in this case there will be an error in the absolute position, function of rotation speed.
For this reason it's possible to estimate the zero TOP position setting **E25=1**.
Also in this case the zero TOP is always read but the data isn't used to correct the position counter, there is a control on zero TOP error: if this error becomes great than maximum threshold set on
E27, the logic output function **o33** goes at high level.

It's possible to see in the internal value **D67** the error measured when the zero TOP is detected in degrees and in the internal value **D66** it's possible to see a zero TOP counter.

3.6. CUT LENGHT ACTIVE

This application allows setting up to two cut lengths in [mm] into parameters **E50-E51** and **E52-E53**.
It's possible to choose the active cut length with the logic input function I28:

- I28=L → Cut length A (E50-E51)
- I28=H → Cut length B (E52-E53)

It's possible to switch every time from one length to the other, the drive finish the actual cut after that change the new cut length.
Moreover it's possible to change on the fly also the active Cut length, so the drive starts to use the new cut length request as soon as possible.

4. AUXILIARY FUNCTIONS ROTARY CUT APPLICATION

To complete the Rotary Cut core, are been implemented some auxiliary functions needed to add some protections and to manage the first cut.

4.1. ROTARY CUT ENABLE AND HOMING

The Rotary Cut function is enabled switching on the drive power and activating the logical input function “Cut Enable” **I31**.

4.1.1. ROTARY CUT DISABLED

If the logical input function I01 isn’t active the rotary cut is disabled and the only way to control the motor in speed is give the digital speed reference **E35** in percent of maximum motor speed.
This digital speed reference can be enabled only with the parameter **E37**=1.

4.1.2. HOMING

The first time when the drive goes in run mode with rotary cut enables the Homing is automatically executed.

- Motor starts to run at speed set in parameter **E26,** in percent of maximum motor speed.
- The rotation goes on until the zero TOP is detected. After that the cut point is reached and than the knife is stopped on the stop point, about 180° far from synchronous zone centre.
- When the knife is stopped on the stop point starts the line speed measure and if the line is going also the knife starts to follow it.
- The First Cut Length, from stop point to cut point, is set in mm into parameter **E13**
- After first cut is used the cut length active in the next cut.

4.2. STOP POINT

The stop point in the long cuts is calculated in order to optimize speed and torque profiles, taking into account load frictions.
If the user want to set the stop point in the long cut lengths it’s necessary to set **E29=1** and write in **E30** the stop position referred to the centre of synchronous zone.
Force the stop point can produce a great limitation in the Cut Length Limit Characteristic.

4.2.1. INSTANTANEOUS CUT REQUEST

It’s possible to request an instantaneous cut with the logic input function **I29**.
This request is executed only if the speed line is great than minimum line speed in synchronous zone (**E24**) and the knife is in the stop point.

4.3. MINIMUM LINE SPEED IN SYNCHRONOUS ZONE

Could be dangerous to stop the line during a cut, when the knife is in the synchronous zone.
To avoid this risk, it’s implemented one protection function that works if the speed line in the synchronous zone falls under a minimum threshold set in **E24** in [m/min].
If the protection function works, the knife goes on at minimum speed E24 up to stop point.
At that point the knife waits that the line moves again recovering the space.

4.4. MATERIAL PRESENCE

The logic input function **I30** is needed to test the presence of material in the line.
If I30 goes at low level in automatic way is executed a long length cut and the knife is stopped in the stop point.
When the material comes back the first cut executed is the first Cut length set in parameter **E13.**

4.5. CUT LENGHTS STATISTICS

In the internal value **D68** can be shown he cut length error instantaneous.
Working on **E31** samples is available the average cut length error in **D71** in [mm].
In the internal values **D72** can be shown the maximum cut length error and in **D73** the minimum error.
Setting **E32=1** reset the maximum and the minimum value stored.

4.6. CRUSHING FUNCTION

The crashing function checks the positive torque reference for the knife, in a selectable range of position and activates an alarm if the torque is greater than a threshold.
The function can be enabled with the parameter **E57**. Working on parameters **E54** an **E55** is possible to set the minimum and maximum point for the position-range. If the knife is in the range position and the torque reference is greater than the threshold **E56** (in % of maximum motor torque), alarm **4.2-Cut Crushing** is generated.
The function can be enabled during the homing also. In this case **E57** activates the function and **E58** is the threshold (in % of nominal motor torque). For realize an homing without crushing-function is possible to set **E58** with a very high value (400%). The alarm for crushing during homing is the same seen before, **4.2-Cut Crushing**.
There are two logical output for crushing: **O40 – Warning Crushing** and **O41 – Zone Control Crush**.
These two output are always enabled even if the crushing function is not enabled.
O40 indicates that the torque reference is greater than the threshold (would be in alarm if activated) , **O41** indicates that the knife is inside the range-position for crushing.

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