



ZAPI[®] S.p.A.

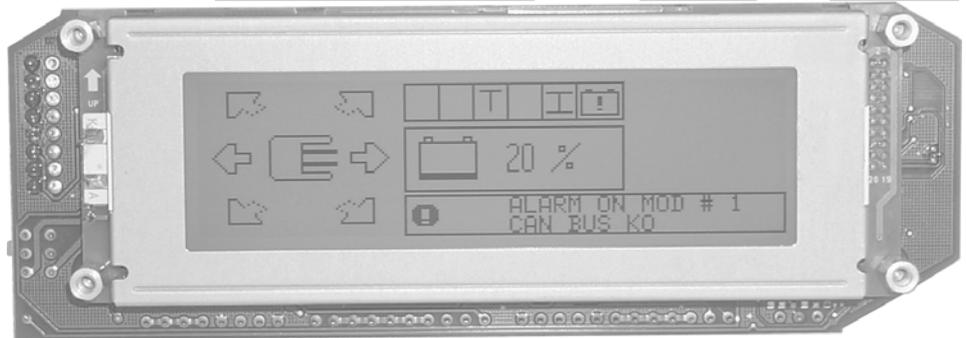
**ELECTRONIC • OLEODYNAMIC • INDUSTRIAL
EQUIPMENTS CONSTRUCTION**

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EN

User Manual

SICOS



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NOTES LEGEND



The symbol aboard is used inside this publication to indicate an annotation or a suggestion you should pay attention.



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APPROVAL SIGNS

COMPANY FUNCTION	INIZIALS	SIGN
PROJECT MANAGER		
TECHNICAL ELECTRONIC MANAGER VISA		
SALES MANAGER VISA		

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1 SICOS DESCRIPTION



IMPORTANT: The following descriptions are about a typical application of SICOS display. The features of the Sicos depends on the customer software installed.

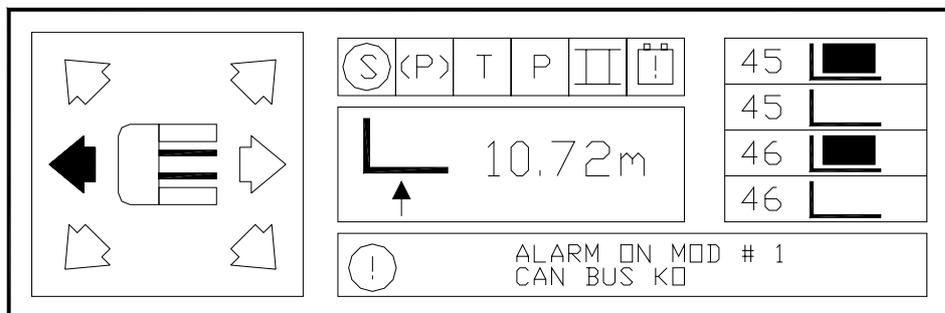
1.1 General features

The SICOS is a can-bus device that provide the following functions:

- Sicos display is an intelligent dashboard connected to the truck system by CAN-BUS line. This dashboard provides the diagnostic of the whole truck system: SICOS itself, Traction controller, Pump controller, Mhyrio, EPS AC and, eventually, other modules connected on the CAN-BUS net. If Traction, Pump or Mhyrio are not present in the CAN-BUS, an alarm "CAN BUS KO" is provided on the SICOS display, the alarm locks the truck. SICOS communicate also with the EPS AC; if EPS AC is not present on the CAN BUS net no alarm is displayed on the SICOS.
- Furthermore, by connecting the console to the SICOS is possible to read and modify the setting of all the modules present on the CAN-BUS net.
- Sicos is also the node of the CAN-BUS line which provides the access to an external diagnostic device, handy console or PC console.
- Sicos provides the conversion between CAN messages and serial link messages so providing the complete visibility of the truck system by a PC. Thank to this Sicos capability, an external tool (handy console or PC console) can have direct access to the diagnostic and set up of the modules connected in the CAN-BUS net.
- The Sicos console has a graphical display with 4 selection buttons control, a main page and some menu that will be explained in the following chapters.

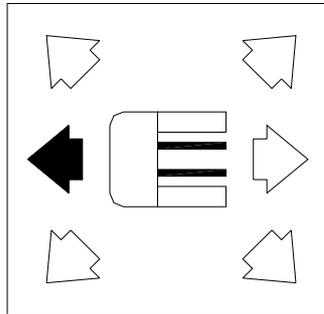
1.2 Graphical display description

The display is composed by a main page and a menu tree.
In the heading is displayed:



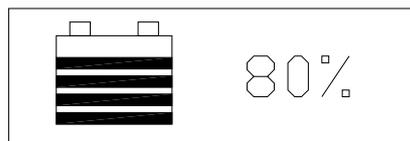
1.2.1 Direction indication

Depends from the selected direction (FWD or BWD) and from the status of three input that give the steering wheel position. On the display are drawn 6 white arrows; by selecting a driving direction, one arrow become black according to the steering wheel direction.



1.2.2 Battery indication

It is displayed the battery charge coming from the traction inverter in percentage and a figure with a bar every 20% of charge. If the battery is low ($\leq 20\%$), then appears also a battery symbol with an exclamation mark in the higher part of the display. The battery charge is displayed after the key on and every time the truck is in stand by condition.



1.2.3 Hourmeter indication

A sand-glass is displayed with the functioning hours every time that the truck is switched-on and every time when coming back to the main page. The hourmeter is displayed for some seconds, after that the battery is displayed again.



1.2.4 Truck speed indication

When the truck is running the truck speed is displayed. The speed sensor is the traction encoder. It is possible to select to display the speed in Km/h or mph by an option. If a speed reduction is selected, a turtle is shown behind the speed.



1.2.5 Height indication

It is displayed when the lifting or lowering function is executed; and only activating an option through an option is possible to select meter or feet. In the displayed height value is considered also a programmable offset that is the height at which is placed the encoder zero sensor. If the Sicos module receives

an height value higher than zero without receiving his zero encoder signal than the display shows 22,22m+offset.



1.2.6 Alarm indication

The name of the alarm and the module in which the alarm happened is displayed in a square in the bottom of the page with the following code:

MOD #1 -> SICOS
MOD #2 -> TRACTION
MOD #5 -> PUMP
MOD #9 -> MHYRIO
MOD #6-> EPS AC



1.2.7 Symbol bar

- 1) Steering sensor problem



- 2) Hand brake activated



- 3) Traction alarm



- 4) Pump alarm



- 5) Driving mode; it is selectable through an option or using the up and down buttons on the main page. Three driving modes are possible. Each mode has its own parameter table



- 6) Discharged battery



1.2.8 Preselector or Customer Logo

Through the activation of an option is possible to show the customer logo on the display. If the option is not activated a white space is shown. If the height preselector function is active in the logo place are displayed 4 floors, 2 for the loaded forks and 2 for the unloaded ones.

To enter the floor selection area is necessary to press the OUT button: in the main page a black cursor appears that can be moved between the floors with UP/DOWN. It is possible to select till to 50 floors. If UP or DOWN are pressed for some seconds, the fast scrolling function is activated. The ENTER button selects the desired floor (signed with a black circle); the OUT button exits the height pre-selector menu and the selection is erased.

45	
45	
46	
46	

2 EMC/ESD INSTALLATION HINTS

2.1 EMC



EMC and ESD performances of an electronic system are strongly influenced by the installation. Special attention must be given to the lengths and the paths of the electric connections and the shields. This situation is beyond ZAPI's control. Zapi can offer assistance and suggestions, based on its years experience, on EMC related items. However, ZAPI declines any responsibility for non-compliance, malfunctions and failures, if correct testing is not made. The machine manufacturer holds the responsibility to carry out machine validation, based on existing norms (EN12895 for industrial truck; EN50081-2 for other applications).

2.2 ESD

ESD concerns the prevention of the effects of electric current due to excessive electric charge stored in an object. In fact, when a charge is created on a material and it remains there. It becomes an "electrostatic charge"; ESD happen when there is a rapid transfer from a charged object to another. This rapid transfer has, in turn, two important effects:

- this rapid charge transfer can determine, by induction, disturb on the signal wiring and thus create malfunctions; this effect is particularly critical in modern machines, with serial communication (canbus) which are spread everywhere on the truck and which carry critical informations.
- in the worst case and when the amount of charge is very high, the discharge process can determine failures in the electronic devices; the type of failure can vary from intermittently malfunction to a completely failure of the electronic device.



IMPORTANT NOTE: it is always much easier and cheaper to avoid ESD from being generated, than to increase the level of immunity of the electronic devices.

2.3 Installation suggestions

- 1) As above stated, the best suggestion is to avoid ESD. The golden rule consists of avoiding the root for ESD that is charge migration. To avoid charge migration it is just enough to adopt insulating materials and coatings on the exposed parts: no metallic part implies no charge migration.
- 2) In case of exposed metallic parts, ESD consequences may be attenuated by connecting (with a wide section cable) to the truck frame, all the exposed

metallic parts (screws, panels, dashboard) coupled through thin dielectric layers to any electrical and electronic components (e.g. wires, controllers, sensors) (this connection creates a by-pass path for the ESD).

- 3) According above criterion 1. and 2., the front panel of the SICOS consists of a metallic plate with insulating coating on it . As a consequence the edge and the screws of this front panel are exposed metallic parts and it is strongly suggested they will be covered with an insulating shield or shell in order they are not accessible to get in touch with the operator's fingers.
- 4) According EN12895 and EN61000-4-2, the coating material of the SICOS front panel is declared to be an insulating coating and so it "shall only be submitted to the air discharge. The contact discharge test shall not be applied to such surface" (8.3.1 in EN61000-4-2).

3 DISPLAY MENU DESCRIPTION

3.1 Selection buttons control

4 buttons provides the capability of changing or reading the parameters of the SICOS display and of the controllers connected to the Can-Bus net:

Enter: push to have access to the selected menu or to confirm a change;

Out: push to exit the selected menu or not to accept a change;

Up: push to scroll up the submenu and to select or increase a parameter;

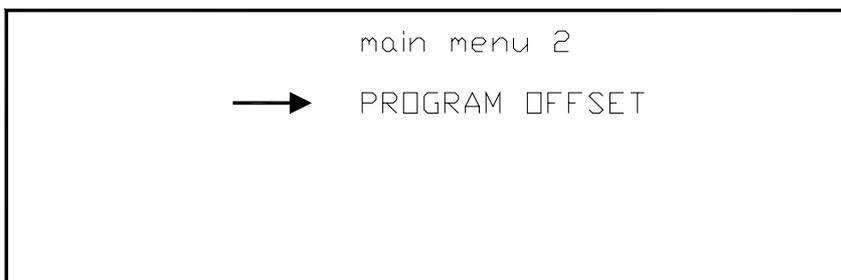
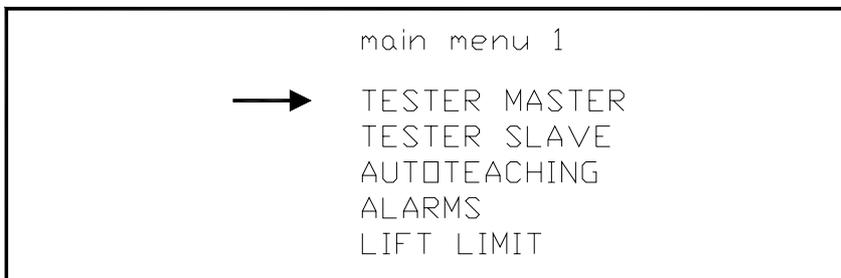
Down: push to scroll down the submenu and to select or increase a parameter;

3.2 Main menu

By pressing Enter the MAIN display MENU is showed: with Up and Down is possible to move an arrow that point the sub-menus, the menu is selected by pressing Enter; Out returns to the main menu.

The main menu has 6 submenu:

- TESTER MASTER : SICOS inputs status tester
- TESTER SLAVE : main PUMP and TRACTION inputs status tester.
- AUTOTEACHING : floors heights setting.
- ALARMS : alarms logbook
- LIFT LIMIT : lifting block height setting
- PROGRAM OFFSET : encoder zero reference switch height



3.3 Submenu

3.3.1 Tester Master

This is the tester menu of the display. It shows the status of the display inputs; it is composed by two pages.

Page 1

tester 1							
I1	<input checked="" type="checkbox"/>	I7	<input type="checkbox"/>	I13	<input checked="" type="checkbox"/>	I19	<input checked="" type="checkbox"/>
I2	<input type="checkbox"/>	I8	<input checked="" type="checkbox"/>	I14	<input type="checkbox"/>	I20	<input type="checkbox"/>
I3	<input type="checkbox"/>	I9	<input type="checkbox"/>	I15	<input checked="" type="checkbox"/>	I21	<input type="checkbox"/>
I4	<input checked="" type="checkbox"/>	I10	<input type="checkbox"/>	I16	<input checked="" type="checkbox"/>	I22	<input checked="" type="checkbox"/>
I5	<input type="checkbox"/>	I11	<input checked="" type="checkbox"/>	I17	<input type="checkbox"/>	I23	<input type="checkbox"/>
I6	<input type="checkbox"/>	I12	<input type="checkbox"/>	I18	<input checked="" type="checkbox"/>	I24	<input type="checkbox"/>

where:

- I1 = forward switch
- I2 = backward switch
- I3 = pedal switch
- I4 = seat switch
- I5 = dead man switch
- I6 = brake switch
- I7 = pressure switch
- I8 = speed reduction switch
- I9 = hand brake switch
- I10 = lifting/lowering request
- I11 = reach request
- I12 = tilting request
- I13 = shift request
- I14 = auxiliary 1 hydraulic function 1
- I15 = auxiliary 2 hydraulic function 2
- I16 = CREEPER function
- I17 = steering sensor A
- I18 = steering sensor B
- I19 = steering sensor C
- I20 = overcoming height block switch

the meaning of the inputs could be changed in order to customer request.

Page 2

For having access to the "Page 2" is necessary to press the Enter button while is displayed the "Page 1".

tester 2	
TRACTION ACCELERAT. =	4.27 VOLT
POTENTIOMETER #1 PU =	2.45 VOLT
POTENTIOMETER #2 PU =	2.47 VOLT
POTENTIOMETER #3 PU =	3.57 VOLT
POTENTIOMETER #4 PU =	2.48 VOLT

where:

TRACTION ACCELERAT.	= traction potentiometer
POTENTIOMETER #1 PU	= lifting/lowering potentiometer
POTENTIOMETER #2 PU	= reach potentiometer
POTENTIOMETER #3 PU	= tilting potentiometer
POTENTIOMETER #4 PU	= side shift potentiometer

3.3.2 Tester Slave

This is the tester menu of the Traction and Pump modules connected with the Sicos by the Can-Bus net. It shows the status of the inputs; it is composed by two pages.

Page 1

```
tester 1

CURRENT TRACTION      =      000 AMP
VOLTAGE TRACTION      =      000 %
FREQUENCY TRAC.      =      000 HERZ
TEMPERATURE TR.      =      000 GRADI
```

where:

CURRENT TRACTION	= Traction inverter current (Arms)
VOLTAGE TRACTION	= Traction inverter voltage (%)
FREQUENCY TRAC.	= Traction inverter frequency (Hz)
TEMPERATURE TR.	= Traction inverter temperature (°C)

Page 2

For having access to the "Page 2" is necessary to press the Up or Down button while is displayed the "Page 1".

```
tester 2

CURRENT PUMP          =      000 AMP
VOLTAGE PUMP          =      000 %
FREQUENCY PUMP        =      000 HERZ
TEMPERATURE PU.      =      000 GRADI
```

where:

CURRENT PUMP	= Pump inverter current (Arms)
VOLTAGE PUMP	= Pump inverter voltage (%)
FREQUENCY PUMP	= Pump inverter frequency (Hz)
TEMPERATURE PU.	= Pump inverter temperature (°C)

3.3.3 Autoteaching

This is a menu who managed floors heights setting; it is composed by one page. Through Up or Down is possible to select the desired floor; By pressing Enter is possible to store in the selected floor the height read from the encoder.

```
autoteaching
LEVEL NUMBER   =   03
HEIGH VALUE    =   65535      "MEMO"
ENCODER VALUE  =   00000
```

where:

LEVEL NUMBER = floor selection

HEIGHT VALUE = programmed height for the selected floor

ENCODER VALUE = encoder height

3.3.4 Alarms

In this menu are displayed the last 5 alarms happened in every module connected to the CanBus net; it is composed by one page.

By pressing Out the question "Clear Alarms?" is displayed. By pressing Enter is possible to clear the logbook instead by pressing Out the alarms stored in the logbook will be not cleared.

ALARMS 1	HOURS	NUM	NTC	MOD
1>CAN BUS KO	00005	02	27	1
2>HIGH TEMPERATURE	00005	47	27	2
3>MOTOR TEMPERAT.	00005	03	27	2
4>CAN BUS KO	00004	02	27	1
5>WATCHDOG	00003	07	27	5

```
CLEAR ALARMS?
```

where:

HOURS = hour counter when the alarm happens

NUM = number of times for the same alarm

NTC = display temperature at the moment of the alarm

MOD = module number on which the alarm happened

1 = SICOS

2 = TRACTION

5 = PUMP
9 = MHYRIO
6 = EPS

3.3.5 Lift Limit

This menu is accessible only if the Out button is pressed during the key switch on. In this menu is possible to program the encoder level corresponding to the stop lifting height; it is composed by one page.

Through Up or Down is possible to select the desired height;

By pressing Enter is possible to store in the selected height the value read from the encoder.

```
autoteaching  
  
HEIGHT VALUE    = 00000  
  "MEMO"  
  
ENCODER VALUE  = 00000
```

where:

HEIGHT VALUE = lifting block height

ENCODER VALUE = height read from the encoder

3.3.6 Program Offset

This menu is accessible only if the Out button is pressed during the key switch on. In this menu is possible to program the "0" level of the encoder; it is composed by one page.

Through Up or Down is possible to select the desired value (the value is express in millimeters);

By pressing Enter is possible to store the value.

```
adjustment  
  
OFFSET VALUE    = 00050  
  "MEMO"
```

where:

OFFSET VALUE = zero encoder height in mm. By pressing UP and DOWN, the height is changed.

4 ZAPI CONSOLE DESCRIPTION

By connecting the console Zapi on the SICOS, it is possible to communicate with the other modules connected to the CanBus net.

In this way it is possible to modify or read the parameter of the module connected. To select the module it is necessary to enter in the "SET MODEL" menu and select the "CONNECTED TO" parameter.

Five options are available:

- 1 -> Sicos connection
- 2 -> Traction connection
- 5 -> Pump connection
- 9 -> Mhyrio connection
- 6 -> EPS-AC connection

If the option is saved while exiting the menu, by switching off and on the key or by pressing the three lower buttons on the console, the selected module is connected.

In case of CAN BUS problems the console switches automatically on the SICOS.

4.1 Sicos "Tester" menu

- 1) ACCELERATOR = traction potentiometer
- 2) ANALOG INPUT #1 = lifting pot
- 3) ANALOG INPUT #2 = reach pot
- 4) ANALOG INPUT #3 = tilt pot
- 5) ANALOG INPUT #4 = side shift pot
- 6) BRAKEPEDAL POT. = brake pot
- 7) FORWARD SWITCH = forward direction switch
- 8) BACKWARD SWITCH = backward direction switch
- 9) ENABLE SWITCH = pedal switch
- 10) SEAT SWITCH = seat switch
- 11) DEADMAN SWITCH = dead man switch
- 12) BRAKE SWITCH = brake switch
- 13) PRESSURE SWITCH = pressure switch
- 14) CUTBACK SWITCH = speed reduction switch
- 15) HANDBRAKE = handbrake switch
- 16) 1ST SPEED SWITCH = lifting/lowering enable switch
- 17) 2ND SPEED SWITCH = reach enable switch
- 18) 3RD SPEED SWITCH = tilt enable switch
- 19) 4TH SPEED SWITCH = side shift enable switch
- 20) DIGITAL INPUT #1 = auxiliary function 1 switch
- 21) DIGITAL INPUT #2 = auxiliary function 2 switch
- 22) CREEPER FUNCTION = CREEPER function status
- 23) STATUS #1 = steering sensor A input status
- 24) STATUS #2 = steering sensor B input status
- 25) STATUS #3 = steering sensor C input status
- 26) DIGITAL INPUT #3 = lifting unlock input

4.2 Sicos "Parameter Change" menu

- 1) CUTBACK SPEED 1 = Traction speed reduction
- 2) CUTBACK SPEED 2 = Traction speed reduction with CREEPER function
- 3) 1ST SPEED COARSE = Lifting max speed
- 4) 5TH SPEED COARSE = Lowering max speed
- 5) 2ND SPEED COARSE = Reach max speed
- 6) 3RD SPEED COARSE = Tilt max speed
- 7) 4TH SPEED COARSE = Side shift max speed
- 8) PUMP CREEP #1 = Minimum pump speed while lifting
- 9) PUMP CREEP #2 = Minimum pump speed while reaching
- 10) PUMP CREEP #3 = Minimum pump speed while tilting
- 11) PUMP CREEP #4 = Minimum pump speed while shifting
- 12) SPEED 2 CUTBACK = Reach speed reduction
- 13) AUX SPEED #1 = pump speed while AUX 1 input active
- 14) AUX SPEED #2 = pump speed while AUX 2 input active
- 15) PUMP STOP DELAY = delay between pump stop and valve closing
- 16) LIFT CUTBACK = lifting speed reduction (with pre-height selector)
- 17) LOW CUTBACK = lowering speed reduction (with pre-height selector)
- 18) ADJUSTMENT #01 = changes slow lift height (with pre-height selector)
- 19) ADJUSTMENT #02 = changes slow low height (with pre-height selector)
- 20) ADJUSTMENT #03 = changes the distance between block height and load height (with pre-height selector)
- 21) ADJUSTMENT #04 = changes the distance between block height and unload height.
- 22) AUXILIARY TIME = delay between lifting-lowering stop and auxiliary valve opening.

4.3 Sicos "Set Model" menu

CONNECTED TO

Selects the CAN BUS module to which connect the console.

- 1 -> Sicos connection
- 2 -> Traction connection
- 5 -> Pump connection
- 9 -> Mhyrio connection
- 6 -> EPS-AC connection

4.4 Sicos "Set Option" menu

1) CHECK UP TYPE

Through this parameter is possible to program the maintenance type selection

- | | |
|---|---|
| 0 | no programmed maintenance |
| 1 | alarm after 300 hours ("Check up needed") |
| 2 | alarm after 300 hours, traction speed reduction after 340 hours |
| 3 | alarm after 300 hours, traction speed reduction after 340 hours, traction block after 380 hours |

2) PERFORMANCE TYPE

0...1...2

Through this parameter is possible to program the truck performance type; on the SICOS this parameter modifies the pump lifting and lowering max speeds, then is passed to the traction that modifies other parameters; can assume the values 0-1-2. It is possible to modify the truck performance by pressing the Up and Down button from the main page of the display too.

3) HEIGHT DISPLAY

ON the height is shown on the display.
OFF the height is not shown on the display.

4) HOUR COUNTER

Through this parameter is possible to program the hourmeter mode
KEYON hourmeter always active with key on
RUNNING hourmeter active only with traction, pump, valves ON.

5) BATTERY CHECK

ON lifting block active when the battery is low.
OFF lifting block not active when the battery is low.

6) PRE-HEIGHT SEL.

ON height preselector present
OFF height preselector not present

7) CHECK UP DONE

ON resets the hours for the programmed maintenance.
OFF function disable.

8) SEAT SWITCH

ON seat switch present
OFF seat switch not present

9) LOGO DISPLAY

ON the customer logo will be displayed
OFF the customer logo will be not displayed

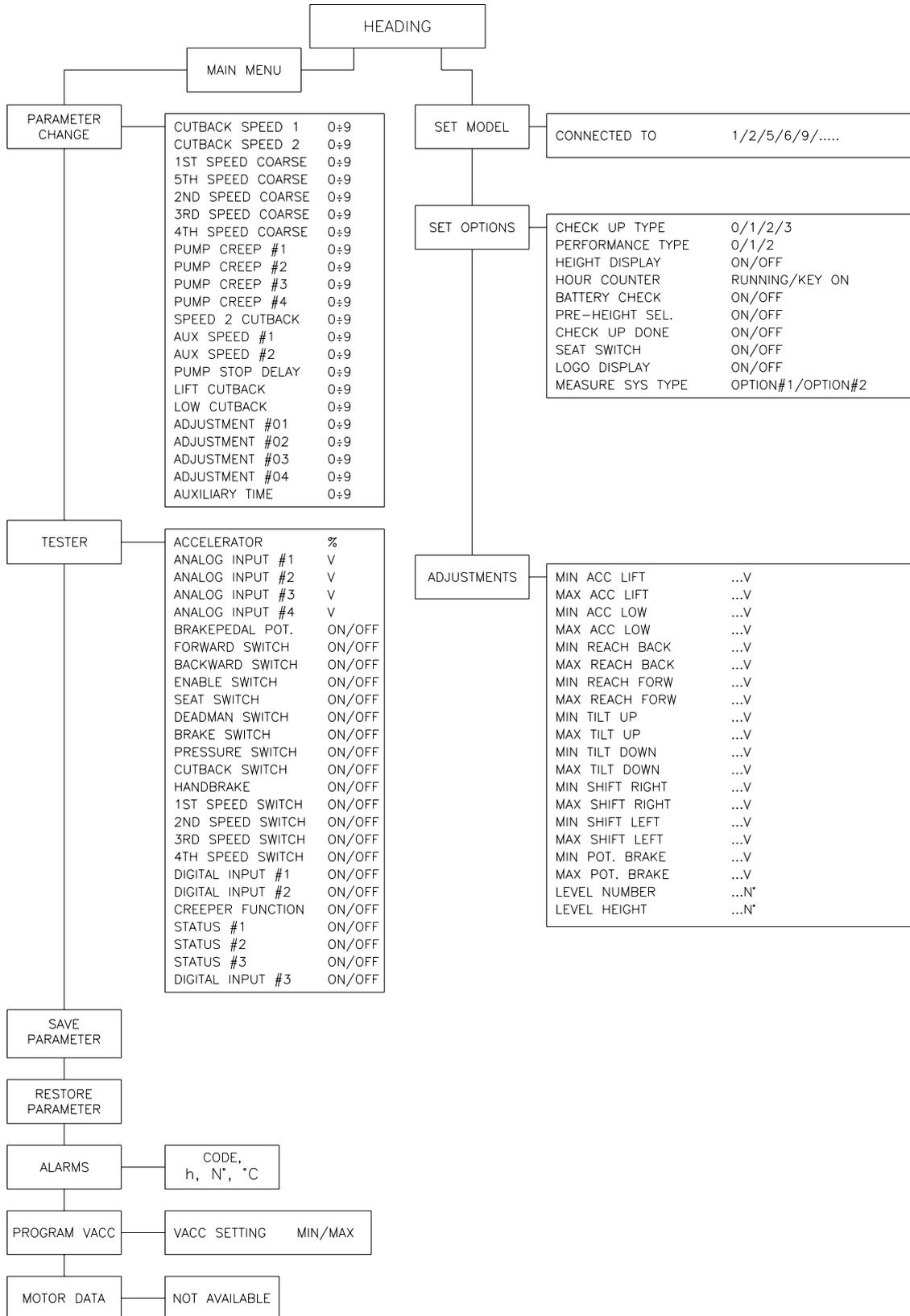
10) MEASURE SYS TYPE

Selects the measurement system:
OPTION #1 metric decimal system
OPTION #2 anglo-Saxon system

4.5 Sicos "Adjustment" menu

- 1) MIN ACC LIFT = lifting pot minimum value
- 2) MAX ACC LIFT = lifting pot maximum value
- 3) MIN ACC LOW = lowering pot minimum value
- 4) MAX ACC LOW = lowering pot maximum value
- 5) MIN REACH BACK = reach pot minimum value (BWD)
- 6) MAX REACH BACK = reach pot maximum value (BWD)
- 7) MIN REACH FORW = reach pot minimum value (FWD)
- 8) MAX REACH FORW = reach pot maximum value (FWD)
- 9) MIN TILT UP = tilt pot minimum value (lifting dir.)
- 10) MAX TILT UP = tilt pot maximum value (lifting dir.)
- 11) MIN TILT DOWN = tilt pot minimum value (lowering dir.)
- 12) MAX TILT DOWN = tilt pot maximum value (lowering dir.)
- 13) MIN SHIFT RIGHT = side shift pot minimum value (right dir.)
- 14) MAX SHIFT RIGHT = side shift pot maximum value (right dir.)
- 15) MIN SHIFT LEFT = side shift pot minimum value (left dir.)
- 16) MAX SHIFT LEFT = side shift pot maximum value (left dir.)
- 17) MIN POT. BRAKE = brake pot minimum value
- 18) MAX POT. BRAKE = brake pot maximum value
- 19) LEVEL NUMBER = floor number to program
- 20) LEVEL HEIGHT = corresponding height to the selected level

4.6 Console map



5 ALARMS

- 1) VACC NOT OK = accelerator high at stand or not correctly programmed
- 2) POT #1 NOT OK = lifting pot high at stand or not correctly programmed
- 3) POT #2 NOT OK = reach pot high at stand or not correctly programmed
- 4) POT #3 NOT OK = tilting pot high at stand or not correctly programmed
- 5) POT #4 NOT OK = side shift pot high at stand or not correctly programmed
- 6) CAN BUS KO = one of the modules connected to the sicos through CAN BUS don't communicate correctly
- 7) CHECK UP NEEDED = programmed maintenance request
- 8) EEPROM KO = EEPROM parameters managing error
- 9) CLEARING EEPROM = appears when pressing the buttons UP+DOWN+ENTER at key switch on for at least 10 seconds. The EEPROM is in the re-programming phase. Turning off the key before 10 sec. will not clear EEPROM
- 10) BATTERY LOW = discharged battery ($\leq 20\%$)
- 11) FORW+BACK = forward and backward switch closed in the same time
- 12) INCORRECT START = pump or traction enable request at key switch on or wrong starting sequence
- 13) POWER FAILURE #1 = short circuit on one of the SICOS digital outputs (three auxiliary outputs)
- 14) STEER SENSOR KO = wrong configuration of the steering switches on the steering wheel



IMPORTANT NOTE ABOUT WASTE MANAGEMENT:

This controller has both mechanical parts and high-density electronic parts (printed circuit boards and integrated circuits). If not properly handled during waste processing, this material may become a relevant source of pollution. The disposal and recycling of this controller has to follow the local laws for these types of waste materials.

Zapi commits itself to update its technology in order to reduce the presence of polluting substances in its product.
