LEROY SOMER

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This manual is to be given to the end user

UNIDRIVE SP DID

Flux vector drive for 0.3 to 1.5 kW induction motor

Instruction manual

UNIDRIVE SP DID
Universal variable speed drive

NOTE

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CAUTION

For the user's own safety, this system must be connected to an approved earth (⏚ terminal).

SAFETY AND OPERATING INSTRUCTIONS FOR THE EQUIPMENT
(In accordance with the low voltage directive 73/23/EEC modified by 93/68/EEC)

Throughout the manual, this symbol warns of consequences which may arise from inappropriate use of the equipment, since electrical risks may lead to material or physical damage as well as constituting a fire hazard.

1 - General
Unjustified removal of protection devices, incorrect use, faulty installation or inappropriate operation could represent a serious risk to personnel and equipment.
For further information, consult the manual.
All work relating to transportation, installation, commissioning and maintenance must be performed by experienced, qualified personnel (see IEC 364, CENELEC HD 384, or DIN VDE 0100 and national specifications for installation and accident prevention).
In these basic safety instructions, qualified personnel means persons competent to install, mount, commission and operate the product and possessing the relevant qualifications.

2 - Use
The drive meets the requirements of the low voltage directive 73/23/EEC, modified by 93/68/EEC.
Electromagnetic compatibility (EMC):
- conforms to IEC 1000-4-2
- EN 50082-2 in ducting
- EN 50081-2 in ducting

The technical characteristics and instructions concerning the connection conditions specified on the nameplate and in the documentation provided must be observed without fail.

3 - Transportation, storage
All instructions concerning transportation, storage and correct handling must be observed.
The climatic conditions specified in the technical manual must be observed.

4 - Installation
Before any use, ensure that the unit is placed on a flat, even support.
The unit must be placed in a location with good lighting as stipulated by the labour regulations (for example: 200 lux).
The user must ensure there is no obstacle to interfere with any action on the emergency stop button for the power supply to which the unit is connected.
Before any work on the equipment, ensure the power source is disconnected (complete isolation) and wait until the shaft has stopped rotating when the unit is connected to a motor.

5 - Electrical connection
When work is performed on the equipment with power on, national accident prevention regulations must be observed.
The electrical installation must comply with the relevant regulations (for example conductor cross-sections, connection of protective conductor, etc.).
The documentation for the UNIDRIVE SP universal drive, ref. 3616en, contains more detailed information.

6 - Servicing and maintenance
Refer to the manufacturer's documentation.

This manual is to be given to the end user. It must not be separated from the installation and commissioning manual for the UNIDRIVE SP, ref. 3616.

UNIDRIVE SP DID

Universal variable speed drive

CONTENTS

All other information on the UNIDRIVE SP drive can be found in the installation and commissioning manual, ref. 3616.

UNIDRIVE SP DID
Universal variable speed drive
GENERAL INFORMATION

FOREWORD
Professional and technological training in the field of electrical engineering* applications must have products representative of industrial solutions available, allowing the operation of electric motors and their control to be studied.
Based on the industrial drive, the UNIDRIVE SP has been adapted for teaching use.
Presented in an enclosure, it comprises the drive's command, control and protection devices for direct use with the drive motor in 0.3 and 1.5 kW ranges, according to the model selected.

** Science and industrial technology training courses concerned: Professional and technical diplomas.*

1 - GENERAL INFORMATION

1.1 - General
The UNIDRIVE SP is an open loop and closed loop flux vector drive for supplying self-controlled synchronous motors and induction motors.

Control
Control method:
- via the operator panel
- via the terminal block
- via the serial link

Power module
The UNIDRIVE SP's inverter bridge allows motor operation in all 4 quadrants of the torque-speed plane.
I/O available on 4 mm diameter double sink safety terminals:
- 1 analogue input, « speed ref. »; 0-10 V by potentiometer ;
- 1 analogue input, « torque ref. »; 0-10 V by potentiometer;

or

4-20 mA « external reference » (selection by programming) ;
- 1 analogue output, « speed image »; +/-10 V ;
- 1 analogue output, « torque image »; +/-10 V.

All I/O can reassigned by PC using the LSSoft software. The connection cable is connected to the front panel on the drive. (*The software and cable are supplied with the drive.*)

During operation in recovery mode, the energy supplied by the motor is dissipated in resistors (not supplied).

1.2 - Characteristics

1.2.1 - Characteristics and functions
An enclosure contains all the components facilitating use and ensuring safety.
The user is protected by an overcurrent relay controlled on the front panel.
To clear the front panel, the power is wired on double sink safety terminals (∅ 4 mm) situated on the side of the enclosure.
Only the connections for command and control are made on the front panel.
Programming keys and display are accessible on the front panel.
The access to special adjustments is made by the PC through the RJ45 socket located on the front panel by a cable provided with the drive.

Control 	**The UNIDRIVE SP DID enclosure** is designed for laboratories and test departments of technical and professional training establishments. **It is essential for it to be powered by an autonomous voltage source coming from a distribution box or a manipulation board having suitable protection in the event of an insulation fault.** **Power-up and power-down will be controlled from the distribution box or the manipulation board.**
Protection	• General: overcurrent relay, padlockable and adjustable from 6 to 10 A. • Connection: - to double sink safety sockets «which are female except for the earth sockets which are male; - to an RJ45 socket for the cable to be connected to the PC.
Indications	On the operator panel, display of the drive status using LEDs.

1.2.2 - Electrical characteristics

• Supply

Supply voltage	3-phase, 380 to 480 V ± 10% - 48 to 62 Hz. Connection to safety sockets for cables fitted with a double sink plug, 4 mm diameter, minimum rating 16 A.
Input current	6,8 A maximum

• Use

Output voltage	3-phase, 0 V to 400 V - Frequency 0 to 960 Hz. Connection to female double sink safety sockets except for the earth sockets which are male, minimum rating 16 A.
Output current	4,2 A maximum continuous

1.3 - Environmental characteristics

Protection	IP20
Temperature: - storage - operating - transport	• 20 °C to + 50 °C • 0 °C to + 40 °C • – 20°C to + 50°C
Altitude	Less than 1,000 m. 0.5% current derating per 100 m above this.
Non-condensing humidity	Conforms to IEC 68-2-3 and IEC 68-2-30.
Vibrations	Conforms to IEC 68-2-61.
Electromagnetic compatibility	Conforms to IEC 1000-4-2, EN 50082-2 in ducting, EN 50081-2 in ducting.

1.4 - Weight and dimensions

Weight: 9,5 kg

Height: 430 mm
Width: 320 mm
Depth: 250 mm

2 - MECHANICAL INSTALLATION

• It is the responsibility of the owner or user to ensure that the installation, operation and maintenance of the system and its options comply with legislation relating to the safety of personnel and equipment and with the current regulations of the country of use.

• The systems must be installed in an environment free from conducting dust, corrosive fumes, gases and fluids, and condensation. The equipment must not be installed in hazardous areas unless it is in an appropriate enclosure. In this case the installation must be approved.

2.1 - Checks on receipt

Before installing the drive, check that:
- the goods have not been damaged during transport
- the following accessories are included:
  - *the cable to connect the PC to the RJ45 socket*
  - *the CD-ROM containing the LSSOFT software*
  - *the CD-ROM containing the technical documentation*
  - *a SMARTCARD containing the original parameters. This card is delivered in its position behind the drive's display.*

2.2 - Handling

Make sure that the handling equipment is suitable for the weight to be handled.

The enclosure is fitted with a carrying handle fixed to the top and 4 rubber feet.

3 - CONNECTION

3.1 - General recommendations

• All power connections must be performed in accordance with the laws in force in the country in which the drive is installed. This includes connection to the supply with earthing link in place, in order to ensure that no directly accessible part of the system can be at supply potential or any other voltage that may prove dangerous by indirect contact.

• The voltages on the cables or connections of the mains supply, the drive and the motor with which it may be associated can cause fatal electric shocks. Contact must be avoided in all circumstances.

• Check that the voltage and current of the drive and the mains supply are compatible.

• All connections and work on equipment external to the drive must be carried out in a state of complete isolation (main isolating switchopen and locked).

• The stop function on the enclosure does not protect against high voltages on the terminal blocks.

• After the drive has been switched off, wait for 1 minute before carrying out any work.

• This equipment must be used under the supervision of teaching staff, themselves experienced and trained.

3.2 - Connection characteristics

Connection	Characteristics SP 2.5T
Supply-unit	400 V 3-ph. + E 50/60 Hz 6.8 A
Unit-motor	400 V 3-ph. + E 50/60 Hz 4.2 A

3.3 - Location of connections and control devices

(see below).

• On the side:
- a terminal block for connection to the supply;
- a terminal block for connection to the motor;
- the external fault output for PTC or PTO probe. This is short-circuited with a shunt if not used;
- the braking output for connection to the external braking resistor;
- 15-pin Sub-D for encoder connection.

• On the front panel:
- manual overcurrent relay, padlockable and adjustable (see section 1.2.1);
- "REV/0/FWD" selector switch;
- "freewheel stop/run" switch;
- "torque/speed analogue reference" selector switch;
- "voltage **or** current reference on analogue input A2" selector switch;
- assignable logic input or output (factory set as logic output);
- analogue input "A1", 0-10 V by speed control potentiometer;
- analogue input "A2", 0-10 V by torque control potentiometer, **or** 4-20 mA by an external reference;
- +/-10 V "speed image" analogue output;
- +/-10 V "torque image" analogue output;
- 250 VAC/2 A relay output;
- 24 VDC/100 mA "sensor" power supply;
- RJ45 socket for connecting a PC (connection cable supplied), located on the front panel of the drive.

Note: the *connection sockets* are *female* double sink "safety" type except for the *earth sockets* which are *male*.

Side view

Front panel view

4 - COMMISSIONING

• The UNIDRIVE SP DID uses software which is adjusted by parameters.

• The performance levels obtained depend on the parameter setting.

• Inappropriate settings may have serious consequences for personnel and machinery.

• The UNIDRIVE SP DID parameters should only be set by appropriately qualified and experienced personnel.

• It is possible to return to an original configuration by loading the parameters from the SMARTCARD. See the parameter setting manual, ref. 3655. Write the value READ to parameter 0.30.

4.1 - Starting the drive with the motor not connected

Connect the drive to the single-phase or 3-phase power supply coming from a distribution box or panel after making sure the supply is switched off.

- Make the connection and check that all cables are plugged in correctly.

- Check that the temperature sensor shunt is installed properly or that the thermal probe is connected correctly.

- Check that the potentiometer is at zero and that the "REV/0/FWD" selector switch is at zero.

- Activate the circuit-breaker located on the front panel of the housing; the display lights up.

4.2 - Starting the drive with the motor connected

- Check that the motor is correctly fastened and that the rotating parts are not accessible to the operator.

- Check that the voltage and power on the motor plate are compatible with the use of the drive (refer to Section 6 "Example of settings for an open loop drive"). To use the "autocalibration" function, make sure the motor is uncoupled.

- Connect the motor.

- Next repeat the same procedure as in paragraph 4.1.

- Set the drive parameters.

Parameter settings to be made

0.01	Minimum frequency Minimum speed		Hz min^{-1}
0.02	Maximum frequency Maximum speed		Hz min^{-1}
0.21	Motor sensor		TH
0.43	Cos φ Encoder phase angle		
0.44	Motor rated voltage		
0.45	Motor rated speed Motor thermal time constant		min^{-1}
0.46	Motor rated current Stalling current		A A
0.47	Motor rated frequency		Hz

Open loop vector control
Closed loop vector control
Servo mode

- Give a "forward" or "reverse" command.

- To adjust the motor rotation speed, adjust the "speed" potentiometer.

- To adjust the motor torque, adjust the "torque" potentiometer after having previously reconfigured the parameters so as to assign the potentiometer to "torque" adjustment. See the parameter setting manual, ref. 3655.

Parameter settings to be made

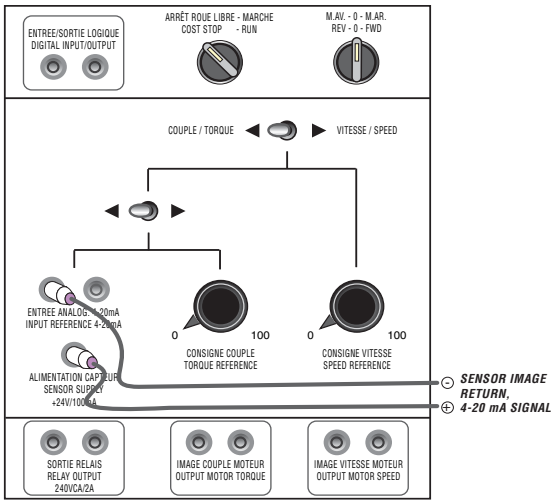
Parameter	Name	Value
7.14	Torque reference	4.08
8.25	Decimal coded binary mode	9.29
8.39		1
9.33	Selection of torque regulation mode	4.11

- Set the potentiometer to zero.

- Put the "run" switch back to zero to stop the motor.

4.3 - Operation with a sensor

If an *image return* coming from a sensor is being used, for operation in regulation mode (for example the 4-20 mA flow rate or pressure sensor mounted on the AQUALEC electro-pump bench), the sensor must be connected according to the diagram below.



For setting the parameters of the UNIDRIVE SP PID functions, see the parameter setting manual, ref. 3655.

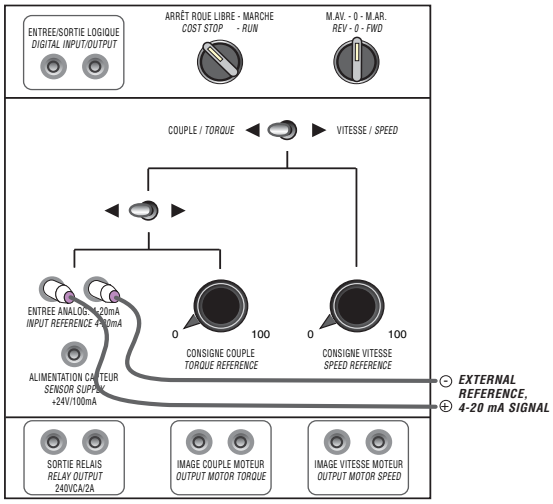
Parameter settings to be made

Return to the factory settings by writing the value "1233" to parameter 0.00.

Parameter	Name	Value
2.11	Acceleration ramp	0
2.21	Deceleration ramp	0
7.08	Scaling of ref. A1	0.7
7.10	Analogue input A1	1.25
7.11	4-20 mA signal	4
7.14	Analogue input A2	1.26
14.03	PID reference source	1.25
14.04	PID sensor return	1.26
14.08	PID enable	1
14.10	Proportional gain	2.1
14.11	Integration gain	0.9
14.12	Derivative gain	0
14.14	PID lower limit	0
14.16	PID output destination	1.36

4.4 - Operation with a 4-20 mA external analogue reference

When using an *external reference* at 4-20 mA (for example the analogue signal from a PLC), the wiring must be done according to the diagram below.



- For selecting the 4-20 mA torque reference (reference input A2) and disabling the 0-10 V reference, see the parameter setting manual, ref. 3655.

- Write the value "2" to parameter 7.11, signal type selection.

4.5 - Scaling the analogue outputs

It is possible to connect directly to the ORPHY GTS II, and use the LS PC MULTI 04 software, so as to be able to plot the torque = f (speed) characteristic.
To do this, the factory setting of the "speed image" and "torque image" analogue outputs, preset as 0-10 V, must be modified.
Refer to the parameter setting manual, ref. 3655.

Parameter settings to be made

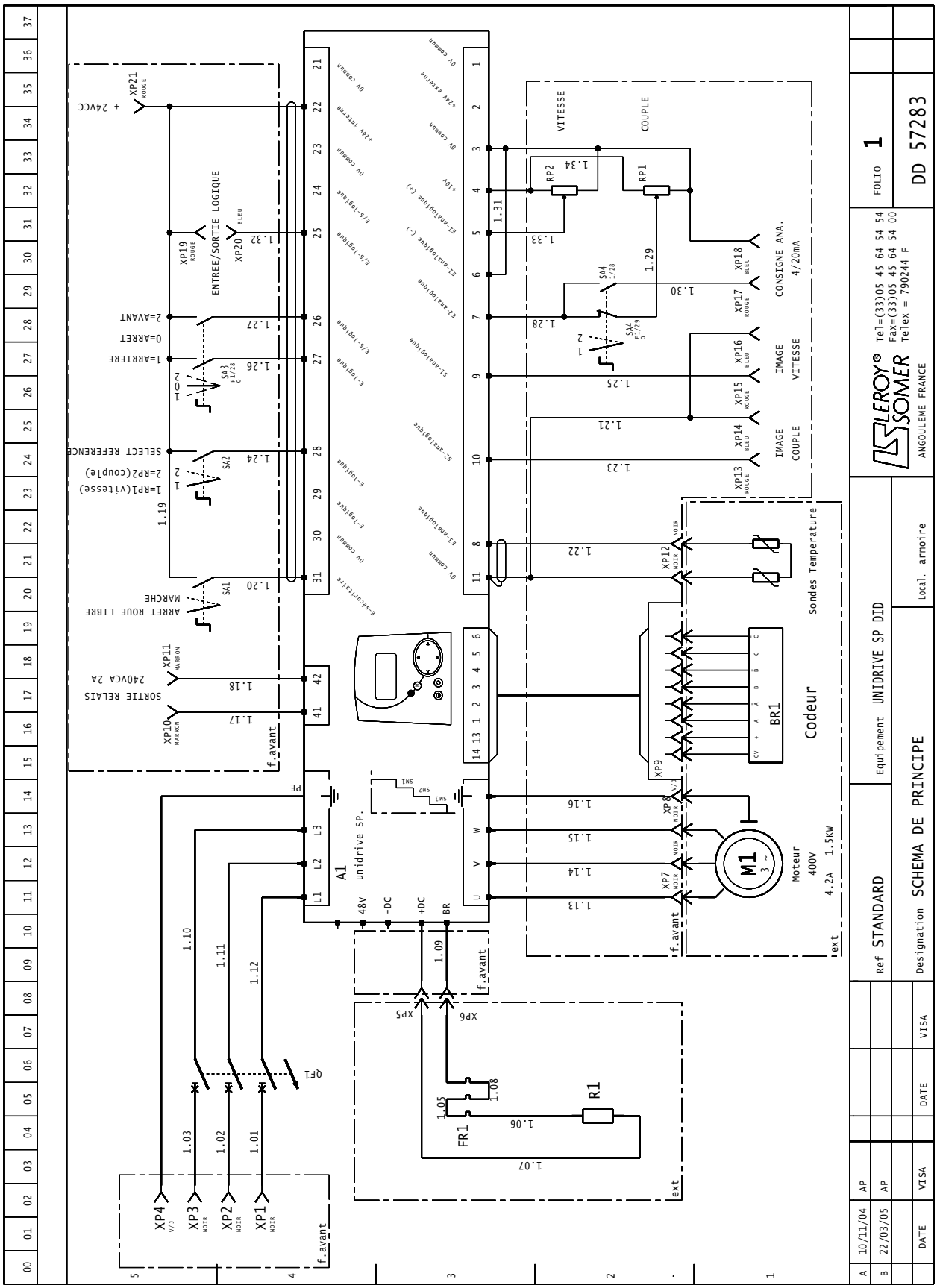
- Write the value "0.5" to parameter 7.20.

- Write the value "0.5" to parameter 7.23.

5 - FAULTS, DIAGNOSTICS AND MAINTENANCE

Refer to the installation and commissioning manual for the UNIDRIVE SP, ref. 3616.

6 - APPENDIX: CIRCUIT DIAGRAM



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