



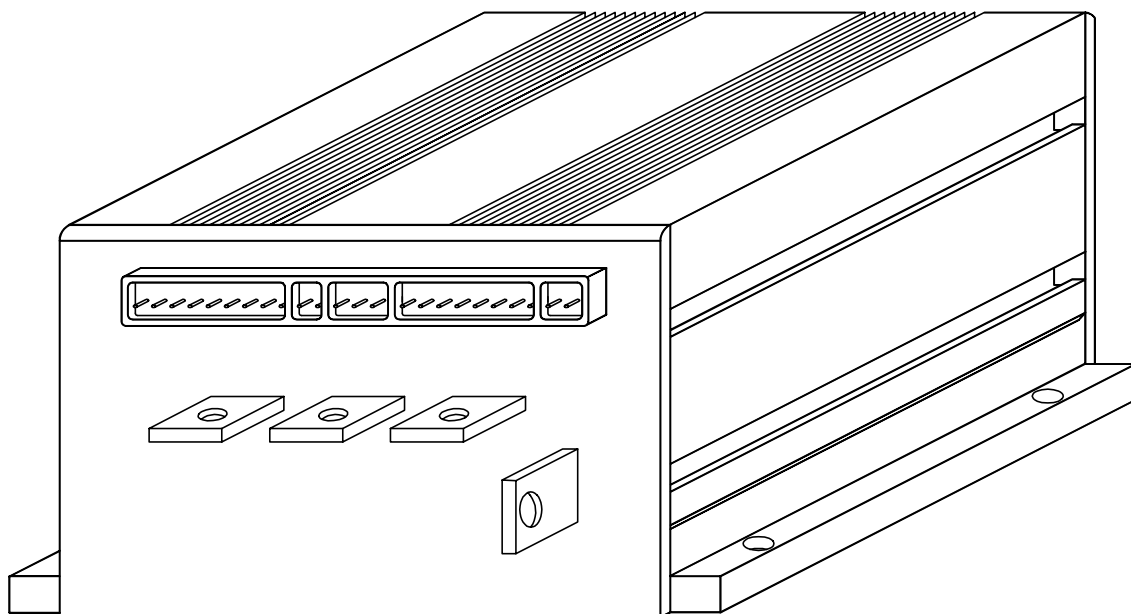
**COSTRUZIONE APPARECCHIATURE ELETTRONICHE - OLEODINAMICHE - INDUSTRIALI**

42028 - POVIGLIO - (R.E.) - Via della Costituzione,32 - ITALIA

Tel. (0522) 960050 (r.a.) - Tlx. 530021 AINDRE I - Fax (0522) 960259

## **ZAPIMOS HP 350A**

### **PUMP MOTOR CONTROLLER**



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Standard pump diagram with 2 speeds on the lifting lever

Standard pump diagram with 2 speeds on the lifting lever + field weakening

Standard pump diagram with pedal driven hydroguide and traction contactor

Standard pump diagram with lifting potentiometer

Standard pump diagram with lifting potentiometer + general contactor

Lifting pump diagram + hydroguide pump

Recommended spare parts

Maintenance

**Legend**

AV = Forward  
IN = Backward  
IND = Weakening  
VMN = Negative motor voltage  
MA = Forward speed microswitch  
MI = Backward microswitch  
MD = Descent microswitch  
MS = Rise microswitch  
NT = Contactor negative  
MCL = Horn microswitch  
MEF = Electric brake switch  
CH = Key  
MT = Handle microswitch  
MUM = Dead man microswitch  
DF = Brake diode  
DV = Flywheel diode  
RV = Speed reduction  
1^V = 1st lift speed request

# 1. GENERAL CHARACTERISTICS

## 1.1 Specifications

Voltages            range A: 24V  
                      range B: 36/40/48V  
                      range C: 60/72/80V  
                      range D: 96V  
Max Current        350 Amps  
Operating Frequency 18KHz  
External temperature range -30 ÷ 40°C  
Minimum temperature reached by the chopper 85°C  
Motors            series and compound

| Drop voltage at 150 Amps: | <i>Supply Voltage [V]</i> | <i>Drop Voltage [mV]</i> |
|---------------------------|---------------------------|--------------------------|
|                           | 24                        | 300                      |
|                           | 36/40/48                  | 590                      |
|                           | 60/72/80/96               | 910                      |

Microprocessor logic unit:

Via console it is possible to set 2 different configurations:

1. 5 speed pump control chopper
2. 4 speed pump control chopper + driver of hydroguide contactor

## 1.2 Adjustment tools

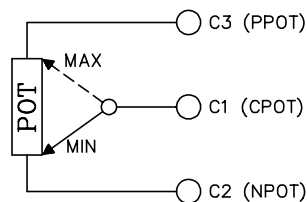
### 1.2a Microswitches

The microswitches send a voltage signal when the desired speed request is made.

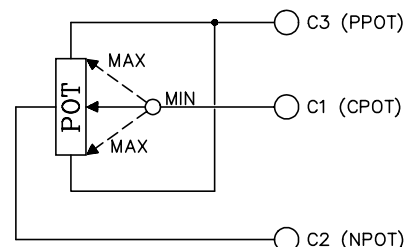
### 1.2b Potentiometer

In the 3-wire configuration, the CPOT (C1) useful input signal goes from 0V to 10V. The resistive value of the potentiometer must be between 500 ohm and 10 kohm, as lower values overload the power supply.

3 WIRE PEDAL



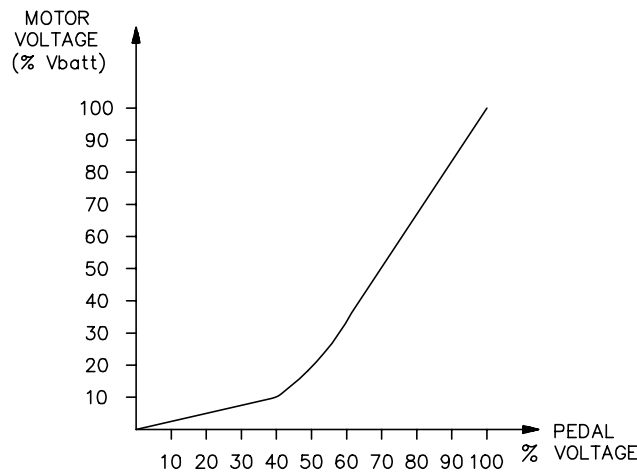
3 WIRE HANDLE



2-wire potentiometer (please request while ordering):

It is possible to use the potentiometer in the 2-wire configuration but you should state its ohmic value since a resistor on the logic boards must be installed accordingly.

Correspondence between the voltage signal to pin C1 and motor voltage.



The procedure for automatic potentiometer signal acquisition is carried out from the console. This makes it possible to adjust the minimum and maximum useful signal in the respective directions.

The sequence of procedures is described in the programming console manual.

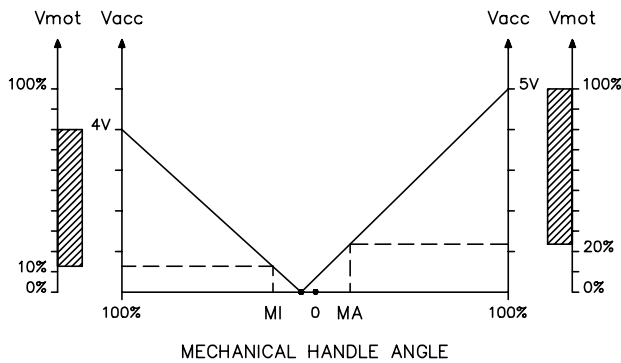


fig. 8a

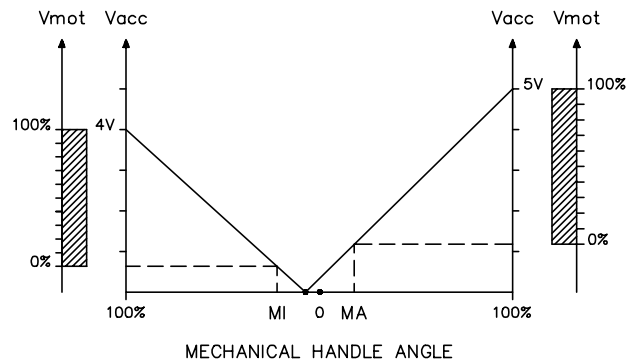


fig. 8b

The first graph (Fig. 8a) shows the correspondence of the motor voltage without having made the acquisition, while the second graph (Fig. 8b) shows the same correspondence after signal acquisition by the potentiometer.

The acquisition procedure is invalidated by the machine if the difference between the maximum value and the minimum value is less than 2V.

This acquisition procedure makes it possible:

- to use "reversed" potentiometric signals, i.e. those which are carried from a high initial value to a low final value.
- to use a normal potentiometer instead of one with central zero.

For the correct functioning of signal acquisition, it is absolutely necessary that the running microswitches be activated by the same shaft that moves the potentiometer.

- 2-wire potentiometer (request while ordering)

It is possible to use a potentiometer with 2-wire configuration, in which case the resistive value of the potentiometer desired must be indicated, as a resistance with the correct corresponding value must be fitted in the logic unit.

### **1.3 PERFORMANCE FEATURES**

- Optimum sensitivity to low speeds.
- Self-diagnosis with indication of the type of anomaly by an optional LED.
- Configurable from the console (traction or lifting).
- Modification of parameters from the console.
- Internal hour-meter with values that can be displayed on the console.
- Memorisation of the last 5 alarms tripped, with relative hour-meter value and temperature that can be displayed on the console.
- Console tester for real time checking of the main parameters such as inputs, motor voltage, battery, etc.
- Absence of arc on the contactors
- Internal arc suppressor of the contactors coils.
- High motor and battery efficiency thanks to high frequency commutation.
- Priority is given to the highest speed.

### **1.4 COMPENSATION CONCEPT**

By introducing the compensation the voltage power supply of the pump is linked to the load. This is because the pump voltage is the sum of a fix part (socket - threshold) and a part that varies with load (current). By acting on the compensation parameter it is possible to adjust the current weight, so that we set a rule on how to vary the motor voltage as a function of the load. In this way the whole amount of oil that circulates can produce work. Also the hydrolic circuit is independent from the requested performance, therefore it can be cheaper (reduced jack and pipe cross-section, no back pressure valve and no neck downs).

### **1.5 PROTECTION FEATURES**

#### **- Battery inversions:**

It is necessary to respect the connections indicated in the diagrams in order to avoid damage to the power unit. In the lifting versions, a general contactor may be connected which is handled by the logic against any polarity inversions.

The logic is intrinsically protected against polarity inversions.

#### **- Connection errors:**

All the inputs are protected against connection errors.

The contactors do not accept loads greater than 3 amp, and are in any case protected against overloads and short circuits.

#### **- Thermal protection:**

If the temperature exceeds 80°C, the maximum current is reduced in proportion to the thermal increase. The temperature may never exceed 85°C.

#### **- Low battery charge:**

When the battery charge is low, the maximum current is reduced by 50%, and in the lifting version all functions except hydrodrive (and descent) are blocked. This feature may be excluded via the console.

#### **- External agents:**

The chopper body completely sealed, and thus is protected against splashes of liquid (IP54).

**- Protection against accidental startup:**

A precise sequence of operations is necessary for starting the machine.

If these operations are not carried out correctly, the machine will not start.

The request for running must be activated after the key and handle microswitch (or seat micro-switch).

**- Protection against uncontrolled movements:**

The contactors do not close if:

- the power unit is not functioning
- the accelerator does not go below the minimum value stored increased by 2 V
- the logic is not perfectly functional
- one running microswitch is stuck.

## **1.6 THERMAL CONSIDERATIONS**

- The heat generated by the control unit must be dissipated. For this to be possible, the compartment must be ventilated and the cooling surfaces ample.
- The cooling system is dimensioned on the basis of the performance required of the machine. For situations in which ventilation is poor and heat exchange difficult because of the materials used, it is advisable to use forced air ventilation.
- The power dissipated by the module varies depending on the current and the work cycle.

## **1.7 GENERAL NOTES ON USE OF H2P**

- Never combine SCR low frequency choppers with H2 modules, as the filtre condensers contained in the H2 module alter SCR chopper functioning, subjecting it to excessive workloads. Thus, if you wish to use two or more control units (e.g. lift + traction), they must all be of the high frequency ZAPIMOS family.
- Do not connect the chopper to a battery with a different nominal voltage than that indicated on the chopper identification plate. A higher battery voltage can cause MOS failure. A lower battery voltage prevents the module from functioning.
- During battery recharge, the H2 module must be completely disconnected from the battery, as in addition to altering the charge read by the battery charger, the module can be damaged by the overload voltages generated by the charger.
- The H2 module must only be supplied using a traction use battery; do not use outputs of straighteners or power suppliers. For special applications, consult the nearest ZAPI service centre.

## **3 INSTALLATION**

Install the chopper with the base-plate on a flat metallic surface that is clean and unpainted. Apply a light layer of thermo-conductive grease between the two surfaces to permit better heat dissipation.

Despite the protection provided against external agents, the continuous attack of corrosive substances may cause the connector contacts to oxidise, thus jeopardising good functioning. Keep this in mind when choosing the installation position on the vehicle.

Use the special holes on the base-plate for fastening the chopper.

Make sure that the wiring of the cable terminals and connectors is carried out correctly.

Fit anti-jamming filters on the horn, solenoid valves, and contactors not connected to the chopper such as those for activating the pump motor or hydrodrive motor, if the latter is not handled by the chopper itself.

### **3.1 CONNECTION CABLES**

For the auxiliary circuits, use cables of 0.5mm<sup>2</sup> section.

For power connections to the motor and to the battery, use cables having sections of 35 - 5mm<sup>2</sup>.

For the best chopper performance, the cables to the battery should be run side by side and be as short as possible.

### **3.2 CONTACTORS**

Choose the type of contactors on the basis of the maximum operating current of the motor and the specific chopper configuration.

- The current absorbed by the coil must not be greater than 3 amp.
- The coil suppressors are inside the chopper; do not use contactors with arc suppressors.
- For contactors with magnetic suppressors, make sure you respect the polarity indicated on the cap.

### **3.3 FUSES**

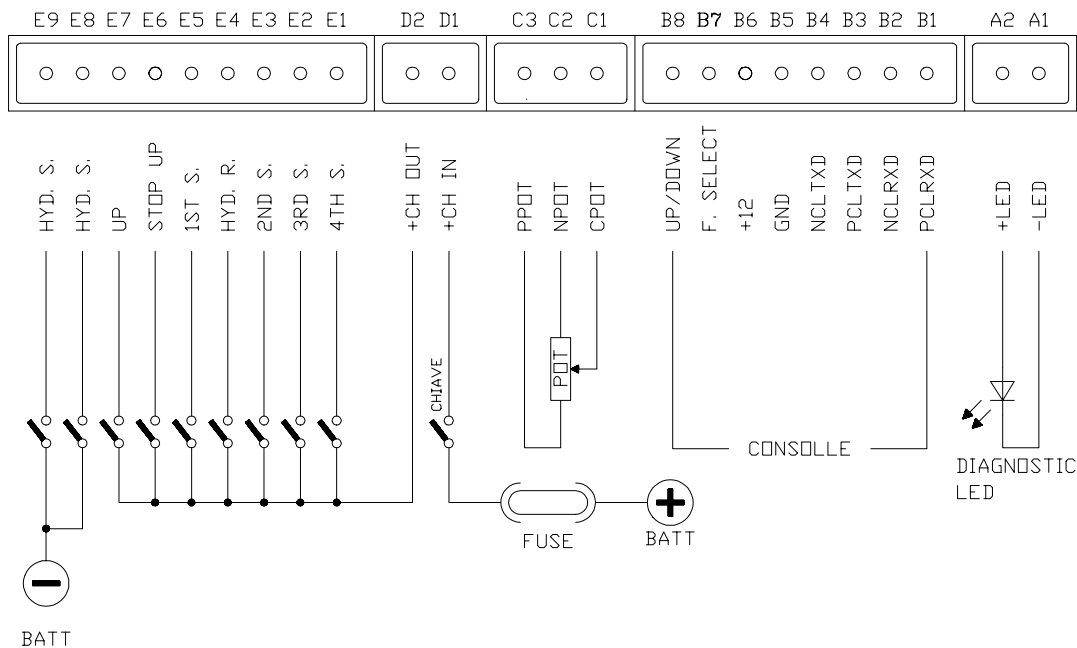
- Use a 10 amp fuse for auxiliary circuit protection.
- For protecting the power unit, see the diagrams.

The value shown is the maximum allowable. For special applications or requirements this value can be reduced.

For safety reasons, we recommend that you use protected fuses in order to prevent the spread of fused particles in the event of blowout.



### 3.4 LOGIC BOARD CONNECTORS

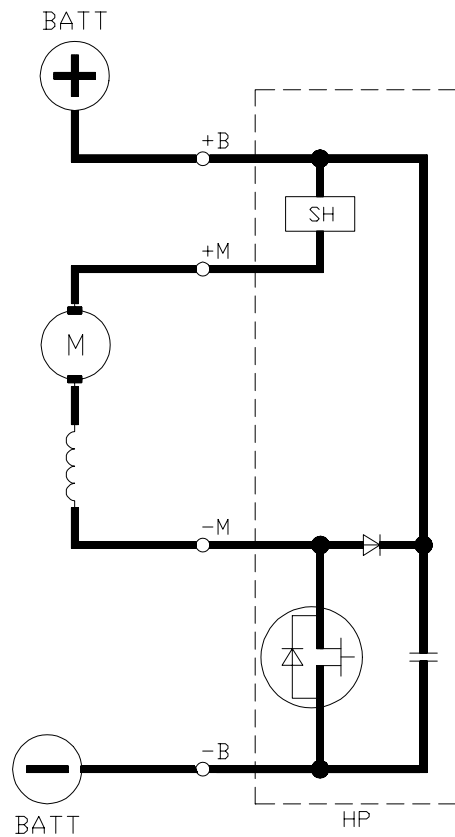
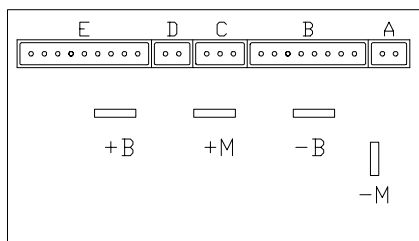


| <i>pin</i> | <i>function</i> | <i>description</i>   |
|------------|-----------------|--|
| A1         | -LED            | Alarm LED negative: to be connected to the cathode   |
| A2         | +LED            | Alarm LED positive: to be connected to the anode<br>Output current 12mA, for standard type LED   |
| B1         | PCLRXD          | Serial reception positive  |
| B2         | NCLRXD          | Serial reception negative  |
| B3         | PCLTXD          | Serial transmission positive   |
| B4         | NCLTXD          | Serial transmission negative   |
| B5         | GND             | Console supply negative  |
| B6         | +12             | Console supply positive  |
| B7         | FUNCTION SELECT | Channel for mini-console (speed signal)  |
| B8         | UP/DOWN         | Channel for mini-console (speed ref.)  |
| C1         | CPOT            | Potentiometer central unit: connected to the potentiometer cursor. For speed regulation, the useful signal ranges from 0 Volt (minimum speed) to 10 V (maximum speed). |
| C2         | NPOT            | Potentiometer negative: a battery negative.  |
| C3         | PPOT            | Potentiometer positive: a 12 V output.<br>Do not short circuit this terminal toward the battery negative or apply a resistive load of less than 500 ohm.               |
| D1         | +CH IN          | To be connected to the key.  |
| D2         | +CH OUT         | The positive to be sent to the function request microswitches is taken from this pin. This positive is taken after the internal diode.                                 |

| <i>pin</i> | <i>function</i> | <i>description</i>  |
|------------|-----------------|---|
| E1         | 4th speed       | Input 4th speed request. Enabled if E1 is connected to +Batt  |
| E2         | 3th speed       | Input 3th speed request. Enabled if E2 is connected to +Batt  |
| E3         | 2nd speed       | Input 2th speed request. Enabled if E3 is connected to +Batt  |
| E4         | Hyd speed       | (Active High) Input hydroguide request. Enabled if E4 is connected to +Batt. In the pump standard version E4 is hyd speed, in the PUMP+HYDRO version E4 is the hydroguide contactor. In both versions the programmable timing hydro time is active. |
| E5         | 1st speed       | Input 1st speed request. Enabled if E5 is connected to +Batt.   |
| E6         | Stop up         | Input stop lifting. When active function on pin E7 is stopped.  |
| E7         | Up              | (Active High) Input speed request associated to a potentiometer.  |
| E8         | Hyd speed       | Same function as E4 but Active Low.   |
| E9         | Hyd speed       | Same function as E8 but electrically disconnected from it.  |

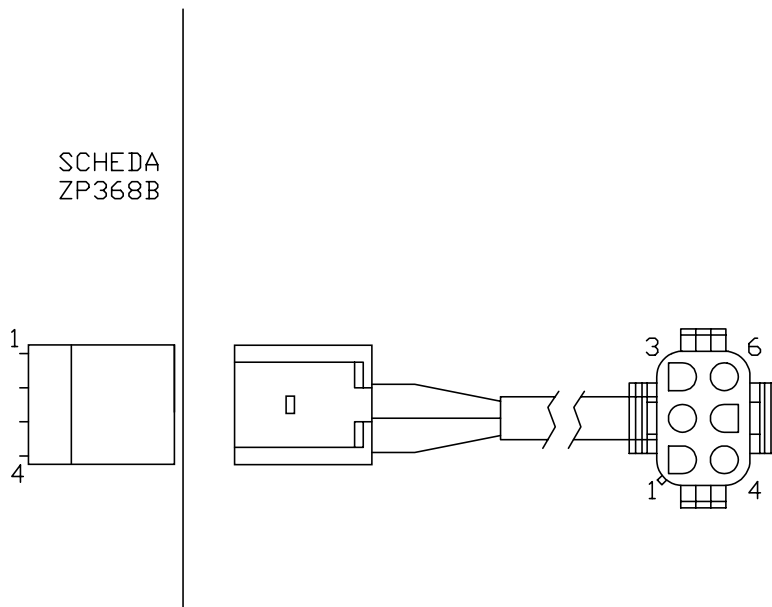
### 3.5 POWER CONNECTORS

- +M** Output current sense
- +B** Battery positive
- M** Connected to the power mosfet drain, it supplies a negative to the motor with variable duty cycle
- B** Battery negative



### 3.6 CONTACTORS CONNECTOR DESCRIPTION

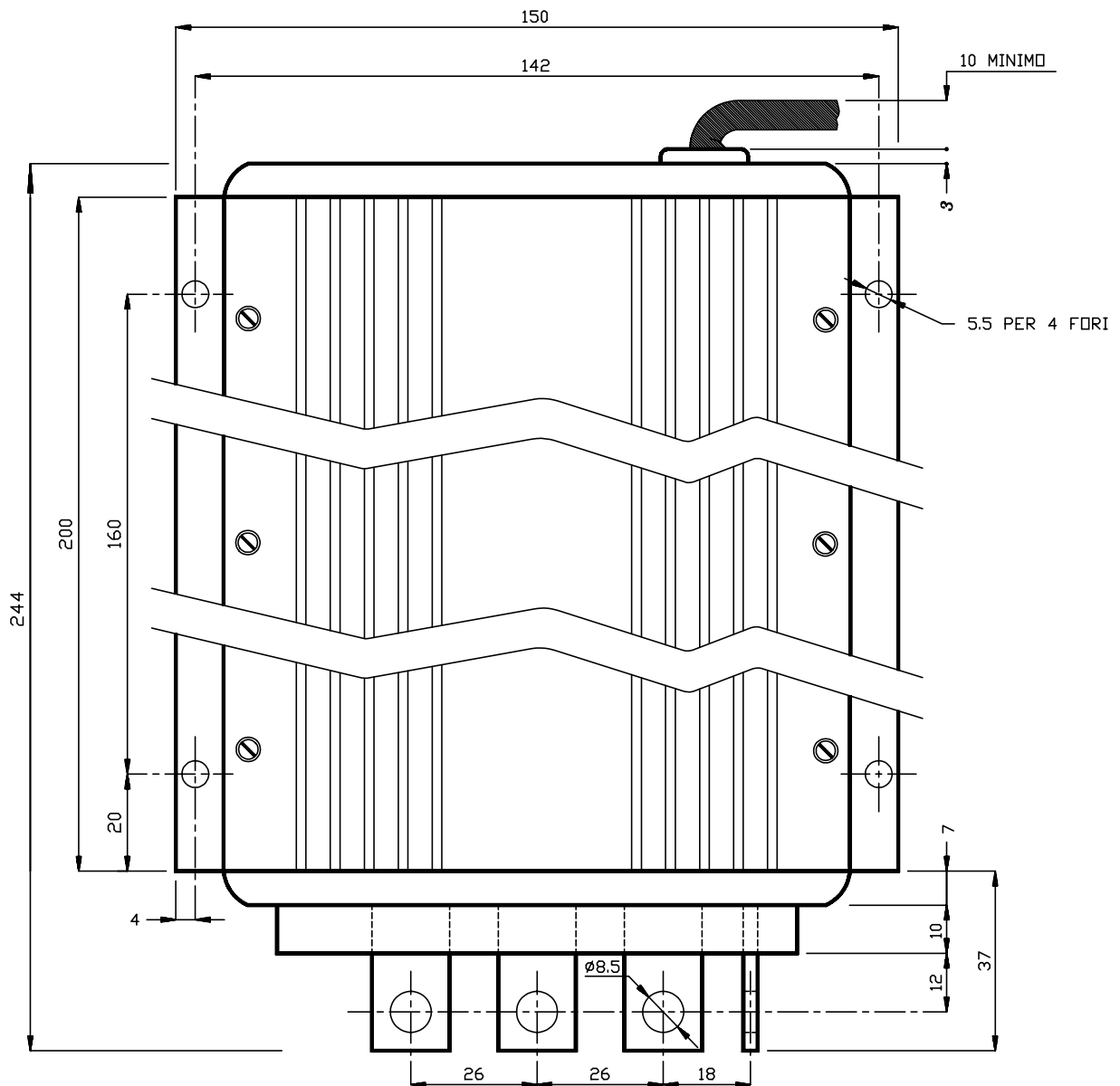
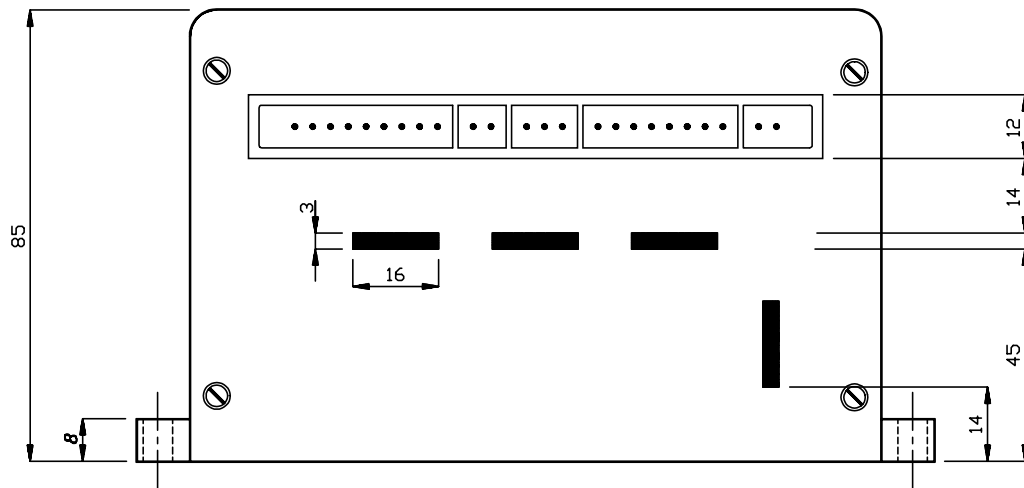
In order to command the general, hydroguide and bypass contactors a 6 pin mate-N-lock connector is available. From this connector it is possible to get contactors coils commands.



| <i>Connector G<br/>(logic board)</i> | <i>Wire color</i> | <i>Connector</i> | <i>Function</i>                               |
|--------------------------------------|-------------------|------------------|---|
| 1                                    | -                 | -                | Not used                                      |
| 2                                    | white-grey        | 3                | Negative bypass or field weakening contactor. |
| 3                                    | jellow-black      | 5                | Negative hydroguide or general contactor      |
| 4                                    | red-black         | 1                | Contactors positive, same key voltage.        |

Note: If the H2P is configured as PUMP+HYDRO it is not possible to drive the general contactor because the comand for the coil is now used for the hydroguide contactor only.

### 3.7 MECHANICAL DRAWING



## 4. PARAMETER MODIFICATIONS

Modification of the parameters, in addition to the configuration of the inputs, is made directly by ZAPI on customer specifications, or the customer may make adjustments himself using the programming console or the mini-console, with which only certain parameters to be modified. The console can remain connected to the chopper when running and the parameters can also be varied in real time during operation.

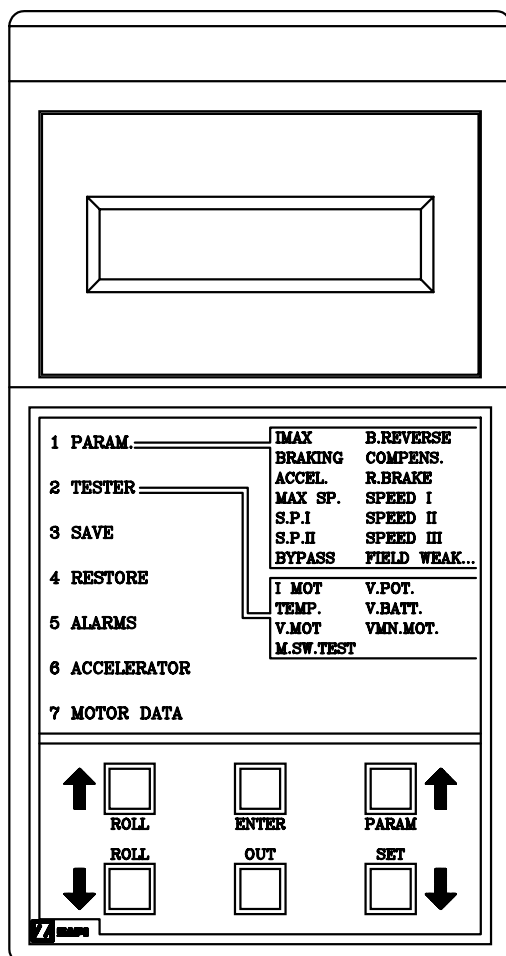
To confirm data, press ENTER when requested by the message on the console.

The parameters thus modified and optimised on one unit can be stored from the console (SAVE) and then reloaded (RESTORED) on another chopper, thus allowing fast and standardised calibration (see console manual for details).

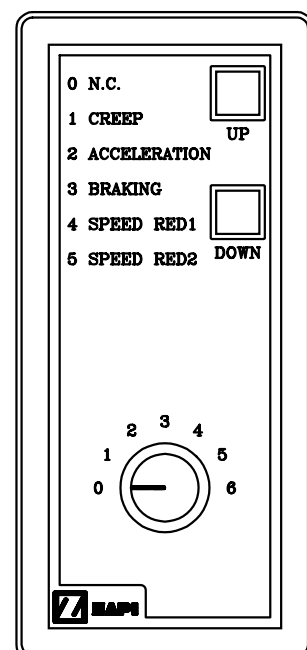
Pay special attention to the polarity of the console connector when it is hooked up to the chopper.

**HOOKING UP MUST ONLY BE DONE WITH THE MACHINE OFF.**

### 4.2 PROGRAMMING CONSOLE



### 4.3 MINI-CONSOLE



## 4.1 MODIFYING PARAMETERS USING THE MINI-CONSOLE

The parameters that can be modified are:

|          | <i>Lifting</i> |
|----------|----------------|
| <b>1</b> | 1ST SPEED      |
| <b>2</b> | 2ND SPEED      |
| <b>3</b> | 3RD SPEED      |
| <b>4</b> | HYDRO SPEED    |
| <b>5</b> | HYDRO COMP.    |
| <b>0</b> | NOT CONNECTED  |

The adjustments are possible within 10 intermediate levels.

- Connect the mini-console to connector (B) on the chopper.  
(the hookup MUST BE MADE WITH THE KEY OFF).
- Supply the machine by activating the key.
- Position the dial selector on the function to be modified.  
The SET-UP button increases the value of the parameter, while SET-DOWN decreases it.  
Note: the variations are made through a count of the number of impulses sent from the buttons; thus for increasing or decreasing more than one point, you need to release and then re-press the button.  
Keeping the button pressed continuously does not provide continuous variation of the parameters.
- The parameters are modified in real time, making it possible to check the values set immediately.  
The modified parameters are automatically stored by the control logic without the need for confirmation before switching off or disconnecting the console.

Important note: The console does not function if connected when the motor is running. Switch the machine off and on again for activating the console functions.

## 4.2 PROGRAMMABLE CONSOLLE FUNCTION DESCRIPTION

The digital consolle display the model type and its built in hourmeter.

|                         |   |
|-------------------------|---|
| Model selection         | PUMP Standard<br>PUMP + HYDRO   |
| Option selection        | PIN G3    bypass/field weakening<br>Battery    free/check<br>HOURS    running/key on<br>PIN G5    status/main contactor   |
| Battery selection       | 24/36/40/48V, 60/72/80/96V + fine adjustment  |
| Programmable parameters | Acceleration<br>Deceleration<br>Max current<br>Creep speed<br>Weak dropout<br>Hydroguide delay<br>Hydroguide speed<br>Hydroguide compensation<br>Non-fine speed regulation 1/2/3/4<br>Fine speed regulation 1/2/3/4 |
| Tester                  | VMN 1/3 BATT<br>Input E1 - E7<br>Potentiometer input<br>Motor current<br>Chopper temperature<br>Battery voltage<br>Motor voltage  |
| Save function           | Parameter memory  |
| Restore function        | Loading parameter on the chopper  |
| Alarm                   | Display of in-memory alarm  |
| Program Vacc            | Potentiometer stroke parameter  |

### 4.3 OPTION AND CHOPPER CONFIGURATION

Configuration of the model      MENU SEL MODEL enables to have the chopper to work in one of the following set:  
 1      Standard pump  
 2      Pump + Hydro = pump + hydroguide contactor

Option configuration      MENU SEL OPTIONS

| <i><b>fuction/pin</b></i> | <i><b>option</b></i> | <i><b>description</b></i>   |
|---------------------------|----------------------|---|
| <b>1) PIN G3</b>          | <b>bypass</b>        | The contactor connected to connector G3 is handled as a bypass, with activation current = 80% I <sub>max.</sub> , output current = 90% I <sub>max.</sub> , activation delay=800 msec.                             |
|                           | <b>weak</b>          | The contactor connected to connector G3 is handled as weakening, with activation current = 50% of the programmable output current (WEAK DROP OUT) from 10% to 100% I <sub>max.</sub> . Activation delay=800 msec. |
| <b>3) BATTERYfree</b>     |                      | No low charge alarm.  |
|                           | <b>check</b>         | Activates the check that reads the battery voltage in standby. When the residual charge is less than 10%, the maximum current is halved and the LED blinks continuously.  |
| <b>6) HOURS</b>           | <b>running</b>       | Hour-metre only active when running.  |
|                           | <b>key on</b>        | Hour-metre active with the key on.  |
| <b>4) PIN G5</b>          | <b>status</b>        | PIN G5 output is active when the chopper is executing any function but STOP UP.   |
|                           | <b>main c.</b>       | PIN G5 output drives a general contactor  |

Selection of battery voltage      MENU SEL BATTERY

It enables to set the nominal battery voltage to drive the charge status of the battery and the tester functions.

Voltages to be selected: 24/36/40/48V, 60/72/80/96V

With ROLL UP and ROLL DOWN buttons it is possible to select the nominal battery voltage and SET UP and SET DOWN buttons allow fine battery voltage adjustments.



## 4.4 PARAMETER MODIFICATIONS

The parameters can be modified with the chopper in standby or running. In the latter case, you must return to standby before switching off the chopper so that the modifications are stored in the chopper's non-volatile memory.

- 1) ACCELER.DELAY = Pump motor acceleration time
- 2) EV. ACCELER DELAY\* = Acceleration time relative to descent (proportional solenoid valve).
- 3) DECELER DELAY = Deceleration time, i.e. to annul the voltage on the motor upon release.
- 4) EV.DECELER DELAY\* = Deceleration time relative to descent.
- 5) IMAX. Defines the maximum chopper current. All current adjustments are expressed as a percentage of this value.  
The adjustment range is from 50% (level 0) to 100% (level 9).
- 6) HYD SPEED COARSE = Coarse hydrodrive speed (from 0 to 100% Vbatt on the motor).
- 7) HYD SPEED FINE = Fine hydrodrive speed (a value from 0 to 10% Vbatt is added to the coarse speed value). The speed is given by:  
motor voltage = [(coarse speed) x 10 + (fine speed)] x Vbatt /100  
The interval of values ranges from 0 to total conduction.
- 8) HYDRO COMPENS = Compensation in current for hydrodrive request.
- 9) CREEP SPEED = Defines the minimum value of voltage applied to the motor with running request active. Allows a more immediate response.
- 10) WEAK DROPOUT = Threshold of current for opening the weakening contactor (if programmed as such and not as bypass, in which case the output threshold is fixed and not programmable).
- 11) HYDRO TIME = Hydrodrive delay time. If set at 0, there is no delay; thus the hydrodrive input can be handled as a 5th speed.
- 12) 1ST SPEED COARSE = Speed no. 1, coarse adjustment.
- 13) 1ST SPEED FINE = Speed no. 1, fine adjustment.
- 14) 1ST SPEED COMP. = Compensation speed no.1.
- 15) 2ND SPEED COARSE = Speed no. 2, coarse adjustment.
- 16) 2ND SPEED FINE = Speed no. 2, fine adjustment.
- 17) 2ND SPEED COMP. = Compensation speed no.2.
- 18) 3RD SPEED COARSE = Speed no. 3, coarse adjustment.
- 19) 3RD SPEED FINE = Speed no. 3, fine adjustment.
- 20) 3RD SPEED COMP. = Compensation speed no.3.
- 21) 4TH SPEED COARSE = Speed no. 4, coarse adjustment.
- 22) 4TH SPEED FINE = Speed no. 4, fine adjustment.
- 23) 4TH SPEED COMP. = Compensation speed no.4.
- 24) MIN. VALVE VOLT.\* = Minimum voltage applied on the proportional solenoid valve.
- 25) MAX. VALVE VOLT.\* = Maximum voltage applied on the proportional solenoid valve.

\* Special function not available on standard version

## TABLE OF MODIFICATIONS

| PARAMETER             | UNIT   | PROGRAMMED LEVEL |      |      |      |      |      |      |      |      |      |
|-----------------------|--------|------------------|------|------|------|------|------|------|------|------|------|
|                       |        | 0                | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    |
| ACCELERATION DELAY*   | sec.   | 0,15             | 0,24 | 0,39 | 0,50 | 0,63 | 0,74 | 0,86 | 0,97 | 1,09 | 1,22 |
| EV. ACCELER DELAY     | sec.   | 0,39             | 0,63 | 0,71 | 0,81 | 0,97 | 1,05 | 1,27 | 1,36 | 1,46 | 1,54 |
| DECELER DELAY         | sec.   | 0,06             | 0,13 | 0,19 | 0,25 | 0,31 | 0,38 | 0,44 | 0,50 | 0,56 | 0,62 |
| EV. DECELER DELAY     | sec.   | 0,30             | 0,60 | 0,70 | 0,78 | 0,95 | 1,04 | 1,26 | 1,36 | 1,43 | 1,53 |
| I MAX. (600A)         | Amp    | 300              | 333  | 367  | 400  | 433  | 467  | 500  | 533  | 567  | 600  |
| I MAX. (500A)         | Amp.   | 250              | 278  | 306  | 333  | 361  | 388  | 416  | 444  | 472  | 500  |
| I MAX. (400A)         | Amp    | 400              | 222  | 244  | 266  | 289  | 311  | 333  | 355  | 378  | 400  |
| SPEED COARSE (TUTTE)  | %VBatt | 0                | 11   | 22   | 33   | 44   | 55   | 66   | 77   | 88   | 100  |
| SPEED FINE (TUTTE)    | %VBatt | 0                | 1,2  | 2,4  | 3,6  | 4,8  | 6,05 | 7,3  | 8,5  | 9,7  | 10,9 |
| COMPENSAZIONE (TUTTE) | K (I)  | 10               | 2,0  | 3,0  | 4,0  | 5,0  | 6,0  | 7,0  | 80   | 90   | 100  |
| CREEP SPEED           | %VBatt | 0                | 1,9  | 3,9  | 5,9  | 7,8  | 9,8  | 11,7 | 13,7 | 16,6 | 17,6 |
| WEAK DROPOUT          | %Max.  | 10               | 20   | 30   | 40   | 50   | 60   | 70   | 80   | 90   | 100  |
| HYDRO TIME            | sec.   | 0                | 0,5  | 2    | 4    | 7    | 9    | 12   | 14   | 17   | 20   |
| MIN VALVE VOLT        | %VBatt | 7,4              | 11,3 | 15,2 | 19,2 | 23,1 | 27,0 | 31   | 35   | 39   | 43   |
| MAX VALVE VOLT        | %VBatt | 56               | 60   | 64,5 | 70   | 74   | 78,5 | 83,5 | 88   | 92,5 | 97,5 |

### 4.5 SEQUENCE OF SETTINGS FOR LIFTING

- With the machine switched off, connect the programming console and then switch on. If no wiring errors or component defects are found, the display shows the manufacturer's name, programme release, configuration, and hour-metre value.

If the module has already been configured, the procedure passes directly to step four.

Otherwise, proceed in order as follows.

Consult the console manual for further procedure details.

- 1) Configure the chopper model.
- 2) Select the desired options.
- 3) Select and set battery voltage.
- 4) Check the functioning of all the wired inputs, including the potentiometer, by means of the tester functions on the console.
- 5) Carry out accelerator signal acquisition on the "PROGRAM VACC" menu.
- 6) Set the maximum current by selecting the level corresponding to the desired value.
- 7) Set the speed of the respective functions with the machine in standby, and the level of compensation set at "0". Then apply a load and set the compensation until it reaches the desired speed. As the adjustments of speed and compensation are interdependent, further adjustments must be made before reaching the optimum condition.
- 8) Set the hydrodrive speed in the same way as the others, with the only difference being that the speed is set with the steering in standby, while the compensation is set with the steering under load.
- 9) Set acceleration, deceleration, and creep as necessary.

## 5 DIAGNOSIS

Description of the alarms signalled by the diagnostic LED.

The alarm code is shown in parentheses. A detailed description is given in the section "DECODING THE ALARMS DISPLAYED ON CONSOLE".

**1 BLINK** = Logic anomaly (EEPROM DATA KO, EEPROM PAR. KO, EEPROM CONF. KO, EEPROM OFF-LINE, CHOPPER NO CONF, WATCH-DOG).

**2 BLINKS** = Running request on startup or error in handle/speeds sequence (INCORRECT \ START).

**3 BLINKS** = Error on VMN test (NO FUL CONDUCTION).

**4 BLINKS** = Accelerator high in standby - this error inhibits machine operation (VACC > 1 V).

**5 BLINKS** = Error in reading current - this error inhibits machine operation (1 HIGH AT STAND, I=0 EVER).

**6 BLINKS** = Malfunctioning of the contactor driver circuit (DRIVER SHORTED, COIL SHORTED).

**7 BLINKS** = Excessive temperature, greater than 80\_ (TH. PROTECTION).

**CONTINUOUS BLINKING (32 BLINKS)** = Low battery charge, battery with < 10% of residual charge (BATTERY).

### 5.1 DECODING THE ALARMS DISPLAYED ON CONSOLE

#### 1) STAND BY VMN LOW

The test is carried out in standby. If the VMN voltage is lower than 1/3 of the battery voltage, an alarm is signalled. Possible causes:

- a) Check the motor wiring to make sure it is correct.
- b) Chopper broken, replace.

#### 2) NO FULL COND.

The test is carried out in full conduction.

If, in this condition, the VMN is found to be greater than 1/3 VBATT, the diagnostic circuit is faulty, causing a safety risk, and thus machine operation is inhibited. If the defect persists, replace the logic.

#### 3) TH.PROTECTION

An indication that the chopper temperature has exceeded 80°C.

The maximum current is gradually reduced, reaching 0 at a temperature of 85°C. If the alarm occurs while cold:

- a) Check the thermal sensor connection.
- b) Thermal sensor failure.
- c) Connection on the power interrupted (check the connector that connects the logic to the power unit).
- d) Logic failure.

#### 4) BATTERY

The battery charge is low.

The alarm is signalled only if the BATTERY CHECK option has been selected. All functions except hydrdrive are inhibited.

### **5) INCORRECTSTART**

A running request is present on key startup.

Possible causes:

- a) Operator error.
- b) Request microswitch stuck.

### **6) I HIGH AT STAND**

Test carried out in standby, checks that the current is nil.

If this is not verified, an alarm is signalled. This alarm shuts down the machine. Possible causes:

- a) Current sensor broken and logic failure.

First replace the logic, and if the defect persists, replace the power unit.

### **7) I=0 EVER**

Test carried out in running.

Checks that the current during running is greater than a minimum value. If not, an alarm is signalled and the machine is shut down. Possible causes:

- a) The current sensor is faulty. Replace the power unit.

### **8) EEPROM PAR.KO**

Fault in the area of memory in which the adjustment parameters are stored. This alarm inhibits machine operation.

If the defect persists when the key is switched off and on again, replace the logic.

If the alarm disappears, remember that the parameters stored previously have been cancelled, and replaced by the default values.

### **9) EEPROM CONF.KO**

Fault in the area of memory in which the special chopper configuration data is stored. If the defect persists when the key is switched off and on again, replace the logic. Otherwise, keep in mind that the chopper configuration has been reset to the default values (regeneration voltage, etc.); thus it must be re-programmed. Consult the console manual.

### **10) EEPROM DATA KO**

The data in the area of memory that handles the hour-metre is incorrect. This alarm does not shut down the machine. If the alarm disappears when the machine is switched off and on again, keep in mind that the hour-metre data has been reset to zero.

### **11) EEPROM OFF LINE**

Fault in the non-volatile memory that contains data relative to the area for the hour-metre, the alarms stored and the programming parameters.

If the alarm persists when the key is switched off and on again, replace the logic.

### **12) CHOP. NO CONF.**

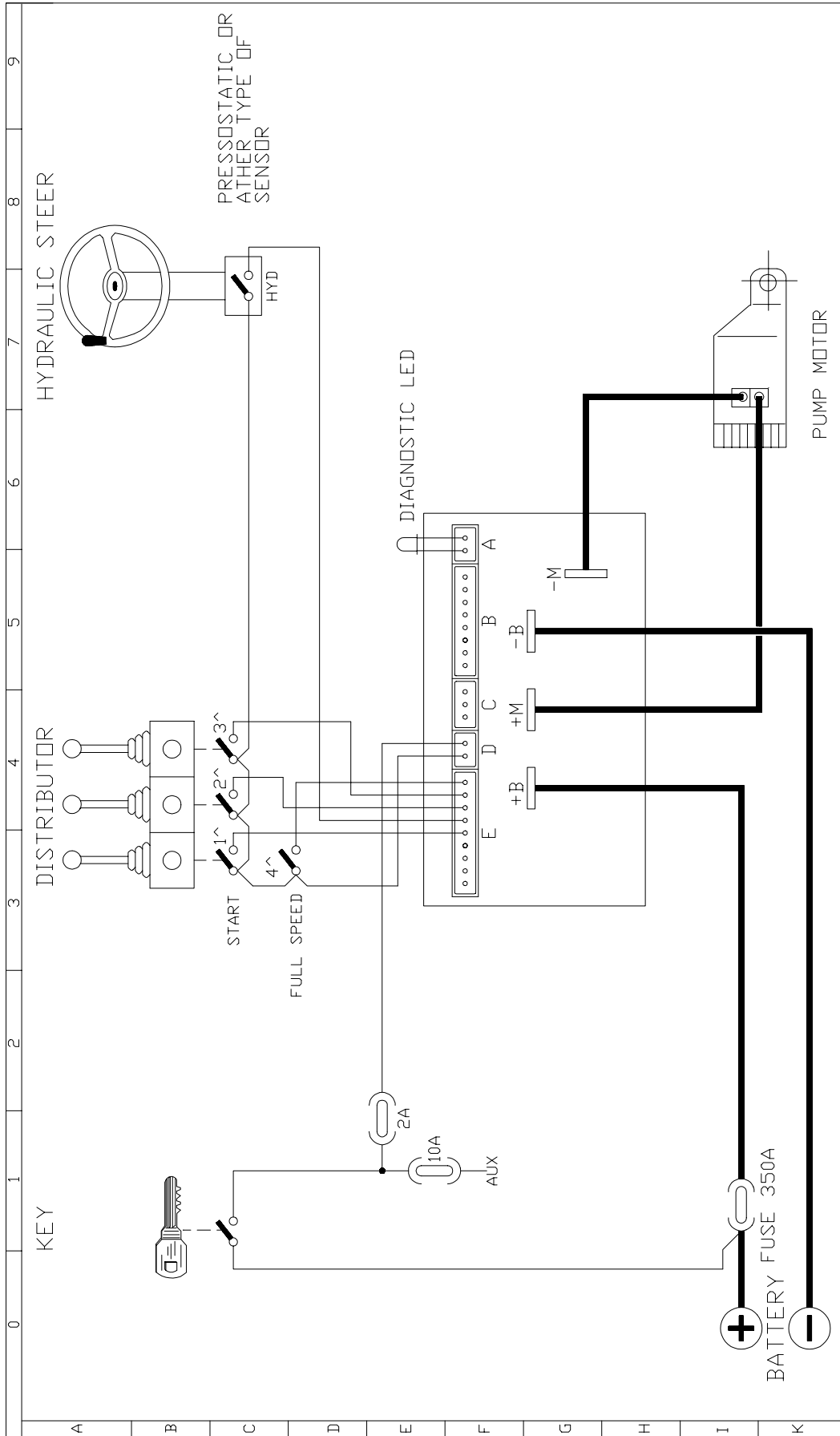
An alarm similar to no.9, except that here, even though the data is correct, it does not correspond to a hardware configuration recognised by the H2. The considerations are the same as for alarm 9 "EEPROM CONF.KO".

### **13) WATCH-DOG**

The test is made in both running and standby.

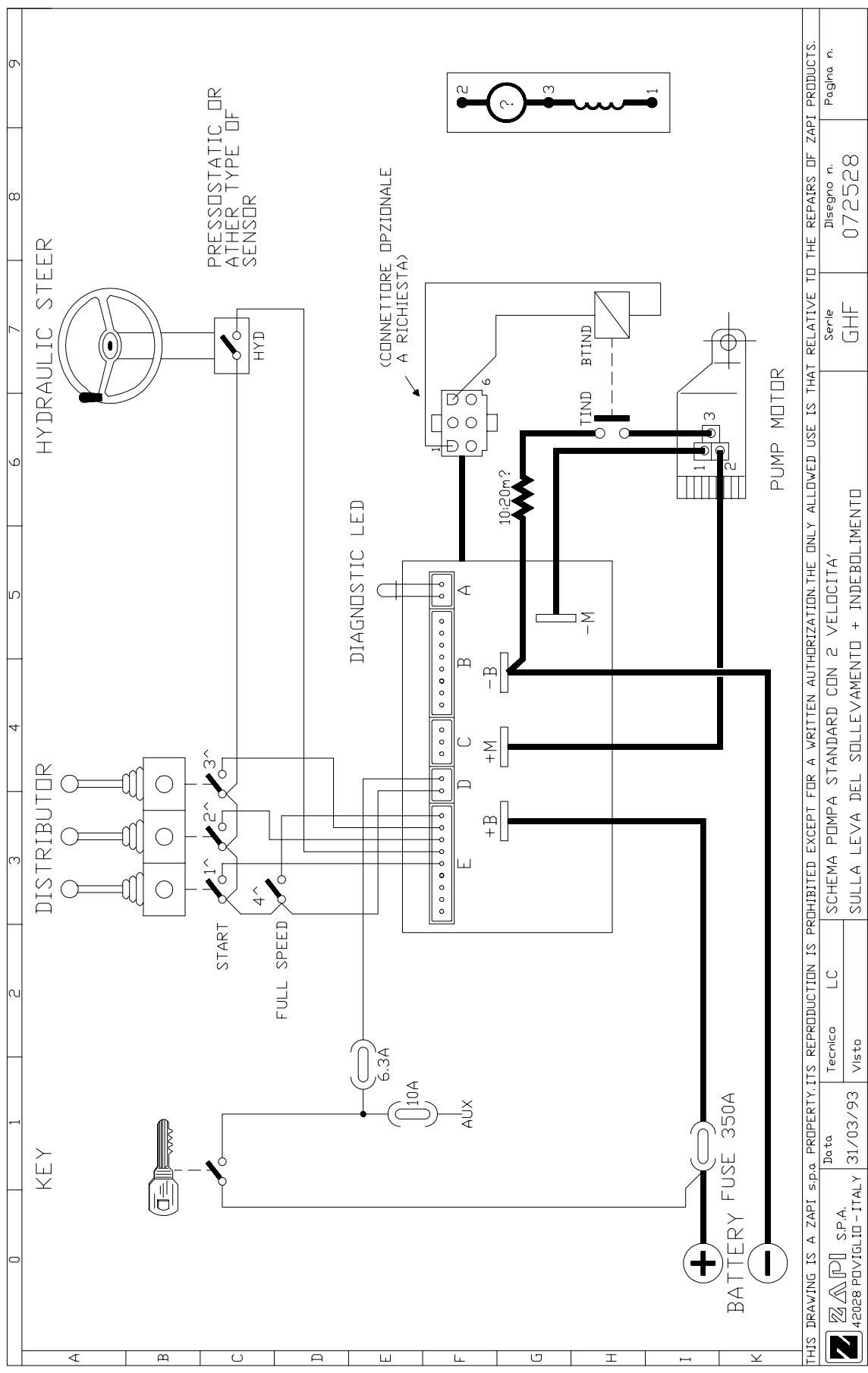
It is a self-diagnosis test within the logic.

If an alarm should occur, replace the logic.



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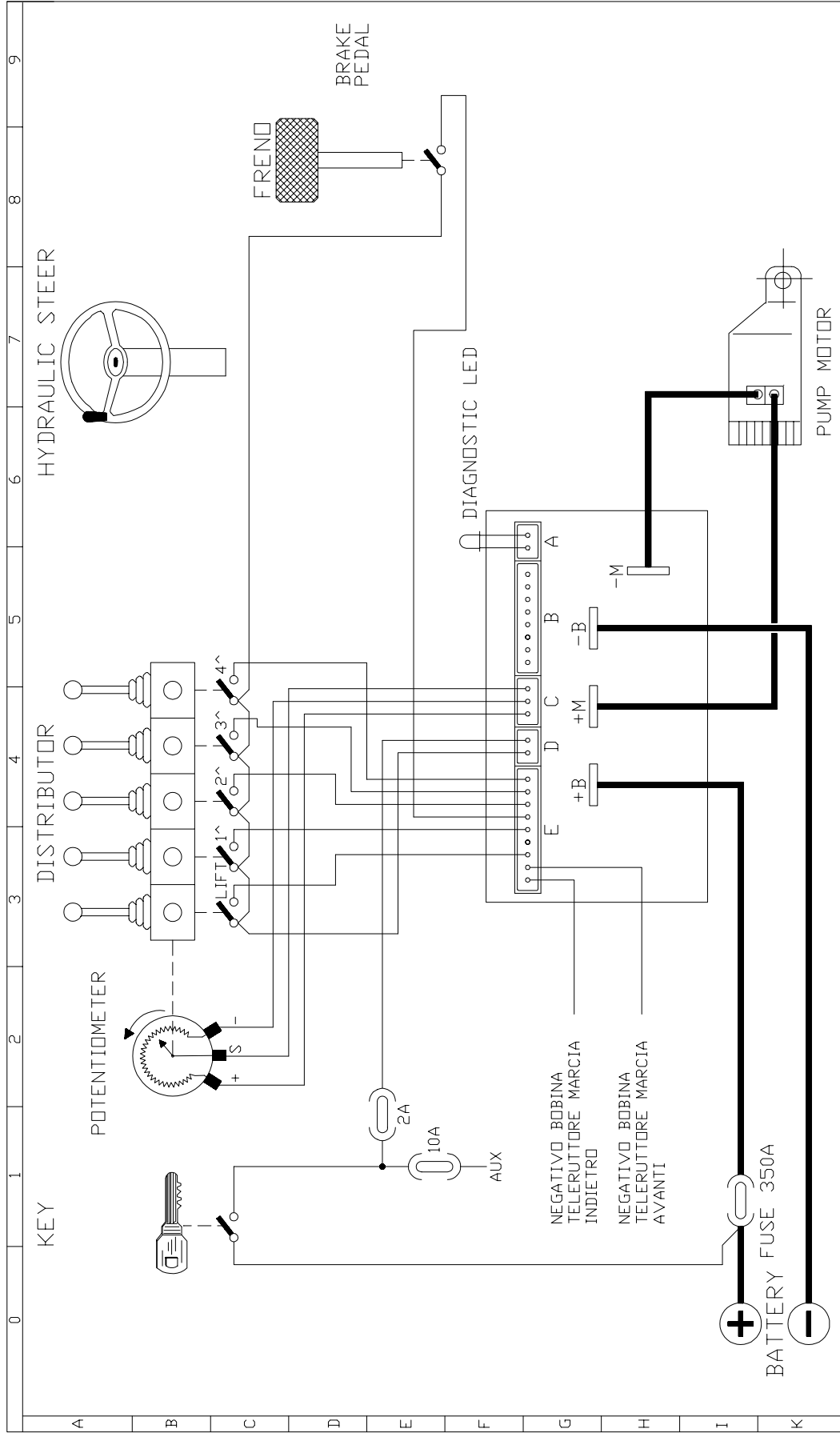
|                                       |                        |             |       |
|---------------------------------------|------------------------|-------------|-------|
|                                       | 42028 PDVIGLID - ITALY | Data        |       |
|                                       |                        | 31/03/93    | Visto |
| S.P.A.                                |                        | Technico LC |       |
| SCHEMA POMPA STANDARD CON 2 VELOCITA' |                        | Serie       |       |
| SULLA LEVA DEL SOLLEVAMENTO           |                        | GHF         |       |
|                                       |                        | Disegno n.  |       |
|                                       |                        | 072527      |       |
|                                       |                        | Pagina n.   |       |



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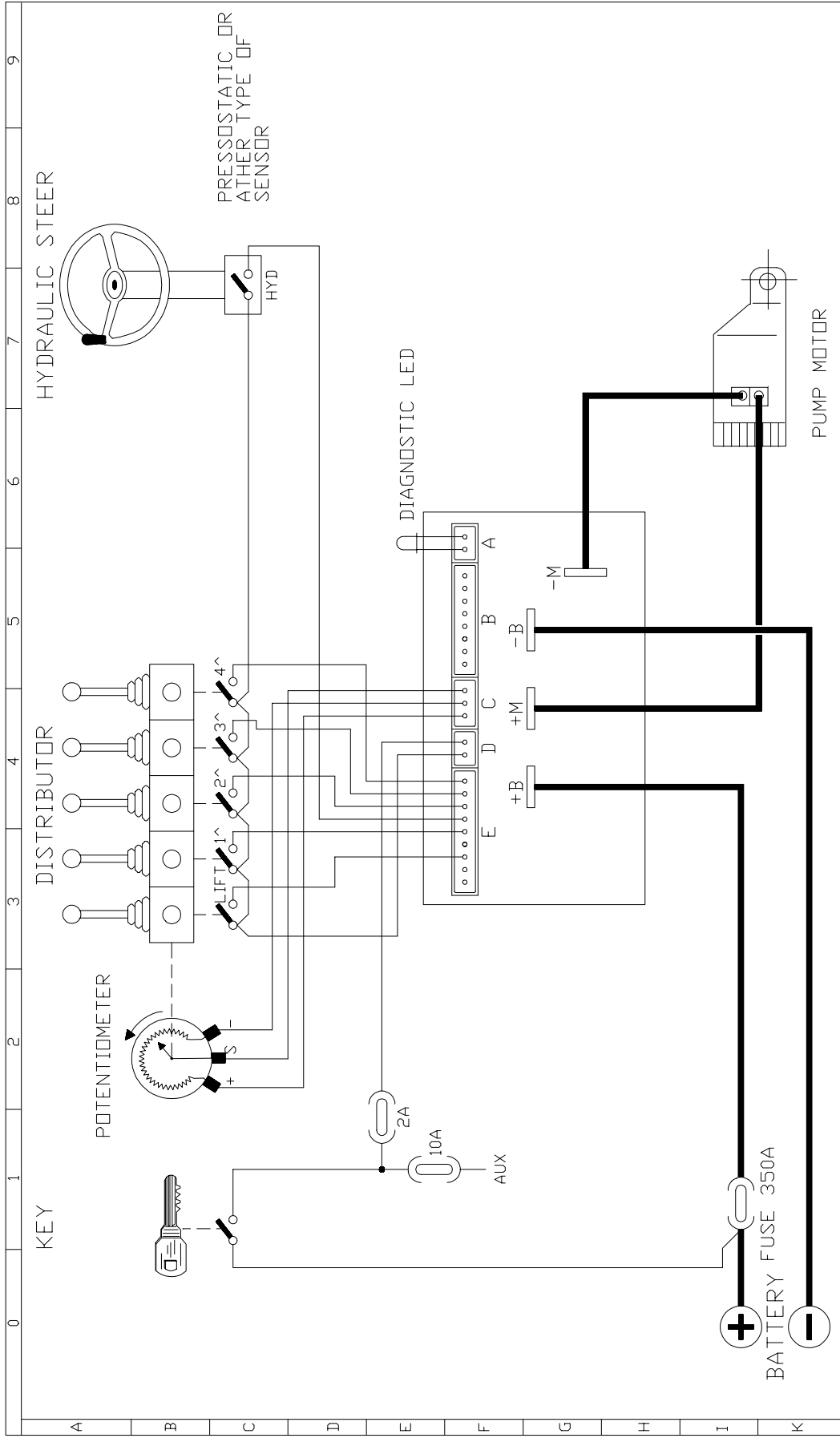
|  |                                  |               |                      |                |
|--|----------------------------------|---------------|----------------------|----------------|
|  | Data<br>31/03/93                 | Tecnico<br>LC | Disegno n.<br>072528 | Pagina n.<br>9 |
|  | S.P.A.<br>42028 POVIGLIO - ITALY | Visto         | Serie<br>GHF         |                |

SCHEMA POMPA STANDARD CON 2 VELOCITA'  
 SULLA LEVA DEL SOLLEVAMENTO + INDEBOLIMENTO



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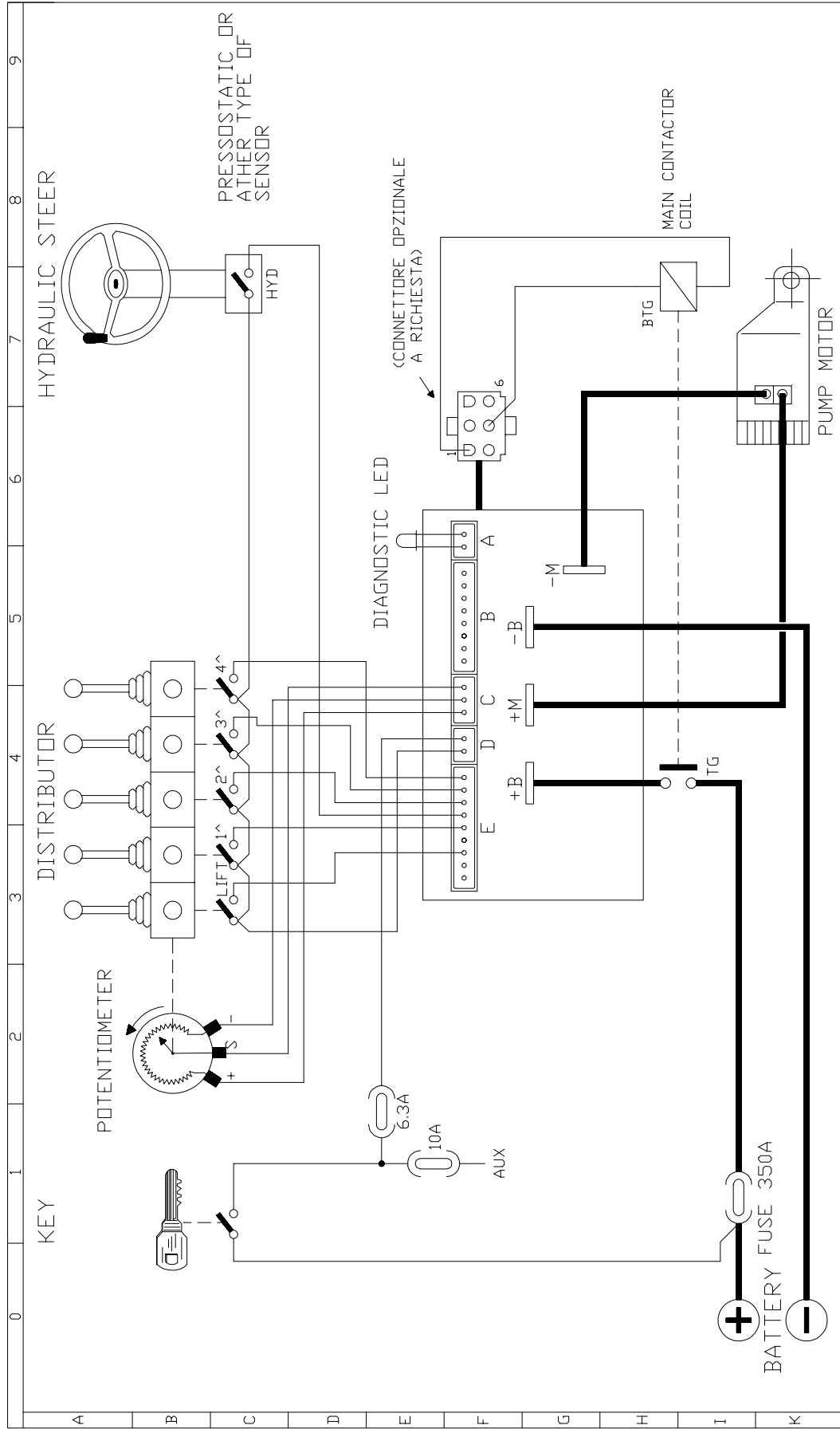
|  |                        |                  |   |                      |              |               |
|--|------------------------|------------------|---|----------------------|--------------|---------------|
|  | S.P.A.                 | Data<br>31/03/93 | Tecnico<br>LC   | Disegno n.<br>072529 | Serie<br>GHF | Pagina n.<br> |
|  | 42028 PDVIGLID - ITALY | Visto            | SCHEMA POMPA STANDARD CON COMANDO IDROGUIDA<br>DA PEDALE FREND E TELERUTTORI TRAZIONE |                      |              |               |



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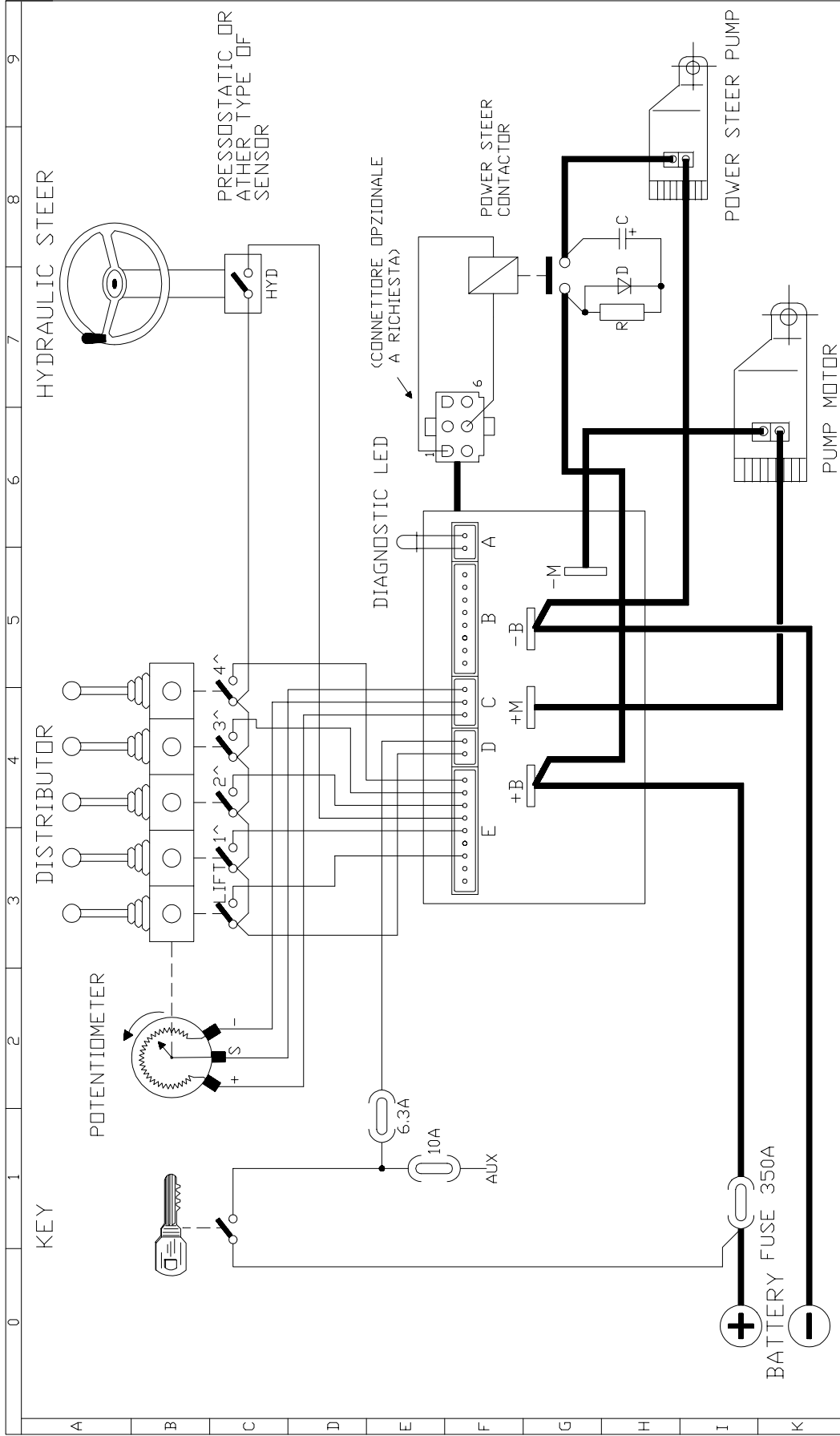
|   |   |               |                      |              |                     |
|---|---|---------------|----------------------|--------------|---------------------|
|  ZAPI S.P.A.<br>42028 PDVIGLID - ITALY | Data<br>31/03/93  | Tecnico<br>LC | Disegno n.<br>072530 | Serie<br>GHF | Pagina n.<br>072530 |
|   | SCHEMA POMPA STANDARD CON POTENZIMETRO SUL SOLLEVAMENTO |               |                      |              |                     |





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|--|----------------------------------|--|---------------|--------------|----------------------|---------------|
|  | S.P.A.<br>42028 PDVIGLIO - ITALY | Data<br>31/03/93   | Tecnico<br>LC | Serie<br>GHF | Disegno n.<br>072531 | Pagina n.<br> |
|  |                                  | SCHEMA POMPA STANDARD CON POTENZIOMETRO SUL SOLLEVAMENTO<br>E Teleruttore Generale |               |              |                      |               |



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|--|------------------------|-----------------|----------------------|-----------|
|  | Data<br>31/03/93       | Tecnico<br>L.C. | Disegno n.<br>072532 | Pagina n. |
|  | 42028 PDVIGL10 - ITALY | Visto           | Serie<br>GHF         |           |

SCHEMA POMPA SOLLEVAMENTO + POMPA IDROGUIDA

## RECOMMENDED SPARE PARTS

| <i><b>ARTICLE<br/>CODE NO.</b></i> | <i><b>DESCRIPTION</b></i>         |
|------------------------------------|-----------------------------------|
| E07008                             | Potentiometer 5 kohm 330          |
| C22000                             | Microswitch 10A 250V 1-way        |
| C16506                             | Protected power fuse 425A         |
| C12373                             | 9-way molex female connector      |
| C12371                             | 3-way molex female connector      |
| C12370                             | 2-way molex female connector.     |
| C12769                             | Female connector (molex)          |
| C12203                             | 6-way female lok connector        |
| C12768                             | Male connector (for female lock)  |
| C12229                             | 6-way male lok connector.         |
| C12767                             | Female connector (for male lock)  |
| C29508                             | Contactor SW 180 24V              |
| C29548                             | Contactor SW 80 24V               |
| C29521                             | Contactor SW 180 36V              |
| C29504                             | Contactor SW 80 36V               |
| C29522                             | Contactor SW 180 48V              |
| C29506                             | Contactor SW 80 48V               |
| C29523                             | Contactor SW 180 80V              |
| C29514                             | Contactor SW 80 80V               |
| P00084                             | Logic Board ZP368B (24/36/40/48V) |
|                                    | Logic Board ZP368B (60/72/80V)    |
|                                    | Logic Board ZP368B (96V)          |

## MAINTENANCE

Check outwear of electric contacts: they should be replaced when matchboard is too strong and wornout. **Electric contacts should be checked every 3 months.**

Check pedal microswitch: verify with a tester that there is no electric resistance between the contacts by measuring the voltage drop between its terminals. Also the release should have a firm sound. **The pedal microswitch should be checked every 3 months.**

Check motor-battery power links: they should be in excellent shae as well as the wires' claddings. **Wires should be checked every 3 months.**

Control of the pedal and contactors springs. They should be able to extend to its full extention and **checked every 3 months.**

Check contactors mecanical movements. They should be frictionfree and not stick. **Mechanical movements of the contactors should be checked every 3 months.**

**CHECKS SHOULD BE DONE BY SKILLED PERSONNEL ONLY AND, ALL SPARE PARTS SHOULD BE ORIGINAL.**

**INSTALLATION OF THIS ELECTRONIC CONTROLLER SHOULD BE DONE ACCORDING TO THE DIAGRAMS INCLUDED IN THIS MANUAL AND ANY VARIATION SHOULD BE DONE ACCORDINGLY WITH THE SUPPLIER. THE SUPPLIER IS NOT RESPONSIBLE FOR ANY PROBLEM THAT ROSE FROM USING WIRING SOLUTIONS DIFFERENT FROM THE ONES SUGGESTED ON THIS MANUAL.**

**DO NOT USE A VEHICLE WITH A  
FAULTY ELECTRONIC CONTROLLER**