LEROY SOMER

3787 en - 03.2006 / a

UNIDRIVE SP

Winding-unwinding solution with analogue references

Quick start commissioning guide

UNIDRIVE SP

Winding/unwinding solution with analogue references

•Incorrect operational procedures may cause serious body injuries or material damages. This guide may be used only by qualified personnel able to comply with the safety precautions related to electronic drives. See the installation and the commissioning manual that may be found on the CD ROM supplied together with the variable speed drive.

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Contents

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1 - GENERAL INFORMATION

The SP EDL ANA solution offers all winding/ unwinding functions maintaining a constant tension of the product.
It comprises :
- a UNIDRIVE SP variable speed drive,
- a SM-EDL ANA module.

Note : If the Winding-unwinding solution is managed by a field bus (use of a SM-Field bus module), see the complete manual that may be created from the CD Rom supplied together with the drive.

1.1 - Operating principle

The system operates exclusively in closed loop and it must be used with an asynchronous or with a synchronous motor with all types of encoders.
With an axial drive, in order to preserve a constant tension on the product, irrespective of the coil diameter, it is necessary that the torque produced by the motor increases proportionally to the radius.
The tension reference given by a potentiometer is applied through an analogue input.
By means of the line speed applied on another analogue input and of the angular speed issued from the encoder, a radius calculation is made.
The tension reference multiplied by the radius determines the torque that the motor must supply.

To refine the adjustment of the tension on the product, it is possible to compensate the losses without load (mechanical losses) and the inertia during the transient periods.

1.2 - Operating modes :

- speed adjustment : product threading,
- traction adjustment : winding or unwinding.

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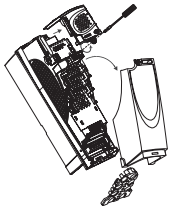
2 - SM MODULE INSTALLATION

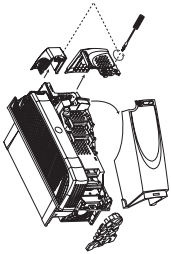
• The drive must be powered down.

2.1 - Access to terminal blocks

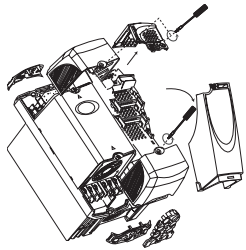
• Size 1



• Size 2

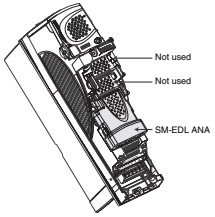


• Size 3 or 4



CAUTION :
Dismantle the internal RFI filter on a drive of size 3 or 4, powered by an IT mains supply. If an external RFI filter is used or an additional motor earth protection is used, it is not necessary to remove the internal filter.

2.2 - Module installation



- Install the SM-EDL ANA module in the lowest possible location and press gently on the module until hearing a click.
- If necessary, to dismantle a module, press at the same time on both sides of the module and remove it.

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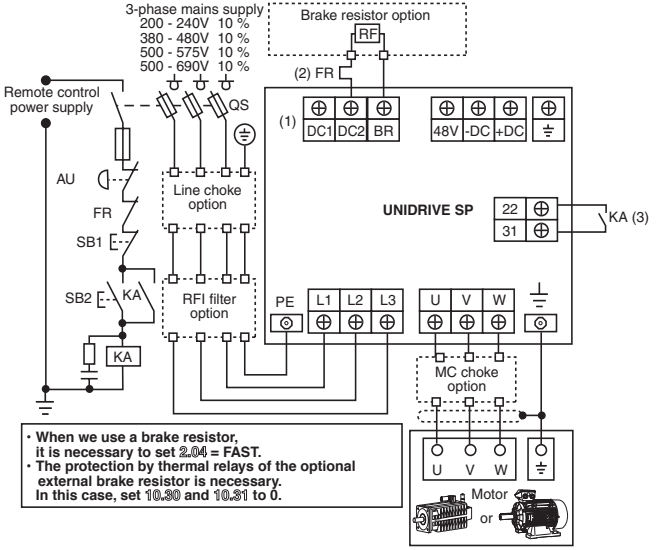
3 - CONNECTIONS

3.1 - Power connection

Power supply for an AC 3-phase mains supply, applicable to the safety standard EN 954-1 Categ. B or 1.

CAUTION :

Before making the power connection, be aware of the location of the drive terminal blocks (different depending on drive size). If necessary, see section D of the manual supplied together with the drive.



(1) For size 1, a single terminal block (48V, -DC, +DC, BR). Connect the resistor between +DC and BR.
(2) The thermal relay is not necessary for the resistors that may be integrated into the heater.
(3) Terminal 31 : safety input/disabling.
When this input is open, it disables the drive. Its conception is so that even in case of failure of one or many components, the absence of the torque on the motor shaft should be guaranteed with a very high level of integrity.

· For detailed instructions or for schemas according to the safety standard EN 954-1 category 2 or 3, see section D of the installation and commissioning manual that may be located on the CD ROM.

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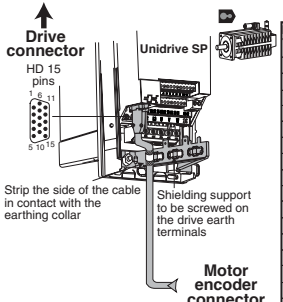
3.2 - Encoder connection

HD 15 drive	▣ and ▣ modes				
	Incremental	Sincos	Sincos - hiperface link	Sincos - EndAt or SSI link	EndAt or SSI
1	▣ : B or F ▣ : A or F	Cos	Cos	Cos	-
2	▣ : B\ or F\ ▣ : A\ or F\	CosRef	CosRef	CosRef	-
3	▣ : A or D or R ▣ : B or D or R	Sin	Sin	Sin	-
4	▣ : A\ or D\ or R\ ▣ : B\ or D\ or R\	SinRef	SinRef	SinRef	-
5	C or O or Z	-	Data	Data	Data
6	C\ or O\ or Z\	-	Data\	Data\	Data\
7	▣ : U	-	-	-	-
8	▣ : U\	-	-	-	-
9	▣ : V	-	-	-	-
10	▣ : V\	-	-	-	-
11	▣ : W	-	-	Clock	Clock
12	▣ : W\	-	-	Clock\	Clock\
13	+5V or +8V or +15V				
14	0V				
15	Motor thermal probe **CAUTION :** **Internal link pin 15 and terminal 8 of the drive. Connect one or another.**				



Example : encoder in quadrature

Ref.pct.	Designation
1	Motor thermal probe
2	
3	-
4	U
5	U\
6	V
7	V\
8	W
9	W\
10	A
11	C or O or Z
12	C\ or O\ or Z\
13	A\
14	B
15	B\
16	+5V or +8V or +15V
17	0V
Shielding (*)	

Ref.pct.	Designation
1	0V
2	+5V or +8V or +12V
3	A
4	B
5	C or O or Z
6	A\
7	B\
8	C\ or O\ or Z\
9	-
10	-
11	Shielding (*)
12	-

(*) Depending on the encoder supplier, the shielding may be different from that indicated in the table.
If there is no shielding terminal available, connect the shielding to 360° at the connector level.

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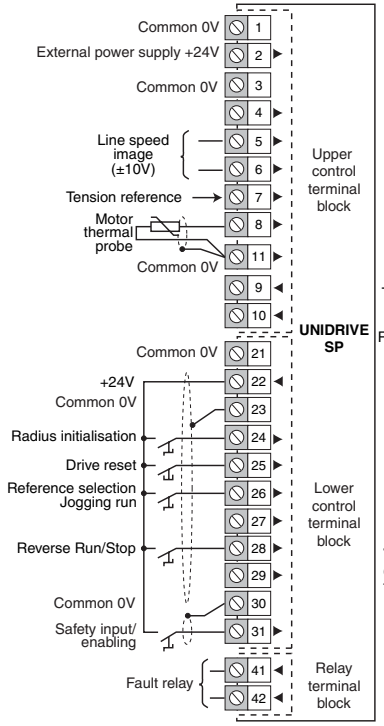
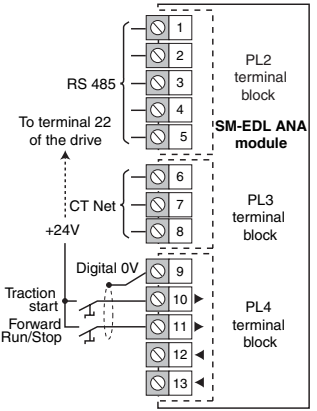
3.3 - Control connection

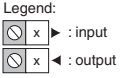




CAUTION:
If the motor probe is connected to pin15 of the HD-15 connector (see encoder connection), terminal 8 of the drive is no longer available.

• In factory settings, UNIDRIVE SP is set in positive logic. The association of a drive with a different command logic may cause the sudden start of the motor.

Legend:



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5	Line speed image input (±10V)
6	

7	Tension reference input

They are used to recover the data necessary to calculate the torque

10	Tension start input (SM-EDL ANA)

It gives the command of passage to torque adjustment

11	Forward Run/Stop input (SM-EDL ANA)

It gives the forward run or stop command

24	Radius initialisation input

It is used to initialise the radius after the loading of a coil

25	Drive reset input

It resets the drive faults

26	Jogging run input

It selects the run by jogging reference

28	Reverse Run/Stop input

It gives the reverse run or stop command

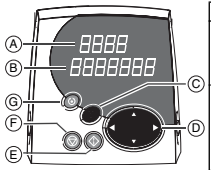
41	Relay output
42	

When the contact is open, the drive is powered down or stopped

4 - PARAMETER-SETTING

4.1 - Display and keyboard

•LED display

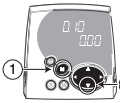
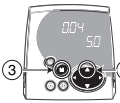
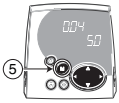
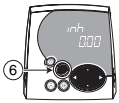


Ref.	Function
Ⓐ	It is used to display : - the drive operating status, - the adjustment parameters, menu and parameter numbers.
Ⓑ	It is used to display: - the operating mode, - the parameter content, - the trip state code.
Ⓒ	Mode key is used to pass from the normal mode to the parameter-setting mode.
Ⓓ	The 2 arrows are used to move under the lower display in order to modify its value or to move from one menu to another. The 2 arrows are used to display in an increasing or decreasing order the parmeters or their values.
Ⓔ Ⓕ Ⓖ	In keyboard mode, these keys are used for the commands : - Run, - Stop, drive reset, - Inversion of the direction of rotation.

•Indications on the operation

	Comment
Auto/tunE	Ongoing auto-tuning phase
dEC	Deceleration after a stop command
inh	- The drive is disabled, it may not start the motor - Free wheel stop
rdY	- The drive is enabled, it is wating for a command - The motor is ready to turn
run	The motor is controlled by the drive
StoP	The drive maintains the motor torque at zero speed
triP	The drive is stopped, it does not control any longer the motor. The trip state code is displayed on the lower display

4.2 - Selection and modification of a parameter

Action	Comment
	Power-up Disabled drive (terminal 31 opened) (initial status)
	① : Access to parameter-setting mode. The parameter **0.10** flashes. ② : The keys ▲ and ▼ are used to access the parameter to be modified. For instance, select parameter **0.04**.
	③ : Access to the parameter modification. The parameter number does not flash any longer. Its value is indicated on the the lower display (the lowest value digit flashes). ④ : Maintain the key pressed in order to display quickly the parameter value. The final adjustment is made by quick presses on the same key. For more quickness, we may move to modify the other digits by ◄ or ►.
	⑤ : The new value of **0.04** is stored Press ▲ or ▼ in order to select a new parameter to be modified.
	⑥ : Return to the initial status of the drive.

Note : In parameter-setting mode, if the user stops inputs for 4 minutes, the display stops flashing and returns automatically to the initial status of the drive.

4.3 - Access level

In factory settings, only menu 0 is accessible by the user (parameters **0.00** to **0.50**).
To access other menus :
- select the parameter **0.49** : its value is L1,
- modify its value of **0.49** to " L2 ". The left and right arrows of the keyboard are active at present, and the menus 1 to 22 are accessible (parameters **1.01** to **22.29**).

4.4 - Modification of the operating mode

Parameter	Settings	Description	Validation
0.00	**1253**	European configuration, mains supply of 50 Hz	Press the Reset key
	or	or	
	1254	USA configuration, mains supply of 60 Hz	
0.48	**OPEn LP (1)**	**Open loop**	
	or	or	
	CL VECt (2)	Vector control in closed loop with asynchronous motor	
	or	or	
	SErVO (3)	Servo mode with Brushless motor	
	or	or	
	rEgEn (4)	Regenerative mode (not used)	

• This procedure of modification of the operating mode causes the return to factory settings of the parameters corresponding to the new mode, including the motor parameters (it is necessary to set the motor parameters before starting). The modification of the operating mode must be made with the variable speed drive stopped or disabled.

• Before following this procedure, check that the system safety is adequate.

4.5 - Return to winding/unwinding factory settings

Parameter	Settings	Description	Validation
0.00	**1233**	European factory setting configuration (50 Hz)	Press the Reset key
	or	or	
	1244	USA factory setting configuration (60 Hz)	
0.29	**2047**	**EDL ANA program initialisation.** **The value 2047 is not visible on the display that passes from 2046 to 0.** **The return of 0.29 to 0 indicates that the program initialisation is performed.**	-

• Check that the motor is stopped and that the system safety is adequate.

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5 - COMMISSIONING

Powered down drive, check that…

- The drive is disabled
- The run command is not validated
- The motor and the encoder are connected

↓

Drive power-up

- The drive displays " inh "
- If the drive displays "trip", see art. 7 " diagnostics "

↓

Operating mode selection

- **0.00** : enter the value 1253 for an European configuration (mains supply 50 Hz) or enter the value1254 for an USA configuration (mains supply 60 Hz)
- **0.48** : enter the mode CL.VECt ■ (2)for the asynchronous motor or SerVO ➡ (3) for the servo motor
- Press the Reset ⊛ key

↓

SM-EDL ANA program initialisation

- **0.29** : enter the value 2047

↓

Enter the motor parameters indicated on the nameplate

- **0.42** : Poles [Auto (0), 2POLE (1), 4POLE (2), 6POLE (3) etc…]
- **0.43** : Power factor (cos φ) ■
- **0.44** : Motor rated voltage (V) ■
- **0.45** : Rated speed with load (min^{-1}) or ■ motor thermal time constant ➡ (see the motor catalogue)
- **0.46** : Motor rated current (A) ■ / Stall current (A) ➡
- **0.47** : Motor rated frequency (Hz) ■
- **0.49** = L2 (1) then **5.08** : motor speed ➡

Pay attention to the motor connection (star or delta)

↓

Incremental encoder :
- in quadrature, 5V
- 1024 points/rev ■ or 4096 points/rev ➡ ?

NO → (E)

To enter the encoder characteristics, see page 17

YES ↓ (A)

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A

YES — Possibility to disconnect the motor ? — NO

Auto-tuning with rotation

• Check that the motor is stopped and disconnected from load.
• Check that there is no danger for persons and goods.
• Once the procedure has ended, the motor will automatically stop in free wheel.
• The procedure may be interrupted at any moment by a stop command, by pressing the stop button of the keyboard, or by activating the disable circuit.
• Irrespective of the reference and of the direction of rotation required, the auto-tuning procedure drives the motor clockwise at 2/3 of its rated speed.
• Irrespective of the reference and of the direction of rotation required, the motor performs 2 low speed turns.

: Full measurement of the motor characteristics and adjustment of the current loop gains.

: Measurement of the phase angle of the slave encoder (**0.43**), and setting of the current loop gains.

• **0.40** : set to 2.
• Enable the drive (close B31).
• Give a run command (close B28).
• The motor starts rotating. Wait for the full stop.
Disable again the drive, and suppress the run command (open B31 and B28).
Connect the motor to the load.

Auto-tuning without rotation (only)

: Reduced measurement of the motor characteristics and adjustment of the current loop gains.
Check that the motor is stopped before proceeding to auto-tuning.

• **0.40** : set to 1.
• Enable the drive (close B31).
• Give a run command (close B28).
The drive displays alternately " AutO " then" tunE " during the auto-tuning phase.
• Disable again the drive, and supress the run command (open B31 and B28).

CAUTION:
This auto-tuning mode does not allow the checking of the adequate connection between encoder and motor (no detection of inversion or phase breaking).

B

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B

Enter the values of the parameters essential for the application

- **0.16** : Set the mode : Winder = 1, Unwinder= 0.
- **0.19** : Set the reference - pulse input in min^{-1}.
- **0.20** : Set the maximum line speed in $m.min^{-1}$ x 10.
- **0.21** : Set the initialisation radius in mm.
- **0.22** and **0.23** :
  Set the minimum and maximum ray of the coil in mm.
- **0.28** : Set the plated motor power in kW x 100.
- **0.27** : Set the total mechanical reduction (motor/driving shaft) x 100.
- **0.26** : Set the maximum traction (T_{max}) in Newton.
- **0.25** : Set the minimum traction in max traction percentage (set in **0.26**) x 10.
- **0.24** : Traction when stopped. Set a tension reference percentage after limitations (limited by **0.26** and **0.25**).

CAUTION:
The relation between max ray / min ray must not exceed 15.

Storing

- **0.00** : Enter the value1000
- Press the Reset key

C

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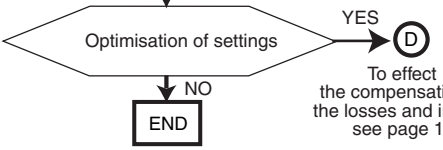
C

Commissioning

Tests without load : this operating mode is used for the product threading.
- Enable the drive (terminal 31 active).
- Jogging operation :
  - Fwd run (close terminal 26 of the drive, then terminal 11 of SM-EDL ANA),
  - Rev run (close terminal 26, then terminal 28 of the drive).
- The parameter **0.10** indicates the motor speed.

Product tests :
- After the product use, disable the drive (open terminal 31).
- Check that the line servo-control is active in order to retain the product.
- Initialise the radius by a pulse on the terminal 24 (obligatory initialisation after each coil changing or after a drive fault).
- Enable the drive (close terminal 31).
- Activate terminal 10 of SM-EDL ANA to validate the tension and terminal 11 (SM-EDL ANA) or 28 (drive) for the direction of rotation.
- The tension is set by the analogue reference (terminal 7 of the drive).
- The following parameters give operation-related indications :
  0.10 : Motor speed measurement in min^{-1},
  0.11 : Product radius in mm,
  0.12 : Line speed x 0.1 $m.min^{-1}$,
  0.13 : Traction reference after limitation in Newton,
  0.14 : Slow shaft rated torque C_{max} (x0.1N),
  0.15 : Control of C_{max}/C_n in %.

CAUTION :
Depending on the product characteristics, an optimisation of the settings may be necessary.



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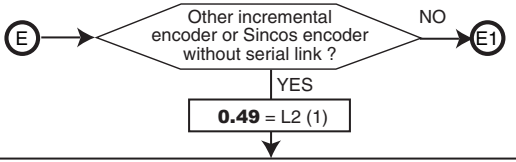
•If the encoder is not a standard LEROY-SOMER incremental encoder, follow the indications below:



Enter the encoder characteristics

- **3.34** : **ELPR (0 to 50000)**
  Quadrature : enter the number of points by revolution.
  Frequency/direction or forward/reverse : enter the number of points by revolution divided by 2.
  Sincos : enter the number of sinusoids by revolution.
- **3.36** : **Voltage**
  Enter the encoder power supply voltage : 5V (0) or 8V (1) or 15V (2)
  CAUTION:
  Feeding an encoder with an excessive voltage can damage it.
- **3.38** : **Type**
  Enter the type of encoder used : Ab (0) : quadrature encoder
  Fd (1) : frequency-direction
  Fr (2) : fwd-reverse
  Ab.SErvo (3) : quadrature encoder + communication paths
  Fd.SErvo (4) : frequency-direction + switching paths
  Fr.SErvo (5) : fwd-reverse + switching paths
  SC (6): SinCos encoder without serial link

A

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E1

0.49 = L2

Enter the encoder characteristics

SinCos encoder with Hiperface or EndAt serial link or EnDat encoder	Sincos encoder with SSI link or SSI encoder
• **3.41** : **Auto-configuration** Enter the On (1) value for an auto-configuration of the encoder parameters when powering up (**3.33**, **3.34** and **3.35**). • **3.36** : **Voltage** Enter the encoder power supply voltage: 5V (0) or 8V (1) or 15V (2). **CAUTION:** **Feeding an encoder with an excessive voltage can damage it.** • **3.37** : **Transmission speed** Enter the serial link speed (save for SinCos encoder with Hiperface link) : 100 kbauds (0), 200 kbauds (1), 300 kbauds (2), 400 kbauds (3), 500 kbauds (4), 1000 kbauds (5), 1500 kbauds (6), 2000 kbauds (7), 4000 kbauds (8). • **3.38** : **Type** Enter the type of encoder used : SC.Hiper (7) : SinCos with Hiperface, EndAt (8) : EndAt, SC.EndAt (9) : SinCos with EnDat link.	• **3.41** : **Selection of SSI format** Enter the OFF (0) value to select the Gray SSI code format. Enter the On (1) value to select the SSI binary format. • **3.33** : **number of turns (number of bits)** Enter the maximum number of encoder turns.Ex. : if **3.33** = 5, the maximum number of turns will be of 2^5. • **3.35** : **Resolution (number of bits)** Enter the resolution of the serial link (number of bits used to represent an encoder turn). • **3.36** : **Voltage** Enter the encoder power supply voltage : 5V (0) or 8V (1) or 15V (2). **CAUTION:** **Feeding an encoder with an excessive voltage can damage it.** • **3.37** : **Transmission speed** Enter the link speed : 100 kbauds (0), 200 kbauds (1), 300 kbauds (2), 400 kbauds (3), 500 kbauds (4), 1000 kbauds (5), 1500 kbauds (6), 2000 kbauds (7), 4000 kbauds (8). • **3.38** : **Type** Enter the type of encoder used : SSI (10) : SSI encoder, SC.SSI (11) : SinCos with SSI link.

A

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•Compensation of losses and of inertia

D

0.49 = L2

Manual measurement of losses

Make the measurements by means of a coil without load.
- Set **19.44** = 1 to validate the measurement of losses.
- Activate terminal 10 (SM-EDL ANA) to validate the tension normal mode.
- Validate the run command of the line (terminal 11 SM-EDL ANA), the drive displays " run " and the motor must remain stopped.
- In order to draw the torque curve = f (speed), find the torque value (**20.28**) and the speed value (**0.10**), as follows :
- by means of the drive keyboard, increase very slowly the value of **20.28** (torque reference) until the moment when the motor starts to turn,
- display this value
- increase from about 10 to 10 points the torque in **20.28** and display the related speeds in **0.10** until obtaining the maximum speed (read in **19.21**).

CAUTION:
After having modified 20.28, select quickly the parameter 0.10 and display immediately its value.
In fact, the drive will try to increase the motor speed, and 0.10 steps.
- Set **19.44** = 0 and **20.28** = 0 to return to the normal operation.
- Draw the torque curve = f (speed). Determine 4 ref. points A, B, C and D (breaks), according to the example below.

The speed and the level of the torque corresponding to each break must be set:
- point A : the zero speed is considered for this point; set the torque in **19.16**,
- point B : set the speed in **19.17** and the torque in **19.18**,
- point C : set the speed in **19.19** and the torque in **19.20**,
- point D : set the torque in **19.22**. The speed is automatically considered for this point by the parameter **19.21**.

To activate the compensations, set **19.37** = 1.

D1

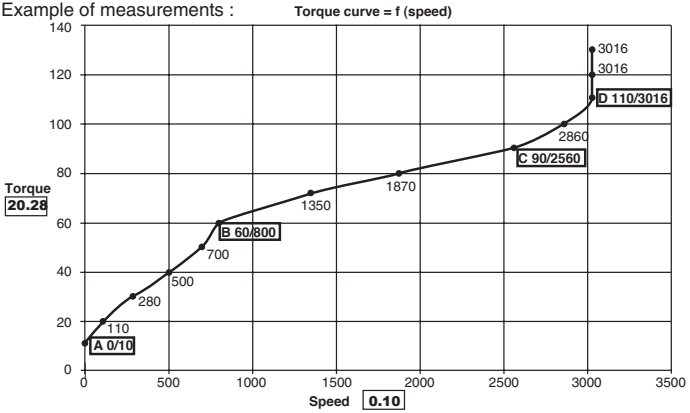
UNIDRIVE SP

Winding/unwinding solution with analogue references

D1

Manual measurement of losses (continued)

Example of measurements :



Programming for the example described above :

	Torque		Speed	
A	**19.16**	10	Zero speed	
B	**19.18**	60	**19.17**	800
C	**19.20**	90	**19.19**	2560
D	**19.22**	110	**19.21**	Max speed

D2

UNIDRIVE SP

Winding/unwinding solution with analogue references

D2

Inertia calculation

- If the voluminal mass and the coil width are known, set their value (in kg/m^3 x 10 and in mm) respectively in **18.28** and **20.36**, then set **18.35** = 0.
- Otherwise, set the product weight (kg x 10) in **18.13** and set **18.35** = 1.
- Validate the inertia compensations by setting **19.36** = 1.

Storing

- **0.00** : Enter the value 1000
- Press the Reset key

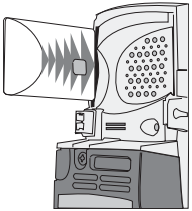
END

UNIDRIVE SP

Winding/unwinding solution with analogue references

6 - SMARTCARD

SMARTCARD is supplied in standard version together with UNIDRIVE SP.
It is used to save the drive parameters on SMARTCARD, or to load parameters in the drive by means of SMARTCARD.



• Drive saving

Parameter	Settings	Description	Validation
0.00	1000	Storage of all the drive parameters	Press the Reset key
0.30	Prog (2)	Storage of the drive parameters on SMARTCARD	Press the Reset key After the transfer, **0.30** returns to 0.
0.29	3333	Storage of the drive parameters on SMARTCARD (menus 20, 70 and 71)	Press the M key

• SMARTCARD loading

Parameter	Settings	Description	Validation
0.30	REAd	Loading of the SMARTCARD parameters into the drive	Press the Reset key After the transfer, **0.30** returns to 0.
0.29	6666	Loading of the SMARTCARD application parameters into the drive (menus 20, 70 and 71)	Press the M key

7 - DIAGNOSTICS

• **Indications on winding-unwinding** (read only parameters) :

Parameter	Indication	Unit
0.10	Measured motor speed	min^{-1}
0.11	Product radius	mm
0.12	Line speed	x 0.1 $m.min^{-1}$
0.13	Tension reference after limitation	N
0.14	Slow shaft rated torque	x 0.1 N
0.15	Control of C_{max}/C_n	%

• **Indications on trip state**

If the drive stops, the output bridge of the drive is inactive and the drive does not control any longer the motor.

The upper display indicates " triP " and the lower display indicates the fault type.

Mnemonic display	Winding-unwinding fault	Solution
t125	Radius calculation fault or product breaking	• The product is broken or is is not correctly held by the by the tractor (sliding) • Check the product condition or the adjustment regarding the band breaking **20.27**
th	Motor thermal probe	The EDL ANA solution manages the motor thermal probe in standard version. If there is no probe connected, set **0.49** = L2 (1), then **7.15** = Volt (6). If the probe is connected, the motor temperature is too high.

Note : For the other drive faults, see section K of the commissioning manual that may be set from CD-ROM.

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• Terminal block configuration

	Function	Terminal	Source/Dest.	Digital inversion	Assignment
UNIDRIVE SP	Line speed image	5 and 6	**7.10**	**7.09**	**18.20**
	Tension reference	7	**7.14**	**7.13**	**18.21**
	Radius initialisation	24	**8.21**	**8.11**	**19.32**
	Drive reset	25	**8.22**	**8.12**	**10.33**
	Jogging run	26	**8.23**	**8.13**	**19.42**
	Free	27	**8.24**	**8.14**	**-**
	Reverse Run/Stop	28	**8.25**	**8.15**	**19.48**
	Free	29	**8.26**	**8.16**	**-**
SM-EDL ANA	Tension start	10	**-**	**-**	**19.33**
	Forward Run/Stop	11	**-**	**-**	**19.47**
	Band end signal	12	**-**	**-**	**19.38**
	Band end stop	13	**-**	**-**	**19.39**

Notes

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MOTEURS LEROY-SOMER 16015 ANGOULÊME CEDEX - FRANCE

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