Nidec

All for dreams

Quick start commissioning guide

Unidrive SP

Positioning Solution

Part number : 3773 en - 2017.11 / c

LEROY-SOMER™

•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.

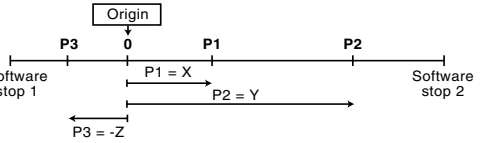
1 - GENERAL INFORMATION

The SP POS solution offers all with positioning application functions.
It comprises :
- a UNIDRIVE SP variable speed drive,
- a SM-POS module,
- a SM-I/O module.

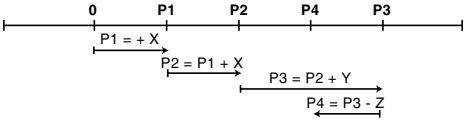
Note : If the Positioning solution is managed by a field bus (use of a SM-Field bus module in stead of a SM-I/O module), see the complete manual, that may be created from the CD Rom supplied together with the variable speed drive.

1.1 - Absolute mode/relative mode

The positioning mode depends on the origin chosen.
Absolute mode :



Relative mode :



1.2 - Origin cycling on reference sensor

In standard version, a reference sensor must be mounted onto the installation and it will allow the location of the origin position.

1.3 - Stops

Two software stops allow the limitation of the travel of the mobile to be positioned (used in absolute mode).

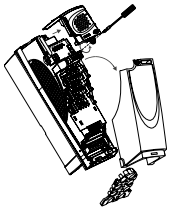
• For safety, end of travel switches must be installed between the software stops and the mechanical system limits.

2 - SM MODULE INSTALLATION

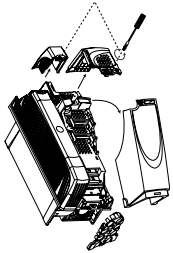
• The drive must be powered down.

2.1 - Access to terminal blocks

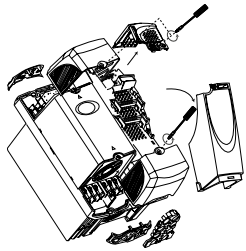
• Size 1



• Size 2

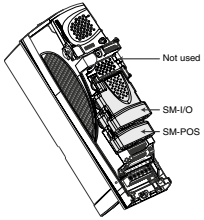


• Size 3 or 4



CAUTION :
Dismantle the internal RFI filter on a drive of size 3 or 4, powered by a mains supply without earthing (IT 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-POS module in the lowest possible location and press gently on the module until hearing a click.
- Then, proceed in the same way as regards the SM-I/O module in the middle location.
- If necessary, to dismantle a module, press at the same time on both sides of the module and remove it.

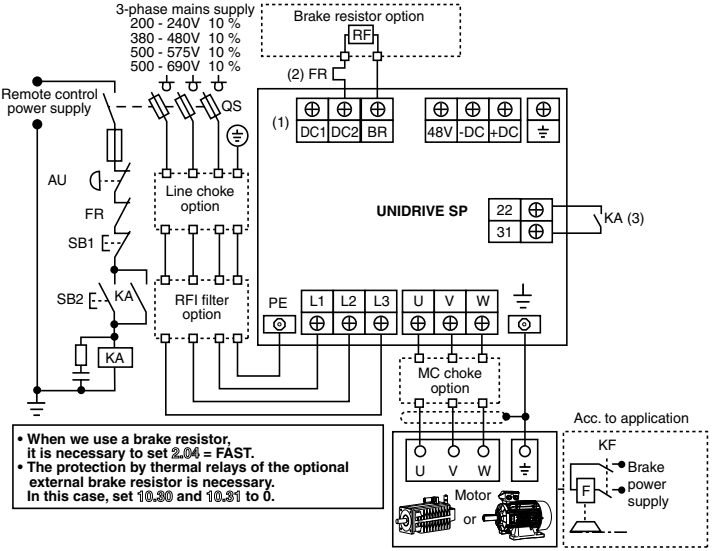
3 - CONNECTIONS

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.

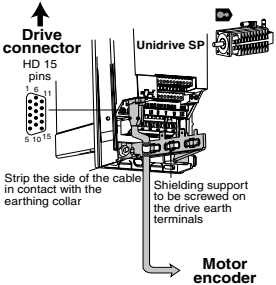


(1) For size 1, a single terminal block (48V, -DC, +DC, BR). Connect the resistor between +DC and BR.
(2) The thermal relay is not necessary for the resistors that may be integrated into the heater.
(3) Terminal 31 : safety input/disabling.
When this input is open, it disables the drive. Its conception 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 is located on the CD ROM.

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	Cos	Cos	Cos	-
	: A or F				
2	: B\ or F\	CosRef	CosRef	CosRef	-
	: A\or F\				
3	: A or D or R	Sin	Sin	Sin	-
	: B or D or R				
4	: A\ or D\ or R\	SinRef	SinRef	SinRef	-
	: B\ or D\ or R\				
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.**				



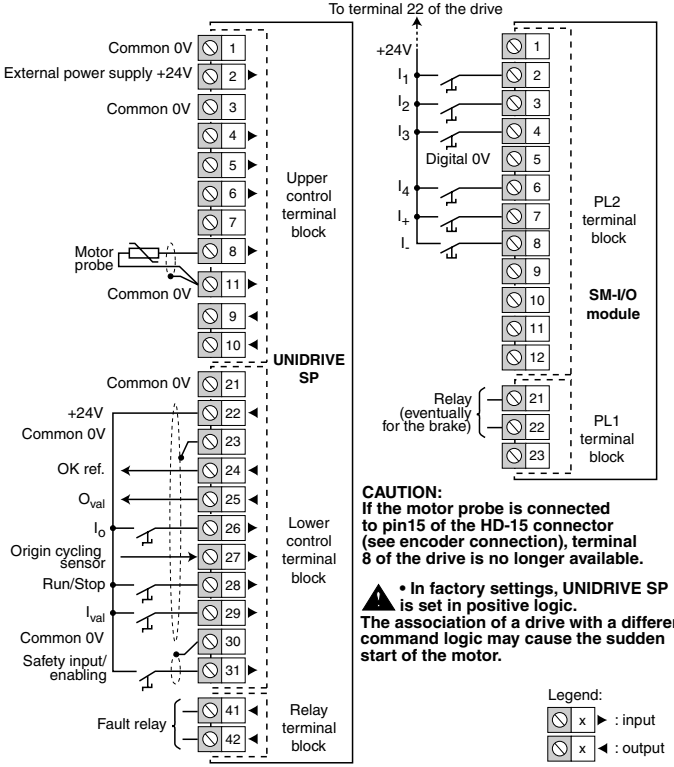
Example : encoder in quadrature

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 orZ
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.

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:
x ▶ : input
x ◀ : output

2 **3** **4** **6**	I_1 to I_4 inputs (SM-I/O)
They are used for the selection of an encoded or direct mode position	

7 **8**	I_+ and I_- inputs (SM-I/O)
They control the manual movement of the mobile, at a low speed	

24	OK ref. output
The origin cycling has been correctly effected. It allows the authorisation of the positioning commands.	

25	O_{val} output
The mobile reached the required position	

26	I_o input
It gives the command to proceed to an origin cycling	

27	Reference cycling sensor input
Sensor necessary to set the positioning origin in absolute mode	

28	Run/Stop input
It gives the Run or Stop command	

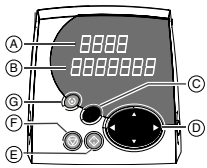
29	I_{val} input
It validates the position command in encoded mode As the position selection is made by I_1 - I_4 inputs, I_{val} allows the authorisation of the movement once the selection is ended	

41 **42**	Relay output
When the contact is open, the drive is powered down or stopped	

4 - PARAMETER-SETTING

4.1 - Display and keyboard

• LED display

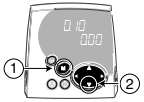
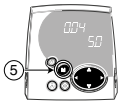
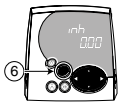


Ref.	Function
Ⓐ	It is used to display : - the drive operating status, - the adjustment parameters, menu and parameter numbers.
Ⓑ	It is used to display: - the operating mode, - the parameter content, - the trip state code.
Ⓒ	Mode key is used to pass from the normal mode to the parameter-setting mode.
Ⓓ	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 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 or 1254	European configuration, mains supply of 50 Hz or USA configuration, mains supply of 60 Hz	Press the Reset key
0.48	OPEn LP (1) or CL VECt (2) or SErVO (3) or rEgEn (4)	**Open loop** or Vector control in closed loop with asynchronous motor or Servo mode with Brushless motor or 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 positioning factory settings

Parameter	Settings	Description	Validation
0.00	1233 or 1244	European factory setting configuration (50 Hz) or USA factory setting configuration (60 Hz)	Press the Reset key
0.29	2047	**Positioning 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.

5 - COMMISSIONING

Powered down drive, check that…

- The drive is disabled
- The run command is not validated
- The motor and the encoder (and the brake if necessary) 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-POS program initialisation

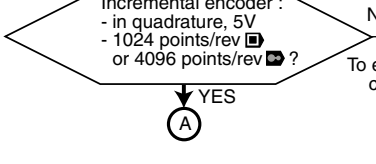
- 0.29 : enter the value 2047

After initialisation, 0.29 returns to 0

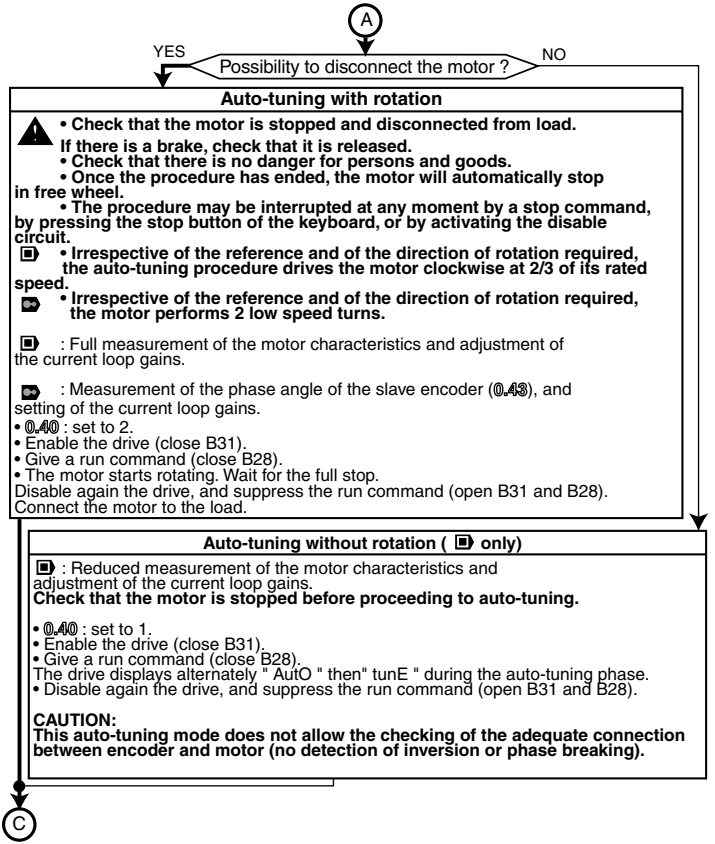
Enter the motor parameters indicated on the nameplate

- 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) ■

Pay attention to the motor connection (star or delta)



To enter the encoder characteristics, see page 18


A
YES
Possibility to disconnect the motor ?
NO
Auto-tuning with rotation
• Check that the motor is stopped and disconnected from load.
If there is a brake, check that it is released.
• 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 suppress 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).
C

C

Inertia measurement

• Check that the motor is stopped.
• Check that there is no danger for persons and goods.
• Once the procedure ends, 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.

• 0.40 : set to 3.
• Enable the drive (close B31).
• Give a run command (close B28).
The motor performs several rotations of 1/3 to 2/3 of the rated speed.
Wait for the full stop.
Disable again the drive, and suppress the run command (open B31 and B28).
Note : for optimisation of the speed loop gains, inertia measurement is necessary. For more explanations, see the parameter explanation manual ref. 3655 (parameter 3.17) available on CD Rom.

0.49 = L2 (1)

Origin cycling

Manual movement :
This manual operation is used to control the mechanics and the brake release.
• Enable the drive,
• Activate the I_+ or I_- input : the mobile moves motor clockwise (I_+) or motor counterclockwise (I_-) at the low speed set in 0.16.

Control of the mobile direction for the origin cycling :
During the origin cycling, the mobile will move to the same direction as when I_+ is activated, searching the sensor. If the mobile does not move to the adequate direction (moving away from the sensor), enter On (1) in 18.32.

Origin cycling :
• Give a run command,
• Activate the I_O input: the mobile moves to the reference sensor, decelerates since the detection of the sensor forward side, moves slowly backward and stops on the sensor reverse side. The origin cycling is over.
• Deactivate the run command and I_O.
• To make sure that the origin cycling has been correctly performed, check that 0.14 "OK ref." indicates On (1). If 0.14 = OFF (0), restart the procedure.

D

D

Automatic scaling

This scaling allows the drive to define the relation between the customer unit and the motor rotation.
- Move the mobile to a position known by means of I_+ or I_-.
- Validate the beginning of the scaling procedure by entering On (1) in **18.31**.
- Move the mobile to another known position by means of I_+.
- Enter in **0.28** the movement value in customer units (ex: the value 100 to express 100 cm or 100 mm).
- Enter **18.31** = OFF(0) to end the scaling procedure.

All positions will be expressed in user unit defined by this procedure.

Position setting

- **0.21** : Selection of the position to be set, for instance position n°1 (P1), that is **0.21** = 1.
- **0.22** : enter the value of the position in customer unit,
- **0.23** : enter the positioning type (OFF (0) : absolute mode, On (1) : relative mode) to reach P1,
- **0.24** : enter the maximum movement speed to reach P1 (min^{-1}),
- **0.25** : enter the acceleration ramp to reach P1 (1/100s for 1000min^{-1}),
- **0.26** : enter the deceleration ramp to reach P1 (1/100s for 1000min^{-1}).

Select a new position by **0.21**, and restart the procedure for each position.

• Check that the motor and the machine may withstand the maximum selected speed.

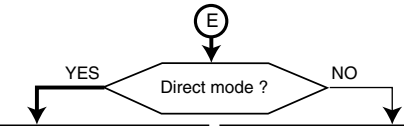
Setting of software stops

- The software stops are activated in factory settings. If they are not necessary (relative mode), enter OFF (0) in **19.34**.
- If the stops are necessary (check that **19.34** is set to On (1)), enter the limit A in **19.27** and the limit B in **19.28** (expressed in customer unit, in relation to the origin).

Storing

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

E



Direct mode

- Give a run command.
- Activate an input to give a position command to the mobile :

I_1	I_2	I_3	I_4	Position
0	0	0	0	**0**
1	0	0	0	**1**
0	1	0	0	**2**
0	0	1	0	**3**
0	0	0	1	**4**

Note : When all the I_1 to I_4 inputs are deactivated, no position is selected.
• To stop the system, deactivate I_1 to I_4, then suppress the run command.

Encoded mode (without parity)

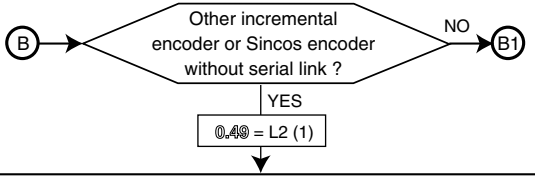
- **19.40** : enter On (1), to select the encoded mode.
- Store: **0.00** = 1000 + Reset
- Select a position by I_1 to I_4, then activate I_{val} to validate the position command.

I_1	I_2	I_3	I_4	Position
0	0	0	0	**1**
1	0	0	0	**2**
0	1	0	0	**3**
1	1	0	0	**4**
0	0	1	0	**5**
1	0	1	0	**6**
0	1	1	0	**7**
1	1	1	0	**8**
0	0	0	1	**9**
1	0	0	1	**10**
0	1	0	1	**11**
1	1	0	1	**12**
0	0	1	1	**13**
1	0	1	1	**14**
0	1	1	1	**15**
1	1	1	1	**16**

- To stop the system deactivate I_{val} and remove the run command.

Disable the drive (open the terminal 31)

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) : forward-reverse
  Ab.SErvo (3) : quadrature encoder + communication paths
  Fd.SErvo (4) : frequency-direction + switching paths
  Fr.SErvo (5) : forward-reverse + switching paths
  SC (6) : SinCos encoder without serial link

A

In order to proceed to commissioning, resume page 14

B1

0.49 = L2

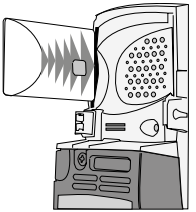
Enter the encoder characteristics	
SinCos encoder with Hiperface or EndAt serial link or EnDat encoder	**Sincos encoder with SSI link or SSI encoder**
• 3.41 : **Auto-configuration** Enter the On (1) value for an auto-configuration of the encoder parameters when powering up (3.33, 3.34 and 3.35). • 3.36 : **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 link, 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

In order to proceed to commissioning, resume page 14

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 positioning parameters into the drive (menus 20, 70 and 71)	Press the M key

7 - DIAGNOSTICS

• Indications on positioning (read only parameters) :

Parameter	Indication	Unit
0.10	Measured motor speed	min^{-1}
0.11	Mobile real position	Customer unit
0.12	Position error	Customer unit
0.13	Selected position	No. position
0.14	OK ref.	-
0.15	O_{val} reached position	-

• 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	Positioning fault	Solution
t080	Load backdriving	Motor setting-related problem or mechanical problem, the load drives the motor
t081	Speed difference	• Speed error higher than the value in 20.35 (speed error reference) • Gain setting-related problem, or too low 20.35 parameter
t082	Pursuit error	Inadequately set position loop gain or too low 20.36 pursuit error reference threshold
t083	Software stop reached or exceeded	Mobile position outside the stops set in 19.27 or 19.28
t084	Sensor - end of stroke reached	Activated end of stroke sensor (see parameter 18.37 or 18.38)
t085	Current threshold reached	• Motor current higher than the 20.32 threshold • Motor in mechanical stop or too low threshold (20.32)
t086	Differenece of position between the motor encoder and the carried off course encoder	Sliding between motor encoder and carried off corse encoder : - mechanical problem (ex: breaking off bet. the 2 encoders) - too low 20.39 threshold
th	Motor thermal probe	The positioning solution manages the motor thermal probe in standard version. If there is no connected probe, 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 on CD-ROM.

• Terminal block configuration

	Function	Terminal	Source/Dest.	Digital inversion	Assignment
UNIDRIVE SP	OK ref	24	8.21	8.11	19.31 (0.14)
	O_{val}	25	8.22	8.12	19.33 (0.15)
	I_o	26	8.23	8.13	18.42
	Sensor	27	8.24	8.14	18.39
	Run/Stop	28	8.25	8.15	18.41
	I_{val}	29	8.26	8.16	18.45
SM-I/O	I_1	2	16.21	16.11	18.46
	I_2	3	16.22	16.12	18.47
	I_3	4	16.23	16.13	18.48
	I_4	6	16.24	16.14	18.49
	I_+	7	16.25	16.15	18.43
	I_-	8	16.26	16.16	18.44

Notes

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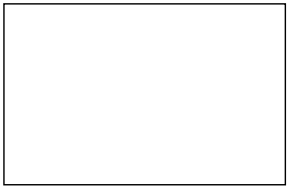

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