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⚠ = **The information given in paragraphs marked with this symbol is essential for the purposes of safety.**

SIGNATURES OF APPROVAL TABLE

COMPANY DEPT. SERVICES	MANAGEMENT EXECUTIVE	
ENGINEERING SECTION EXECUTIVE		
EXPORT MANAGER		

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1 PRESENTATION

HPRC stands for **H**igh frequency **P**ump **R**emote **C**ontroller which is a pump motor control and an integrated valve control.
It enables controlling all the hydraulic functions of a carriage using manipulators as controls instead of ordinary levers directly connected to the control valve.
There are considerable advantages:

- great freedom in positioning the valves and oil pipes since there is no longer the constraint of the control valve;
- extraordinary ergonomics for the driver since no effort is needed for control and the manipulators can be positioned as preferred;

The main technical particulars are:

a) Series type motor control:
   - voltage 24 / 36 / 48 / 80V;
   - current 350A e 500A (two versions);
   - high frequency mos: silent and improved efficiency (lower losses in motor and battery).

b) Hydraulic block control:
   - EVP control for descent (controlled in current);
   - control of 8 solenoid valves (EV) type ON/OFF;
   - the valves can be supplied at 12 / 24 / 36 / 48V as required;
   - two drivers can operate even at battery voltage to control for instance one bypass or a weakening.

c) Logic at µP:
   - versatile programming with the standard Zapi console;
   - intelligent diagnosis in the case of malfunctioning (see "alarm" and "tester" sections);
   - programming manipulator travel (4 values per manipulator);
   - programming the direction of movement corresponding to the direction of the manipulator;
   - sophisticated solenoid valve (EV) control to obtain control valve performance and eliminate sudden movements both when starting and stopping.

d) Safety: double µP;
   With there being no control valve, hydraulic functions can become dangerous. Therefore, the logic has been made with two microprocessors, one of which is only for the safety functions and it:
   - cuts off supply to the EV by means of a relay;
   - shuts off pump movement if a fault is detected;
   - enables operation only when requested;
   - requires a dead man micro.

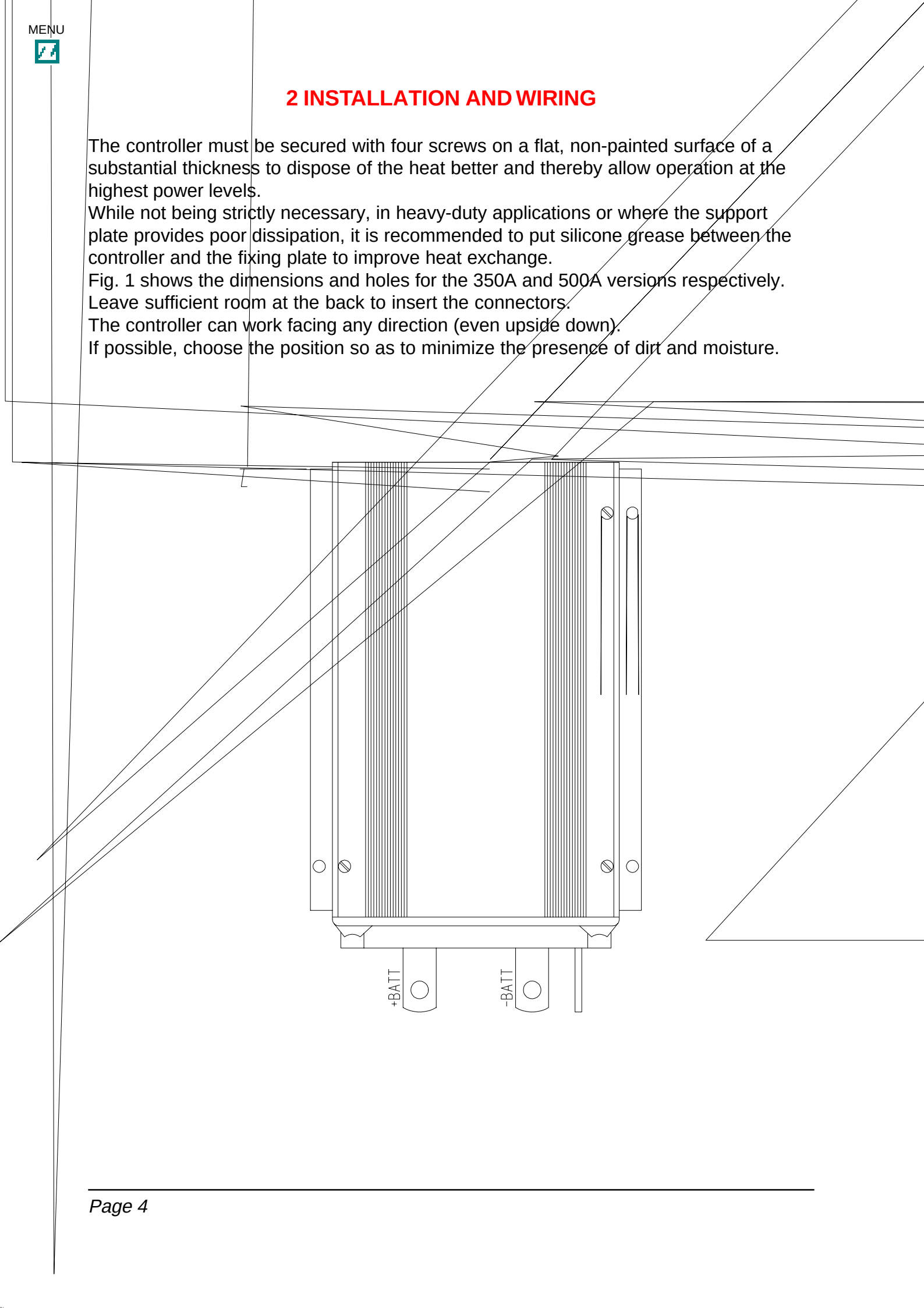
e) Protection:

- aluminium container with IP54.
- thermal protection;
- at switch-on it checks that all the control parts work (standby condition);
- valve control outputs protected against short-circuiting and choppered to supply the rated voltage of the valves.

Protection against battery reversal can only be accomplished with a main remote control switch.
Thorough knowledge of the product will be of great help in choosing, installing and using the product, and it is essential to make full use of its potential which is often present but ignored.
For any problems, please call your nearest distributor.

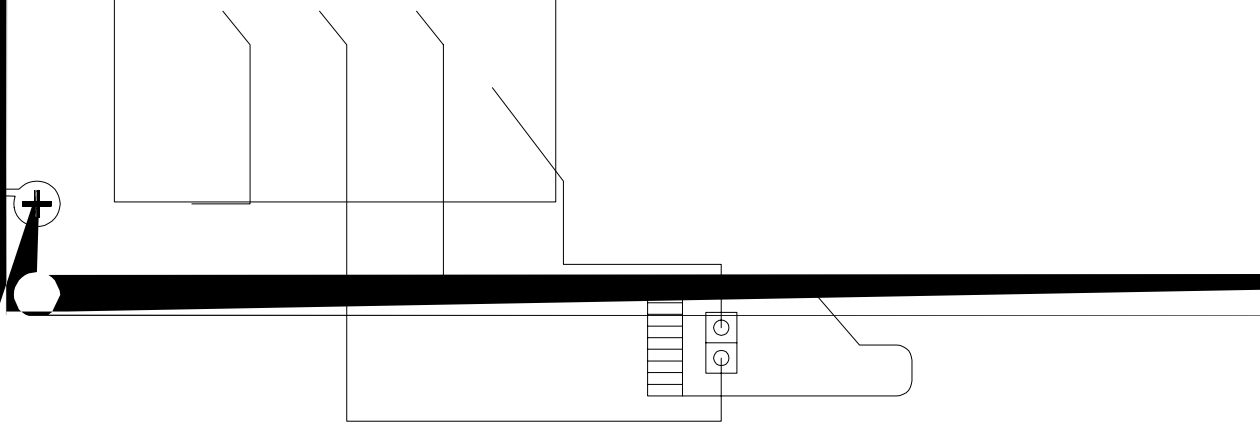
2 INSTALLATION AND WIRING

The controller must be secured with four screws on a flat, non-painted surface of a substantial thickness to dispose of the heat better and thereby allow operation at the highest power levels.
While not being strictly necessary, in heavy-duty applications or where the support plate provides poor dissipation, it is recommended to put silicone grease between the controller and the fixing plate to improve heat exchange.
Fig. 1 shows the dimensions and holes for the 350A and 500A versions respectively.
Leave sufficient room at the back to insert the connectors.
The controller can work facing any direction (even upside down).
If possible, choose the position so as to minimize the presence of dirt and moisture.



2.1 POWER CONNECTIONS

ws the battery and motor wiring diagram.
s are secured with M 8 bolts.
renches to tighten the bolts so as not to bend the copper bar and damage
l fixings. The maximum torque is 10 - 10.5 Nm.



2.2.1 Connector I.

Connector I should be connected to the manipulators.
It takes 4 potentiometers and 4 normally open contacts as shown in the diagram of Fig. 4 which gives the numbering of the Mini-fit connector.
The battery is available for the auxiliary circuits.
Key return is available also on connector L (use the handiest one).
Potentiometer supply is at 5V. Other values are available on request.
The potentiometer should be mounted with the slider midway in the standby position (2.5V).
If there are no enabling micros it must have an electrical travel just a little greater than the mechanical travel actually used (it must reach neither 0 nor 5V).
Standby values are acceptable between 2.75 and 2.25V and limit stop values greater than 3.5 and less than 1.5V.
For each manipulator it is possible to program the:

- maximum value (eg. 4.5V);
- minimum value (eg. 650mV);
- up function start value (eg. 2.9V);
- down function start value (eg. 2.1V).

If enabling micros are used (recommended), it is not necessary to program the last two values. Whereas they are essential if there are no such micros since they define the dead area of the manipulator (≅500mV).

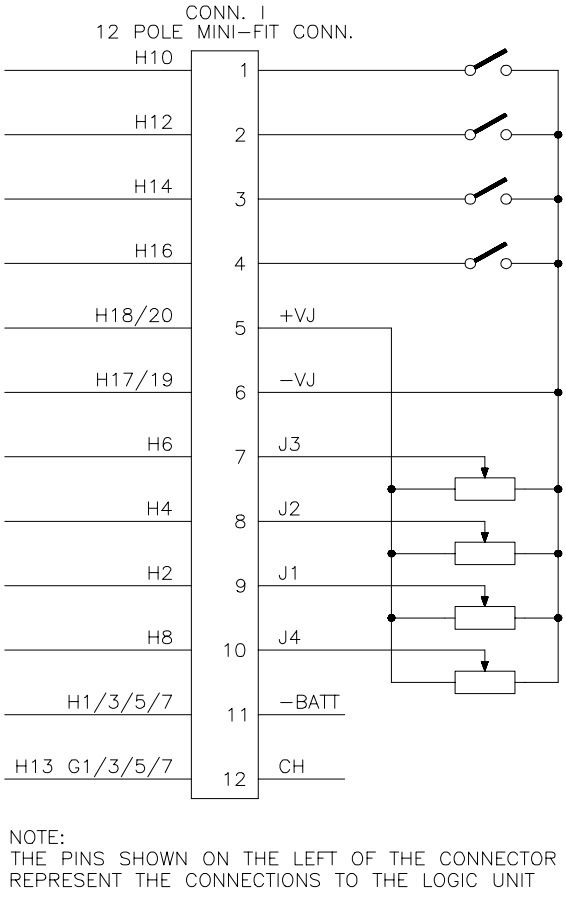


Fig. 4 Connector I auxiliary connection

2.2.2 Connector M.

Connector M should be connected to the solenoid valves (see Fig. 5).
The proportional valve should be connected between pins 15 and 16 and controlled in current IMax. ≅750mA (other values are available when specifically requested).
The up valve (ON-OFF) and the down valve (proportional) are controlled towards positive to enable using a multiple 3-wire valve (see Fig. 6).

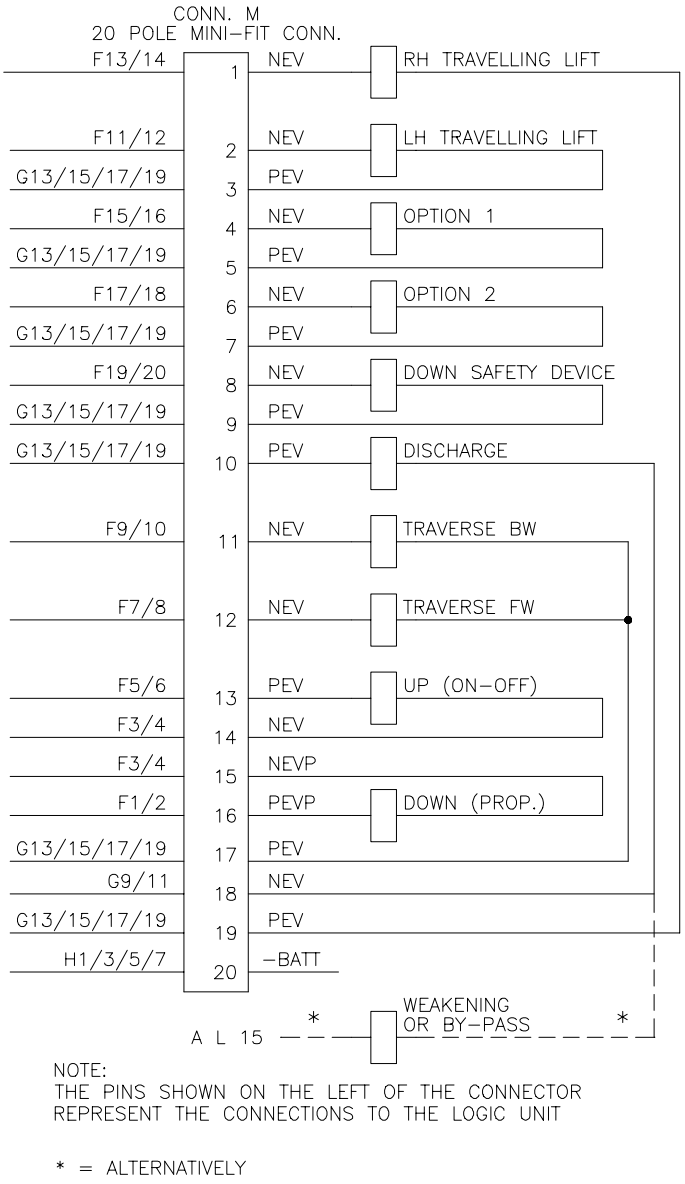


Fig. 5 Connector M auxiliary connection

Fig. 6 Lifting EV connection

The other EV (solenoid valves) are instead controlled towards negative and are grouped in 3 pairs for the functions of traverse, travelling lift and carriage (or optional) for the second, third and fourth manipulator respectively.
The last two drivers can take on different functions and can also control remote control switches supplied at a voltage of 80V.
On the same connector there is the solenoid valve positive (except for proportional and up valves) on pins 3/5/7/9/10/17/19 and battery negative (pin 20).

2.2.3 Connector L.

Connector L has some inputs that always need to be connected to it:

- dead-man (pin 11);
- solenoid valve supply: should be connected on L6 and can be the battery if this is less than 72V or a non-isolated external supply with output <50V.
  This supply for reasons of safety is disconnected by the relay on the back between the mini-fit connectors and reaches the solenoid valve positive either directly or through the drivers in the case of EVS and down EVP.
  Whereas the negative is choppered to supply the valves with their rated voltage no matter what the supply (provided it is higher). In this way the valves can be 12/24/36 or 48V;

other options such as:

- carriage reduction;
- down reduction;
- up reduction;
- battery out;
- hydraulic steering demand: pin 12 is the input normally dedicated to the hydraulic steering demand and may be defined as normally closed towards + Battery or towards - Battery depending on the demand, by means of two jumpers in the logic unit.

And others that can be defined at the user's request.

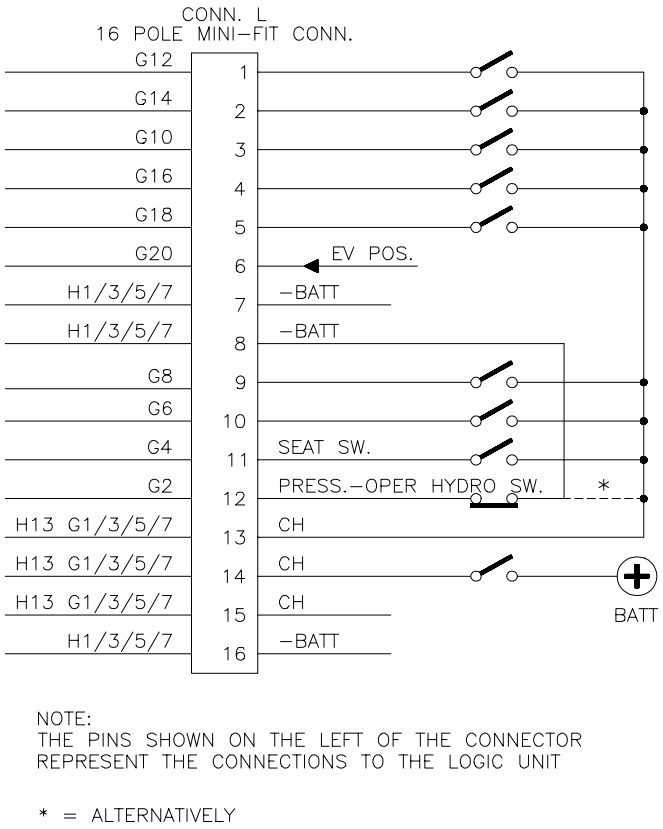


Fig. 7 Connector L auxiliary connection

2.3 CONSUMPTION AND POWER CONNECTIONS

The controller requires a minimum of 300mA without solenoid valves and with no weakening remote control switch at a maximum of 3A with a remote control switch and two energized valves.
The line remote control switch is an option and if used it should be mounted in accordance with Fig. 8 (broken line because it is an option).
It is necessary to supply the power with a fuse in series with +battery, of adequate capacity, as shown in Fig. 2.
The key provides the controller with the supply and in some cases the solenoid valves as well. It must be protected by a fuse in series of approximately 10A (it depends on the other loads).

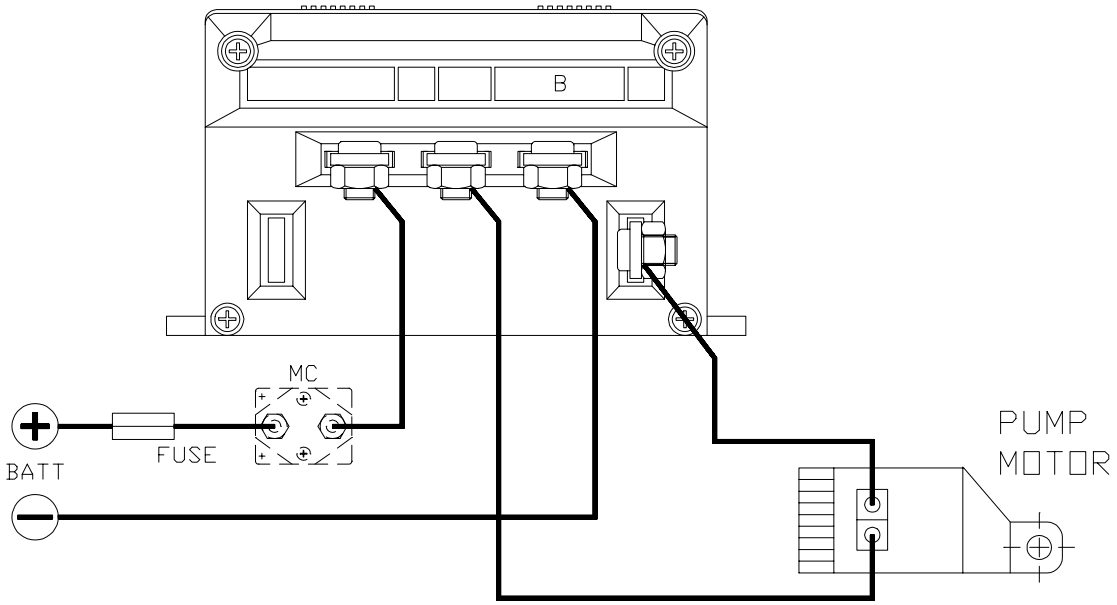


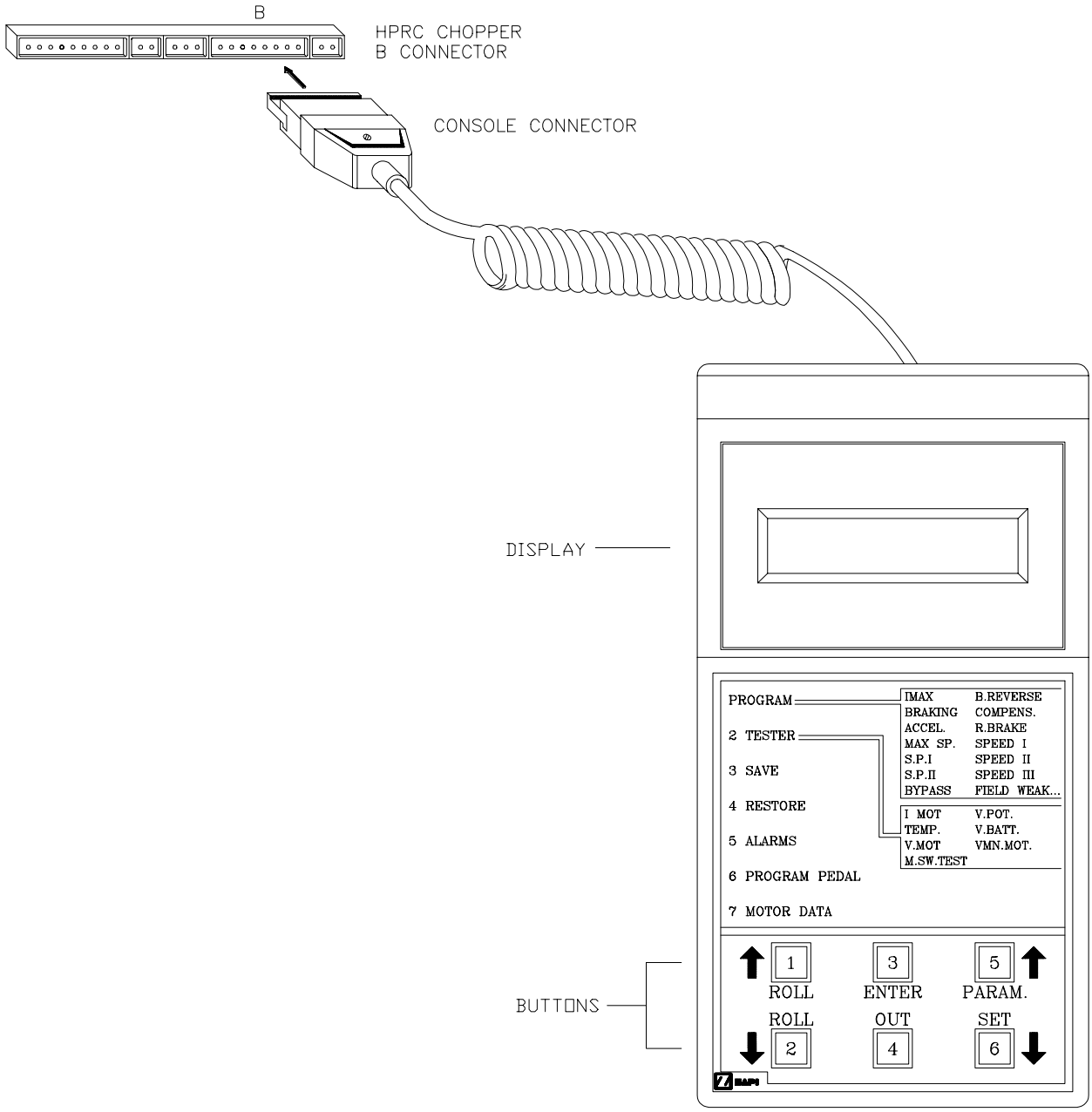
Fig. 8 'Optional' Main Remote Control Switch Connection (350A version).

3 PROGRAMMING CONSOLE

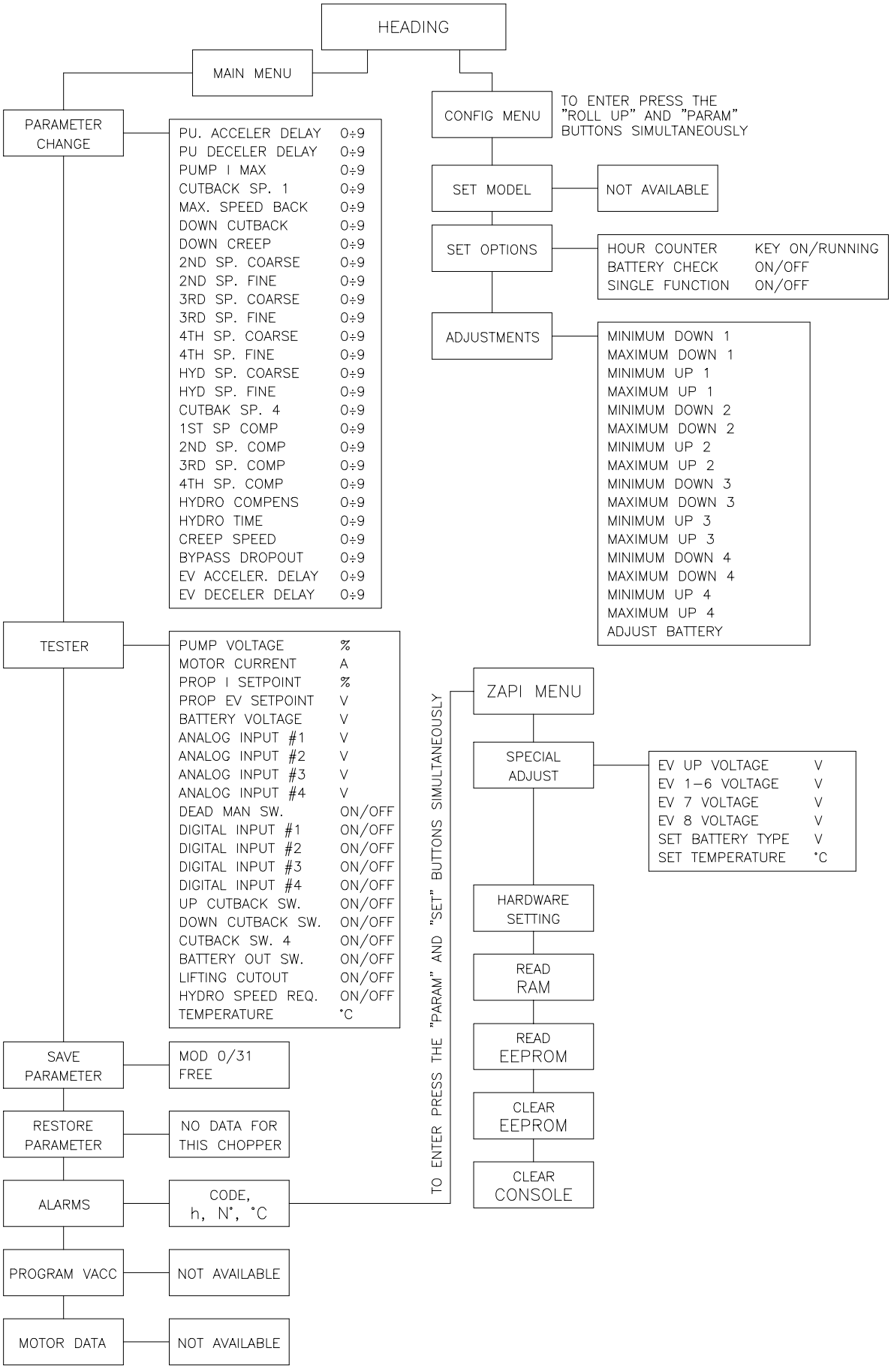
Above the power connections there is just one 8-way connector (B) available that is used to connect the standard Zapi console.
Connect the console before powering it all. It is extremely useful precisely at the start to identify any assembly errors.
Switching on with the key must supply the console and this must connect up with the controller, displaying its name and any faults.
If it fails to come on, check the key and -Batt. connections: they are the only ones necessary for the initial phase.

Pay attention to the polarity of the console connector when it is inserted in the chopper.

3.1 PROGRAMMING CONSOLE



3.2 CONSOLE MENU DESCRIPTION



3.3 PRELIMINARY CHECKS

When switching on with the key, check that the initial heading appears on the console with the particulars of the plant:

Otherwise, one of the following alarms will appear:

1) **INCORRECT START** = Request for a hydraulic function on switching on (eg. lifting, traverse, etc.);
   With the aid of the console on the tester function, check the "digital input #1 (I1)"; "digital input #2 (I2)"; "digital input #3 (I3)"; "digital input #4 (I4)" which at rest must all be OFF.
2) **POS EV NOT OK** = On switching on there is no voltage on the solenoid valve (EV) positive;
   Using a multimeter, check that there is voltage on pin 6 of connector L.
3) **J1/J2/J3/J4 NOT OK** = This occurs when switching on with the key to indicate that at rest the voltage on the manipulator exceeds the envisaged limits;
   In the console tester function check that the Analog Input #1 (I9), AI#2 (I8), AI#3 (I7) and AI#4 (I10) are on 2.5V –200mV.

Note: The relative inputs on the external connector are in brackets.

3.4 PROGRAMMING

After the first few preliminary checks, make the following adjustments:

1) **EV voltages**: go into the protected Zapi menu and configure the solenoid valves (EV) to their rated voltage (SPECIAL ADJUST submenu).
2) **Options**: go into the CONFIG MENU and then access the SET OPTION submenu. The options to set are:
   - HOUR COUNTER: RUNNING = hour counter only active when running. KEY ON = hour counter active with the key.
   - BATTERY CHECK: ON = battery charge check activated. OFF = battery charge check not activated.
   - SINGLE FUNCTION: ON = just one function is carried out at a time. OFF = several functions are carried out at the same time.
3) **Manipulator travel programming**: go into the CONFIG MENU and then access the ADJUSTMENTS submenu.
   Now program the first lever connected to input I9 on the external connector.
   - MINIMUM DOWN 1 = This parameter defines the minimum value of the forward movement of the first lever. To program it, press ENTER on the console and push the lever gradually to obtain a value approximately 400mV less than the one read (2.5V → 2.1V); now, keeping the lever stationary in this position, press the ROLL UP button on the console that makes it possible to save the value obtained temporarily and to pass on to the next parameter.
   - MAXIMUM DOWN 1 = This parameter defines the maximum value of the forward movement of the first lever. To program it, press ENTER on the console and push the lever as far as it will go (values close to 0) and then, keeping the lever in this position, press the ROLL UP button on the console that makes it possible to save the value obtained temporarily and to pass on to the next parameter.
   - MINIMUM UP 1 = This parameter defines the minimum value of the backward movement of the first lever. To program it, press ENTER on the console and pull the lever gradually to obtain a value approximately 400mV higher than the one read (2.5V → 2.9V); now, keeping the lever stationary in this position, press the ROLL UP button on the console that makes it possible to save the value obtained temporarily and to pass on to the next parameter.
   - MAXIMUM UP 1 = This parameter defines the maximum value of the backward movement of the first lever. To program it, press ENTER on the console an dpull the lever as far as it will go (values close to 5) and then, keeping the lever in this position, press the ROLL UP button on the console that makes it possible to save the value obtained temporarily and to pass on to the next parameter.

   Then carry out this procedure for all the other levers available.
   Lever 2 input I8;

   Lever 3 input I7;

   Lever 4 input I10.

To be able finally to save and store the fixed values in memory, press OUT on the console and then ENTER to confirm. These last two steps must be carried out even if only one of the above parameters has been modified.
CAUTION: It is possible to reverse the direction of the real movement with the same manipulator demand: to accomplish this you need to reprogram the lever by following the above procedure and swapping over the minimum and maximum programming procedure of the lever concerned.
Eg. Minimum Down 1 → 2.9V.
Maximum Down 1 → 4.5V.
Minimum Up 1 → 2.1V.
Maximum Up 1 → 0.5V.

3.5 PARAMETER ADJUSTMENTS

After carrying out these first essential operations you can now go ahead and start up the machine, adjusting the variable parameters in the console as preferred.

1) **PU ACCELER. DELAY**: determines the pump acceleration ramp.
   Since there is a delay at level 0 the ramp is fast (128 mS) whereas at level 9 the ramp is slow (1.3 S).
2) **PU DECELER DELAY**: determines the pump deceleration ramp.
   Since there is a delay at level 0 the ramp is fast (32mS) whereas at level 9 the ramp is slow (3.2 S).
3) **PUMP I MAX**: determines the maximum pump current
   level 0 → 50% IMax.
   level 9 → 100% IMax.
4) **CUTBACK SP1**: determines the up speed reduction (input I9)
   level 0 → 16% CT.
   level 9 → 100% CT.
5) **MAX SPEED BACK**: determines the maximum down speed
   level 0 → 50% of the maximum programmed EVP current.
   level 9 → 100% of the maximum programmed EVP current.
6) **DOWN CUTBACK**: determines the down speed reduction (input I9)
   level 0 → 0% CT.
   level 9 → 100% CT.
7) **DOWN CREEP**: determines the minimum voltage applied on the down solenoid valve (input I9)
   level 0 → 17% of the minimum programmed EVP current.
   level 9 → 70% of the minimum programmed EVP current.
8) **2nd SPEED COARSE**: determines the maximum traverse speed (input I8)
   0 → 8% CT.
   9 → 93% CT.
9) **2nd SPEED FINE**: determines the maximum traverse speed (input I8) in fine mode
   0 → 8% CT.
   9 → 93 CT.
10) **3rd SPEED COARSE**: determines the maximum travelling lift speed (input I7)
   0 → 8% CT.
   9 → 93 CT.

11) **3rd SPEED FINE**: determines the maximum travelling lift speed (input I7) in fine mode
    0 → 8% CT.
    9 → 93 CT.

12) **4th SPEED COARSE**: determines the maximum carriage speed (input I10)
    0 → 8% CT.
    9 → 93% CT.

12) **4th SPEED FINE**: determines the maximum carriage speed (input I10) in fine mode
    0 → 8% CT.
    9 → 93% CT.

13) **CUTBACK SPEED 4**: determines the reduction in speed on the carriage (input I10)
    0 → 8% CT.
    9 → 93% CT.

14) **1st SPEED COMP**: determines the compensation on lifting (input I9) so as to keep the speed more or less constant as the load changes.

15) **2nd SPEED COMP**: determines the compensation on the traverse (input I8) so as to keep the speed more or less constant as the load changes.

16) **3rd SPEED COMP**: determines the compensation on the travelling lift (input I7) so as to keep the speed more or less constant as the load changes.

17) **4th SPEED COMP**: determines the compensation on the carriage (input I10) so as to keep the speed more or less constant as the load changes.

18) **HYDRO COMP**: determines the compensation on the hydraulic steering so as to keep the speed more or less constant as the load changes.

19) **HYDRO TIME**: determines the duration of the hydraulic steering from when demand ceases
    0 → 1S.
    9 → 17S.

20) **CREEP SPEED**: determines the minimum speed on the pump
    0 → 4% CT.
    9 → 13% CT.

21) **BYPASS DROPOUT**: determines the current to turn on the bypass remote control switch
    0 → 39% IMax.
    9 → 100% IMax.

22) **EV ACCEL. DELAY**: determines the proportional solenoid valve acceleration ramp
    0 → 0.5S.
    9 → 5S.

23) **EV DECELER. DELAY**: determines the proportional solenoid valve deceleration ramp
    0 → 0.25S.
    9 → 4.5S.

N.B. CT stands for Total Conduction.

3.6 DESCRIPTION OF ALARMS

Some alarms could occur during the tests:

1) **PUMP STBY I HIGH**: (5 flashes).
   This occurs when switching on by key and it means that the controller has detected a high standby current and all controls are inhibited.
   This alarm may be due to the current sensor circuit being broken or the logic malfunctioning, or a wrong setting.
2) **PUMP I = 0 EVER**: (5 flashes)
   This can occur either when switching on or when running and it means the chopper has detected no current. This alarm is a shutdown. If it occurs on standby it may be due to the fact that the motor has too high a resistance; in this case, call your nearest technical service point.
   Whereas, if this alarm occurs during operation, the most likely cause is breakage of the current sensor circuit (if the motor turns) or the logic malfunctioning (if the motor is at a standstill).
3) **EEPROM KO**: (1 flash)
   This alarm can occur either during operation or on standby and it shuts down. It means there is a problem with the memory containing the chopper data. Try and turn off with the key and if the alarm remains it is necessary to replace the logic unit.
4) **MICRO ST KO**: (4 flashes)
   This alarm concerns a malfunctioning of the control or safety microprocessor and can occur either during operation or on standby. The appearance of this alarm does not necessarily mean trouble with the microprocessor because since this alarm prevails over others it may conceal the alarm actually in course. In order to find out which alarm is actually in progress you need to observe the last few alarms recorded, checking the time, temperature, etc. when they occurred.
5) **DRIVER 1 KO**: (6 flashes) **DRIVER 2 KO**: (6 flashes)
   This means that too high a current has been detected on the solenoid valve protection circuit. The cause of this alarm may come from a short on the coil of a solenoid valve or from breakage of the above-mentioned internal circuit, or (more likely) wrong setting of the solenoid valves (eg. 48V for valves at 24 or 12V).
   Driver 2 is affected by EV1 - 2 - 3 - 4 - 5 - 6 - 7 - 8.
   Driver 1 is affected by EVS while the proportional valve has its own alarms.
6) **HIGH TEMPERATURE**: (7 flashes)
   This means that the chopper has exceeded a temperature of 76℃ and in this situation the chopper decreases IMax by 9% for every degree this threshold is exceeded by.
   In this case it is advisable to stop for a few minutes and if on restarting work the temperature has not fallen, there is probably a breakage in the temperature detection circuit (broken sensor).

7) **BATTERY LOW**: (32 flashes)
This means that the battery has dropped by 6% on standby compared to the rated voltage. In this situation the chopper halves the maximum current and it is necessary to charge the battery.

8) **VEVP NOT OK**: (5 flashes)
This means the positive fails to reach the solenoid valves. The most likely causes are:

- stuck relay;
- no or wrong positive connection;
- faulty ST micro
- incorrect voltage on the proportional valve.

9) **INCORRECT START**: (2 flashes)
This means there is a demand for a function on switching on with the key or there is no dead man (or seat micro-switch). The possible causes are:

a) wrong operator manoeuvre; carry out the right sequence: key - seat (DM) - hydraulic function (lifting, traverse, etc.);

b) faulty dead man or demand micro-switch.

10) **PROG JOY1 NOT OK**
This means there has been an error in programming lifting (input I9). It is necessary to reprogram the function correctly.

11) **PROG JOY2 NOT OK**
This means there has been an error in programming the traverse (input I8). It is necessary to reprogram the function correctly.

12) **PROG JOY3 NOT OK**
This means there has been an error in programming the travelling lift (input I7). It is necessary to reprogram the function correctly.

13) **PROG JOY4 NOT OK**
This means there has been an error in programming the carriage (input I10). It is necessary to reprogram the function correctly.

14) **V JOY1 NOT OK**
This means that during an operation with the lifting lever (input I9) the pre-set limits are exceeded. Reprogram correctly.

15) **V JOY2 NOT OK**
This means that during an operation with the traverse lever (input I8) the pre-set limits are exceeded. Reprogram correctly.

16) **V JOY3 NOT OK**
This means that during an operation with the travelling lift lever (input I7) the pre-set limits are exceeded. Reprogram correctly.

17) **V JOY4 NOT OK**
This means that during an operation with the carriage lever (input I10) the pre-set limits are exceeded. Reprogram correctly.

MENU

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OPERATING INSTRUCTIONS
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