LEROY SOMER

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This manual is to be given to the end user

DIGIDRIVE SK DID

Flux vector drive for 0.3 to 1.5 kW induction motor

Instruction manual

DIGIDRIVE SK DID
Flux vector drive

NOTE

LEROY-SOMER reserves the right to modify the characteristics of its products at any time in order to incorporate the latest technological developments. The information contained in this document may therefore be changed without notice.

LEROY-SOMER gives no contractual guarantee whatsoever concerning the information published in this document and cannot be held responsible for any errors it may contain, nor for any damage resulting from its use.

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 DIGIDRIVE SK universal drive, ref. 3897, 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 DIGIDRIVE SK, ref. 3897.

DIGIDRIVE SK DID
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CONTENTS

All other information on the DIGIDRIVE SK drive can be found in the installation and commissioning manual, ref. 3897.

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 DIGIDRIVE SK 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 DIGIDRIVE SK is an open loop flux vector drive for supplying induction motors.

Control
Its U/f ratio is configurable for certain types of operation:
- control of several motors simultaneously
- control of a motor through a transformer
- control of a motor supplied via a long cable

Power module
The DIGIDRIVE SK'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:
- One 0-10 V analogue input
- One 4-20 mA analogue input
- One 0-10 V analogue output
- One 250 V/2 A relay output

All I/O can be programmed by PC, connected to the front panel, using the LSSOFT software. (*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 the 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 DIGIDRIVE SK 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: - 17 to 23 A for SK2.5M - 4 to 6.3 A for SK2.5T • 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

Reference SK2.5M DID	Single phase 200 to 240 V ±10%, 48 to 62 Hz - Input current: 17.4 A - Output current: In = 7 A/I max. = 10.5 A at Un = 230 V 3-phase - Motor rated power (4 poles) 1500 W.
Reference SK2.5T DID	3-phase 380 to 480 V ± 10%, 48 to 62 Hz. - Input current: 5.2 A - Output current: In = 3.8 A/I max. = 5.7 A at Un = 400 V 3-phase - Motor rated power (4 poles) 1500 W.

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: 6,7 kg

Height: 330 mm
Width: 225 mm
Depth: 220 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* on the enclosure
  - the *CD-ROM containing the LSSOFT software*
  - the *CD-ROM containing the technical documentation*

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 plastic 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	
	SK2.5M	SK2.5T
Supply-unit	230 V single phase + E 50/60 Hz 17.4 A	380 V 3-ph. + E 50/60 Hz 5.2 A
Unit-motor	230 V 3-ph. + E 50/60 Hz 7 A	380 V 3-ph. + E 50/60 Hz 3.8 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.

• On the front panel:
- a padlockable manual overcurrent relay;
- "REV/0/FWD" selector switch;
- "freewheel stop" switch;
- "analogue reference A1/A2" selector switch;
- analogue input "A1", 4-20 mA;
- analogue input "A2", 0-10 V by speed or torque control potentiometer;
- 0/10 V "speed 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).

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

Front panel view

4 - COMMISSIONING

• The DIGIDRIVE SK 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 DIGIDRIVE SK DID parameters should only be set by appropriately qualified and experienced personnel.

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 parameter settings"). To use the "autocalibration" function, make sure the motor is uncoupled.

- Connect the motor.

- Next repeat the same procedure as in paragraph 4.1.

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

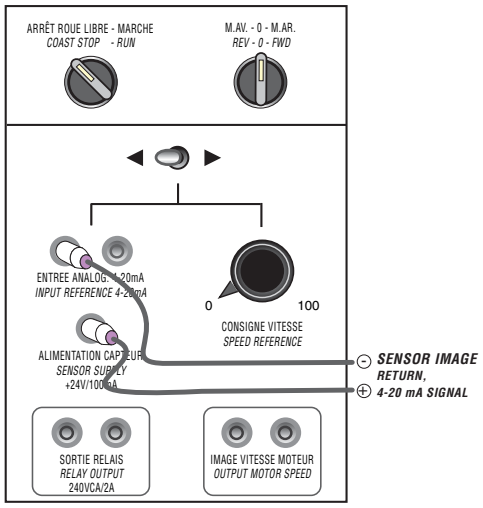
- To adjust the motor rotation speed, adjust the "speed" potentiometer.

- Set the potentiometer to zero.

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

4.3 - Operation with a sensor

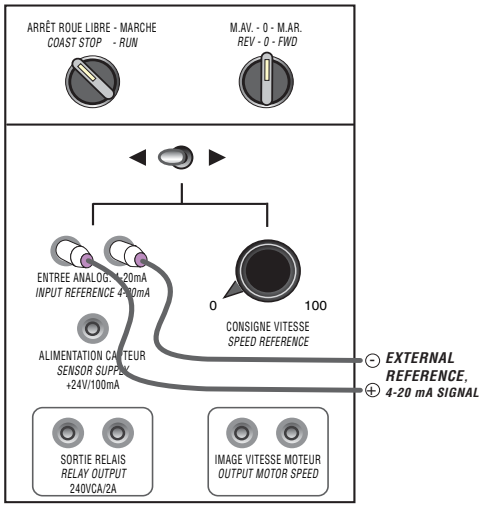
If an *image return* coming from a sensor is being used, for operation in regulation mode (for example the 4-20 mA flow rate or pressure sensor mounted on the AQUALEC electro-pump bench), the sensor must be connected according to the diagram below.
In this configuration, set the switch to the "4-20 mA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



For setting the **parameters** of the DIGIDRIVE PID functions, use the LS SOFT software provided and refer to the "Extended Functions" manual, ref. 3907:

Parameter settings to be made:
- Write the value 0 (acceleration ramp) to parameter 2.11.
- Write the value 0 (deceleration ramp) to parameter 2.21.
- Write the value 1.26 (analogue input A1) to parameter 7.10.
- Write the value 1.25 (analogue input A2) to parameter 7.14.
- Write the value 1.25 (PID reference source) to parameter 14.03.
- Write the value 1.26 (PID sensor return) to parameter 14.04.
- Write the value 1 (PID enable) to parameter 14.08.
- Write the value 0 (PID lower limit) to parameter 14.14.
- Write the value 1.37 (PID output destination) to parameter 14.16.
- Write the value 1.8 (proportional gain) to parameter 14.10.
- Write the value 0.5 (integral gain) to parameter 14.11.

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.



5 - FAULTS, DIAGNOSTICS AND MAINTENANCE

Refer to the installation and commissioning manual for the DIGIDRIVE SK, ref. 3907.

6 - EXAMPLE OF DRIVE SETTINGS

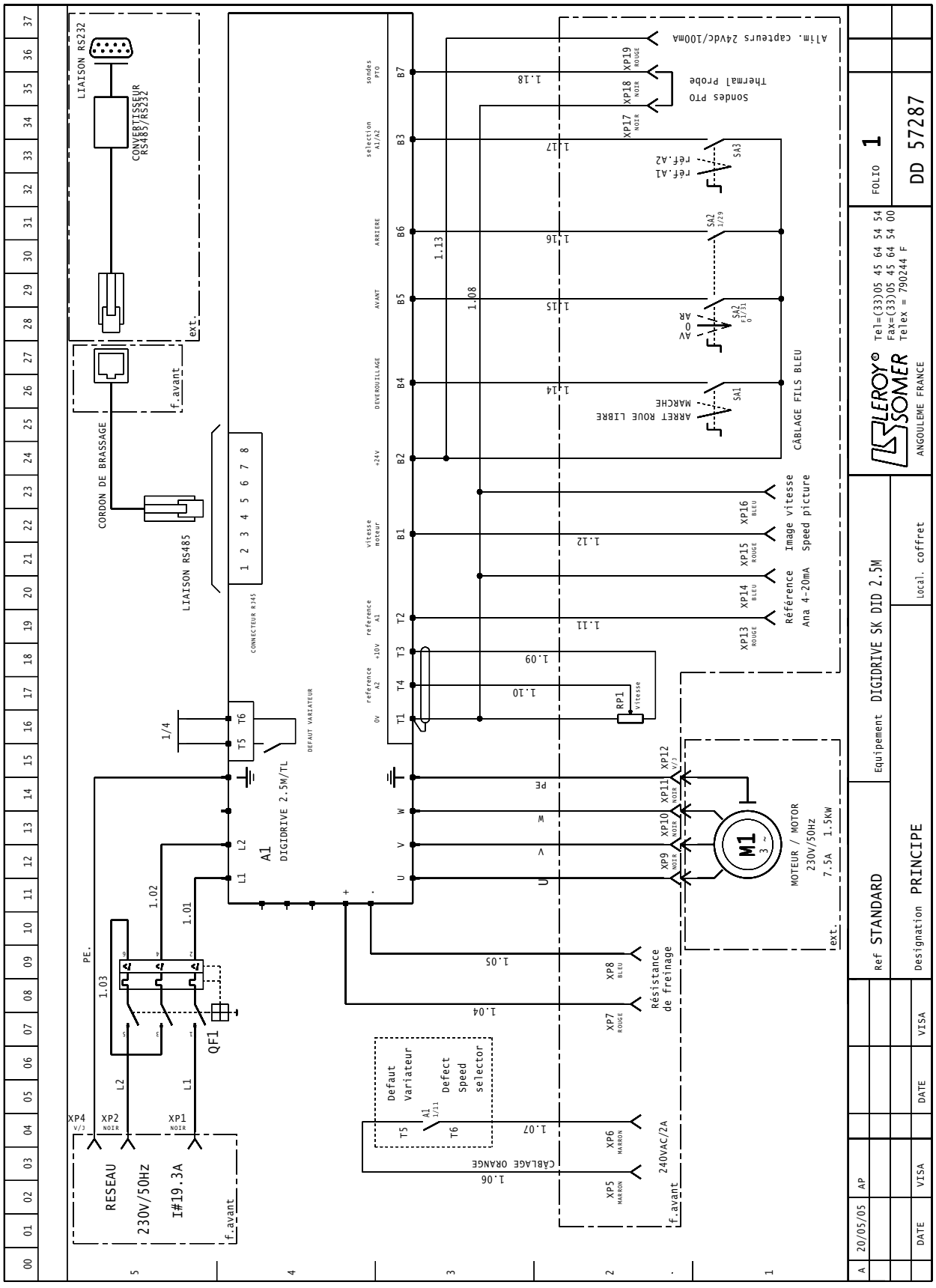
DIGIDRIVE SK type	Serial no.	Motor type	Motor no.	Commissioned on:
2.5 M/TL		**LSFMV90**		

Parameter	Name	Settings	Remarks	Setting on:
01	Minimum limit	0		
02	Maximum limit	50.0 Hz		
03	Acceleration ramp 1	5.0 s/**100 Hz**		
04	Deceleration ramp 1	10.0 s/**100 Hz**		
05	Drive configuration	AI.AV		
06	Motor rated current	5.5 A	Motor nameplate	
07	Motor rated speed (at full load)	1,435 min^{-1}	Motor nameplate	
08	Motor rated voltage	230 V	Motor nameplate	
09	Power factor (cos φ)	0,84	Motor nameplate	
10	Level 2 access and storage of security code	L1	Access to parameters 1 to 10	

For all other information on the DIGIDRIVE SK drive, refer to the "Installation and Commissioning" manual, ref. 3897.

7 - APPENDICES: DIGIDRIVE SK DID CIRCUIT DIAGRAMS

7.1 - Single phase



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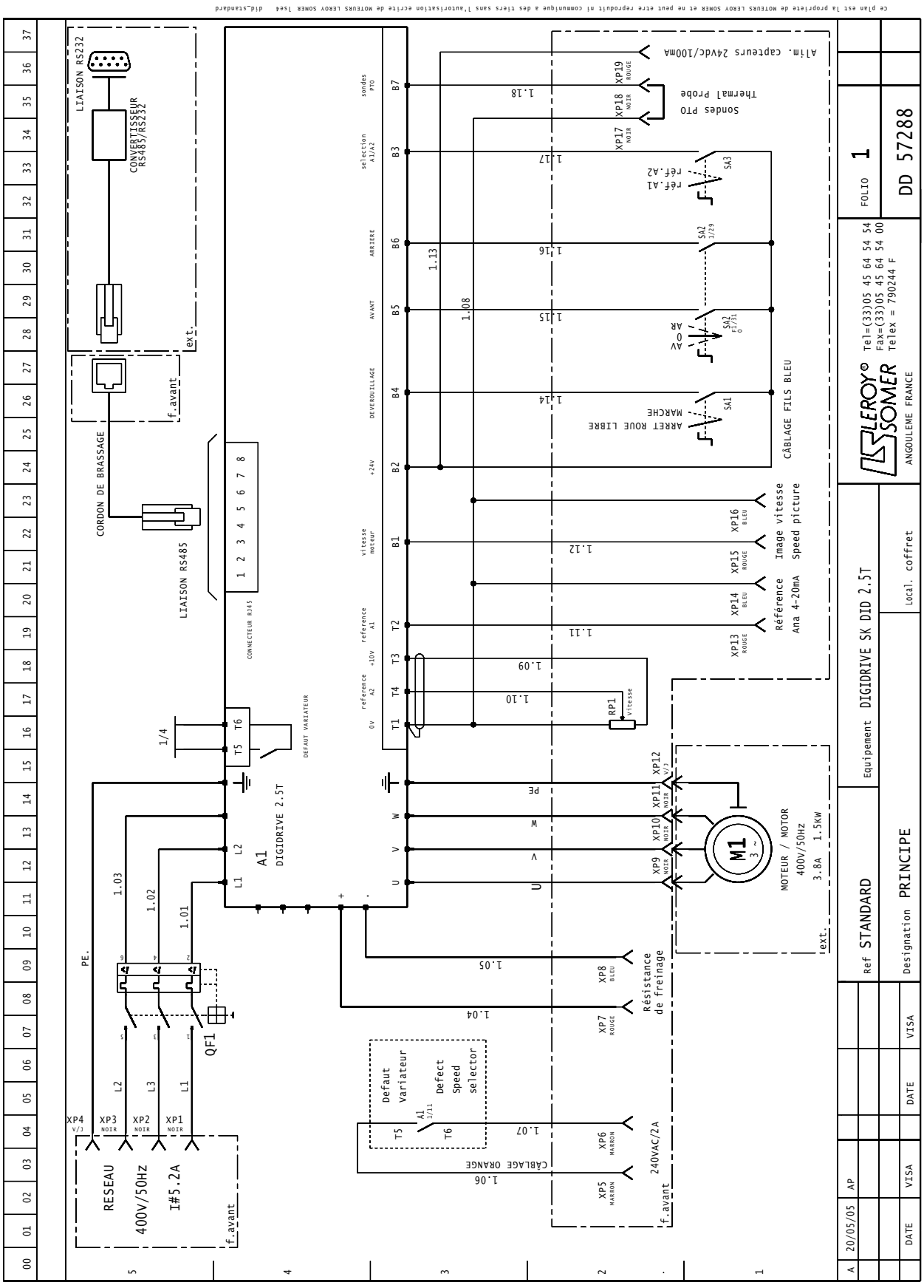
APPENDICES: DIGIDRIVE SK DID CIRCUIT DIAGRAMS

7.2 - 3-phase



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