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EN

User Manual

MHYRIO CB

(MULTIFUNCTIONAL HYDRAULIC REMOTE I/O FOR COUNTER BALANCED TRUCK)

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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.

The symbol aboard is used inside this publication to indicate an action or a characteristic very important as for security. Pay special attention to the annotations pointed out with this symbol.

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APPROVAL SIGNS

COMPANY FUNCTION	INITIALS	SIGN
GRAPHIC AND LAYOUT	CP	
PROJECT MANAGER	FG	
TECHNICAL ELECTRONIC MANAGER VISA	PP	
SALES MANAGER VISA	PN	

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1 INTRODUCTION TO ZAPI CAN SYSTEM

Distributed intelligent systems are not new in Zapi: the first one has gone in production in the '95 with a serial communication link (RS232).
Today we use a more sophisticated and safe communication protocol: CAN BUS.
In this way it is possible to reduce the harness allocating the modules exactly near the sensor or the actuators and connecting the modules with only 4 wires (CAN and supply).
Mhyrio CB is one of this modules designed to drive the hydraulic electrovalves and connect some inputs which normally are in the actuators proximity but with complete independent functions.

2 GENERAL CHARACTERISTIC

2.1 Functional characteristics

Voltage [V] .....12/24/36/48/72/80 V
Output for ON-OFF valves [n°] 3
Output for proportional valves [n°] 9
Digital inputs [n°].....3
Analog inputs [n°].....1
RS-232 [n°] 1
CAN [n°].....1
Protection.....IP65

2.2 Input

Digital inputs: they accept PNP type sensor or switches connected to the positive. The sensor/switch has to be supplied at battery voltage.
Analog inputs: Mhyrio provides 1 analog input. The analog device can be supplied at +5 V or +12 V. It is necessary to specify in the order the voltage selected. The supply output is able to deliver max 100 mA.
ON-OFF valves drivers programmable. They can drive the coil in full conduction or in PWM mode in order to supply the coil at the nominal programmed voltage independently by the battery voltage. See related parameter in 'Set Option' menu.
Proportional valves are driven in current mode with programmable frequency. The valves voltage supply is the same used for ON-OFF valves and the current range have to be defined. Via handset it is adjustable in a big range, but the shunts can be adapted to every types of valves (minimum current 200 mA, maximum current up to 2 A).

3 INSTALLATION HINTS

In the description of these installation suggestions you will find some boxes of different colours, they mean:

*These are **information** useful for anyone is working on the installation, or a deeper examination of the content*

These are Warning boxes, they describe:
- operations that can lead to a failure of the electronic device or can be dangerous or harmful for the operator;
- items which are important to guarantee system performance and safety

3.1 Material overview

Before to start it is necessary to have the required material for a correct installation. Otherwise a wrong choice of cables or other parts could lead to failures/ misbehaviour/ bad performances.

3.1.1 Connection cables

For the auxiliary connections, use cables of 0.5 mm² section.
For the valves connections, use cables of 0.75 mm² section.

3.1.2 Fuses

- Use a 6.3 A Fuse for protection of the auxiliary circuits.
- For Safety reasons, we recommend the use of protected fuses in order to prevent the spread of fused particles should the fuse blow.

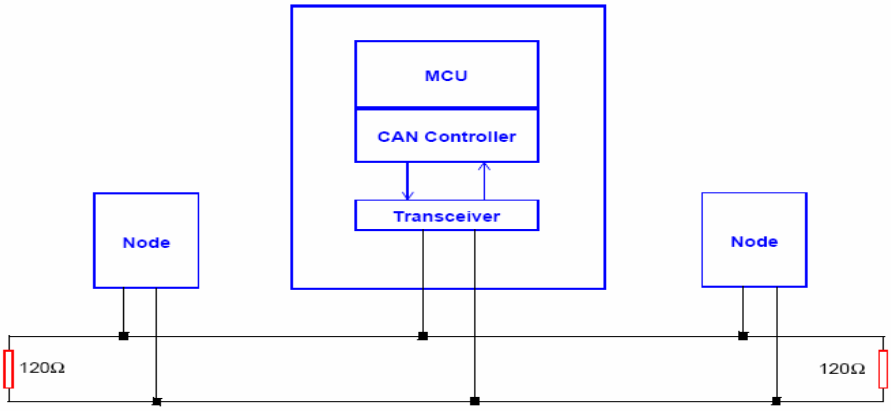
3.2 Installation of the hardware

Before doing any operation, ensure that the battery is disconnected and when all the installation is completed start the machine with the drive wheels raised from the floor to ensure that any installation error do not compromise safety.

Do not connect the controller to a battery with a nominal voltage different than the value indicated on the controller label. A higher battery voltage may cause valves driver section failure. A lower voltage may prevent the logic operating.

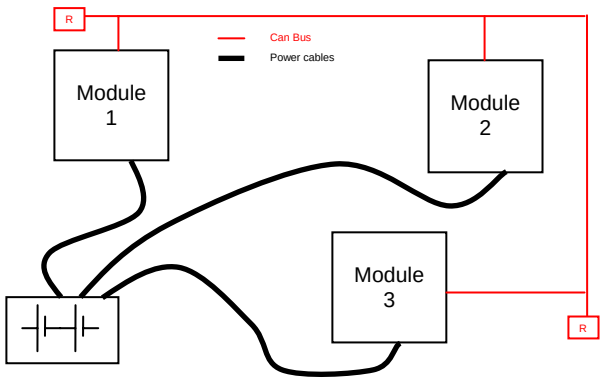
3.2.1 Wirings: CAN connections and possible interferences

CAN stands for Controller Area Network. It is a communication protocol for real time control applications. CAN operates at data rate of up to 1 Megabits per second.
It was invented by the German company Bosch to be used in the car industry to permit communication among the various electronic modules of a vehicle, connected as illustrated in this image:



- The best cable for can connections is the twisted pair; if it is necessary to increase the immunity of the system to disturbances, a good choice would be to use a cable with a shield connected to the frame of the truck. Sometimes it is sufficient a simple double wire cable or a duplex cable not shielded.
- In a system like an industrial truck, where power cables carry hundreds of Ampere, there are voltage drops due to the impedance of the cables, and that could cause errors on the data transmitted through the can wires. In the following figures there is an overview of wrong and right layouts of the cables routing.

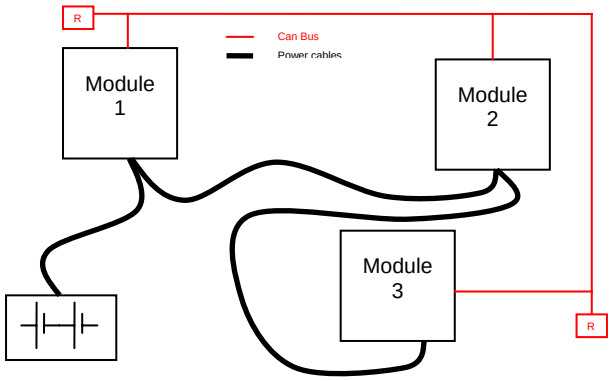
Wrong Layout:



The red lines are can wires.
The black boxes are different modules, for example traction controller, pump controller and display connected by canbus.
The black lines are the power cables.

This is apparently a good layout, but can bring to errors in the can line.
The best solution depends on the type of nodes (modules) connected in the network.
If the modules are very different in terms of power, then the preferable connection is the daisy chain.

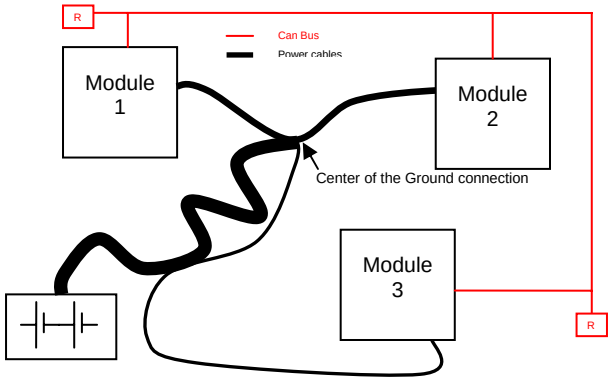
Correct Layout:



Note: Module 1 power > Module 2 power > Module 3 power

The chain starts from the –BATT post of the controller that works with the highest current, and the others are connected in a decreasing order of power.
Otherwise, if two controllers are similar in power (for example a traction and a pump motor controller) and a third module works with less current, the best way to deal this configuration is to create a common ground point (star configuration).

Correct Layout:



Note: Module 1 power ≈ Module 2 power > Module 3 power

In this case the power cables starting from the two similar controllers must be as short as possible. Of course also the diameter of the cable concurs in the voltage drops described before (higher diameter means lower impedance), so in this last example the cable between the minus of the Battery and the common ground point (pointed by the arrow in the image) must be dimensioned taking into account thermal and voltage drop problems.

Can advantages

The complexity of today systems needs more and more data, signal and information must flow from a node to another. CAN is the solution to different problems that arise from this complexity
- simplified design (readily available, multi sourced components and tools)
- lower costs (less and smaller cables)
- improved reliability (fewer connections)
- analysis of problems improved (easy connection with a pc to read the data flowing through the cable).

3.2.2 Wirings: I/O connections

- After crimping the cable, verify that all strands are entrapped in the wire barrel.
- Verify that all the crimped contacts are completely inserted on the connector cavities.

A cable connected to the wrong pin can lead to short circuits and failure; so, before turning on the truck for the first time, verify with a multimeter the continuity between the starting point and the end of a signal wire.

- For information about the mating connector pin assignment see the paragraph “description of the connectors”.

3.2.3 Insulation of truck frame

As stated by EN-1175 “Safety of machinery – Industrial truck”, chapter 5.7, “there shall be no electrical connection to the truck frame”. So the truck frame has to be isolated from any electrical potential of the truck power line.

3.3 Protection and safety features

3.3.1 Protection features

- **Battery polarity inversion**
  It is necessary to fit a MAIN CONTACTOR to protect the MHYRIO against reverse battery polarity and for safety reasons.
- **Connection Errors:**
  All inputs are protected against connection errors.
- **External agents:**
  The controller is protected against dust and the spray of liquid to a degree of protection meeting IP65.

3.3.2 Safety Features

ZAPI controllers are designed according to the prEN954-1 specifications for

safety related parts of control system and to UNI EN1175-1 norm.

The safety of the machine is strongly related to installation; length, layout and screening of electrical connections have to be carefully designed. ZAPI is always available to cooperate with the customer in order to evaluate installation and connection solutions. Furthermore, ZAPI is available to develop new SW or HW solutions to improve the safety of the machine, according to customer requirements.
Machine manufacturer holds the responsibility for the truck safety features and related approval.

The positive of EVs coils (outputs C16, C17, C18 for ON/OFF VALVES; outputs C20, C2, C5, C8, C13 for proportional valves) comes from the valve positive voltage supply (input B2), being controlled by an electronic high-side switch.
In this way, Mhyrio CB is able to open not only the negative side of the valve coil, but also the positive side.

The positive for valves (input B2), can be independent from the Mhyrio CB power supply. It is strongly suggested that valve positive is cut by a device controller by another intelligent module, which is thus able to open the valves positive in case of Mhyrio failures or malfunctioning.
Thus the more safe solution is:
- **PEV supplied to B2, controlled by another intelligent module.**
- **Positive of the valves taken from the PEV (1, 2, 3) and PEVP (1/2, 3/4, 5/6, 7/8, 9) outputs.**

3.4 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).

EMC stands for Electromagnetic Compatibility, and it represents the studies and the tests on the electromagnetic energy generated or received by an electrical device.
So the analysis works in two directions:

1) The study of the **emission** problems, the disturbances generated by the device and the possible countermeasure to prevent the propagation of that energy; we talk about “conduction” issues when guiding structures such as wires and cables are involved, “radiated emissions” issues when it is studied the propagation of electromagnetic energy through the open space. In our

case the origin of the disturbances can be found inside the controller with the switching of the mosfets which are working at high frequency and generate RF energy, **but wires and cables have the key role to propagate the disturbs because they works as antennas**, so a good layout of the cables and their shielding can solve the majority of the emission problems.

2) The study of the **immunity** can be divided in two main branches: protection from electromagnetic fields and from electrostatic discharge.
The **electromagnetic immunity** concern the susceptibility of the controller with regard to electromagnetic fields and their influence on the correct work made by the electronic device.
There are well defined tests which the machine has to be exposed to.
These tests are carried out at determined levels of electromagnetic fields, to simulate external undesired disturbances and verify the electronic devices response.

3) The second type of immunity, **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 happens when there is a rapid transfer from a charged object to another. This rapid transfer has, in turn, two important effects:
   A) this rapid charge transfer can determine, by induction, disturbs on the signal wiring and thus create malfunctions; **this effect is particularly critical in modern machines, with serial communications (canbus) which are spread everywhere on the truck and which carry critical information.**
   B) 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 an 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.

There are different solutions for EMC issues, depending on level of emissions/ immunity required, the type of controller, materials and position of the wires and electronic components.

1) **EMISSIONS**. Three ways can be followed to reduce the emissions:

   A) SOURCE OF EMISSIONS: finding the main source of disturb and work on it.
   B) SHIELDING: enclosing contactor and controller in a shielded box; using shielded cables;
   C) LAYOUT: a good layout of the cables can minimize the antenna effect; cables running nearby the truck frame or in iron channels connected to truck frames is generally a suggested not expensive solution to reduce the emission level.

2) **ELECTROMAGNETIC IMMUNITY**. The considerations made for emissions are valid also for immunity. Additionally, further protection can be achieved with ferrite beads and bypass capacitors.

3) **ELECTROSTATIC IMMUNITY**. Three ways can be followed to prevent

damages from ESD:

A) PREVENTION: when handling ESD-sensitive electronic parts, ensure the operator is grounded; test grounding devices on a daily basis for correct functioning; this precaution is particularly important during controller handling in the storing and installation phase.
B) ISOLATION: use anti-static containers when transferring ESD-sensitive material.
C) GROUNDING: when a complete isolation cannot be achieved, a good grounding can divert the discharge current trough a “safe” path; the frame of a truck can works like a “local earth ground”, absorbing excess charge. **So it is strongly suggested to connect to truck frame all the parts of the truck which can be touched by the operator, who is most of the time the source of ESD.**

4 OPERATIONAL FEATURES

Mhyrio CB has been designed to work on a CANBUS system. So, it follows the commands received by CAN communication and broadcasts the input status on the CAN.
8 of the 9 proportional valves are separated in 4 groups used for 4 different functions. Only one valve of the group can be active.
It is possible to activate more function at the same time.

FUNCTION1	is related to EVP1 and 2 (outputs C1, C3); typically this function is lowering/lifting.
FUNCTION2	is related to EVP3 and 4 (outputs C4, C6); typically this function is an auxiliary function.
FUNCTION3	is related to EVP5 and 6 (outputs C7, C15); typically this function is tilting fw/rev.
FUNCTION4	is related to EVP7 and 8 (outputs C12, C14); typically this function is shifting right/left.

The 9th proportional valve is single and can be driven in parallel to the others proportional valves.

5 DESCRIPTION OF THE CONNECTORS

5.1 Connector CNA: MOLEX SPOX

A1	PCLRXD	Serial communication interface
A2	NCLRXD	Serial communication interface
A3	PCLTXD	Serial communication interface
A4	NCLTXD	Serial communication interface
A5	GND	Negative supply
A6	+12	+12 V supply
A7	-	
A8	-	

5.2 Connector CNB: AMP Ampseal 14 poles

B1	+KEY	Mhyrio CB positive power supply
B2	PAUX	Input of valves positive power supply
B3	-BATT	Mhyrio CB negative supply
B4	CANL	CAN low signal in
B5	CANL-OUT	CAN low signal out
B6	CMM	Positive supply of digital input devices
B7	DI1	Digital Input N° 1
B8	DI2	Digital Input N° 2
B9	CANT	CAN termination: connect to CANH-OUT to insert a 120 ohm termination resistance
B10	PPOS	Positive supply of analog devices (+12 V or +5 V)
B11	ANIN	Analog input (range 0-5 V or 0-12 V)
B12	GND	Negative supply of analog devices
B13	CANH	Can high signal in
B14	CANH-OUT	Can high signal out

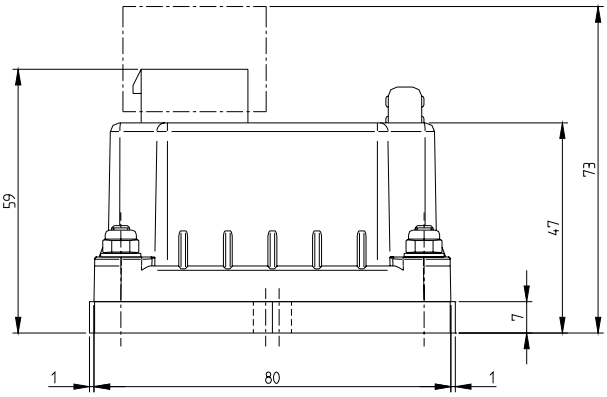
5.3 Connector CNC: AMP Ampseal 23 poles

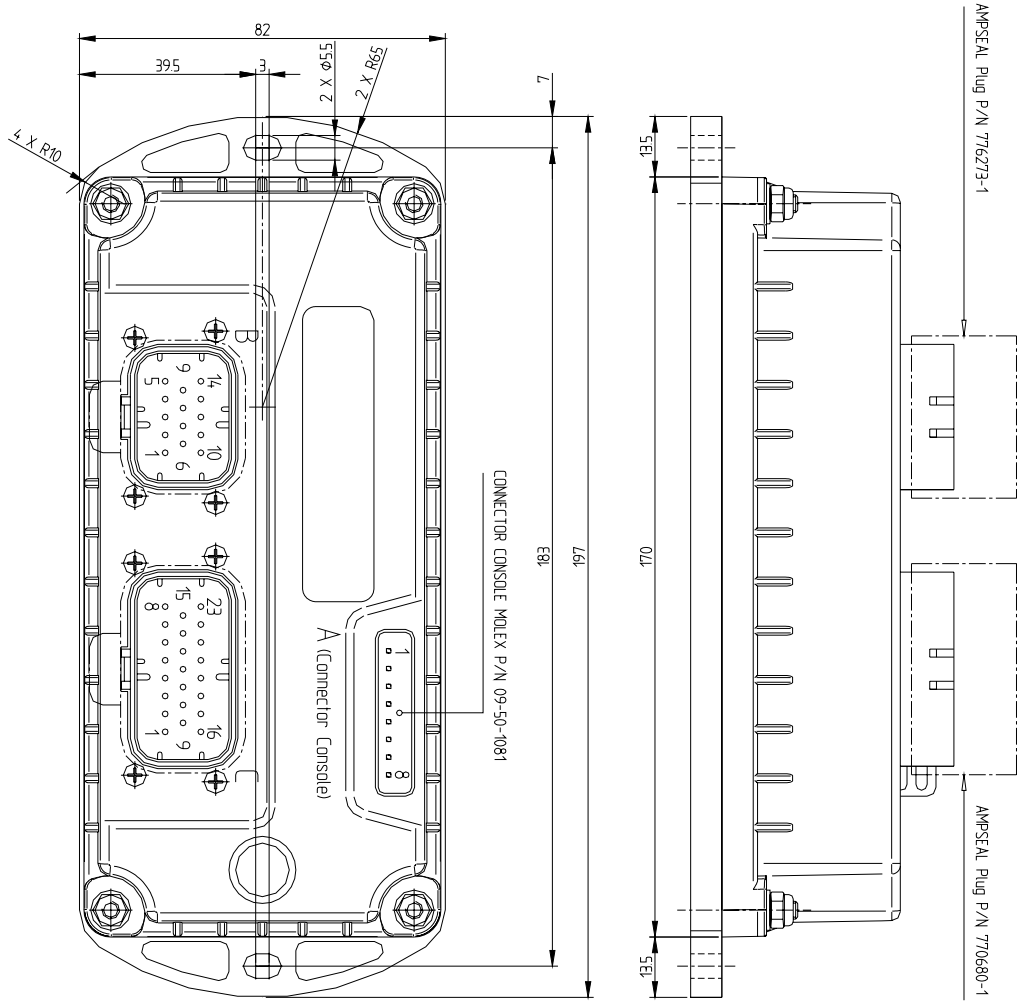
C1	NEVP1	Negative of the proportional electrovalve N°1
C2	PEVP1/2	Positive of the proportional electrovalves N°1 and N°2
C3	NEVP2	Negative of the proportional electrovalve N°2
C4	NEVP3	Negative of the proportional electrovalve N°3
C5	PEVP3/4	Positive of the proportional electrovalves N°3 and N°4
C6	NEVP4	Negative of the proportional electrovalve N°4
C7	NEVP5	Negative of the proportional electrovalve N°5

C8	PEVP5/6	Positive of the proportional electrovalves N°5 and N°6
C9	NEV1	Negative of the on/off electrovalve N°1
C10	NEV2	Negative of the on/off electrovalve N°2
C11	NEV3	Negative of the on/off electrovalve N°3
C12	NEVP7	Negative of the proportional electrovalve N°7
C13	PEVP7/8	Positive of the proportional electrovalves N°7 and N°8
C14	NEVP8	Negative of the proportional electrovalve N°8
C15	NEVP6	Negative of the proportional electrovalve N°6
C16	PEV1	Positive of the on/off electrovalve N°1
C17	PEV2	Positive of the on/off electrovalve N°2
C18	PEV3	Positive of the on/off electrovalve N°3
C19	NEVP	Negative of the single proportional electrovalve
C20	PEVP	Positive of the single proportional electrovalve
C21	CMM	Positive supply of digital input devices
C22	DI0	Digital input N°0
C23	-BATT	Mhyrio CB negative supply

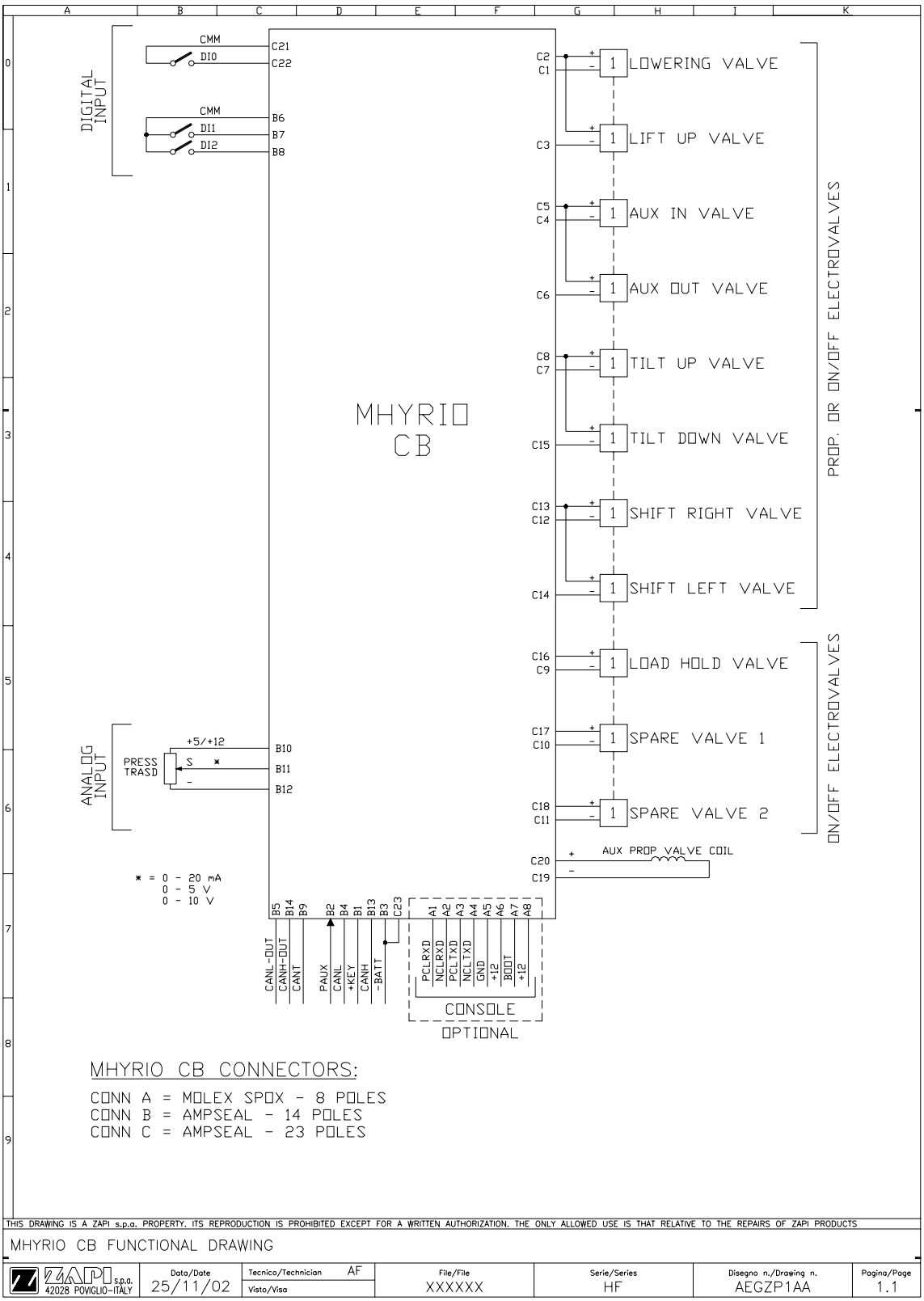
6 DRAWINGS

6.1 Mechanical drawing





6.2 Functional drawing

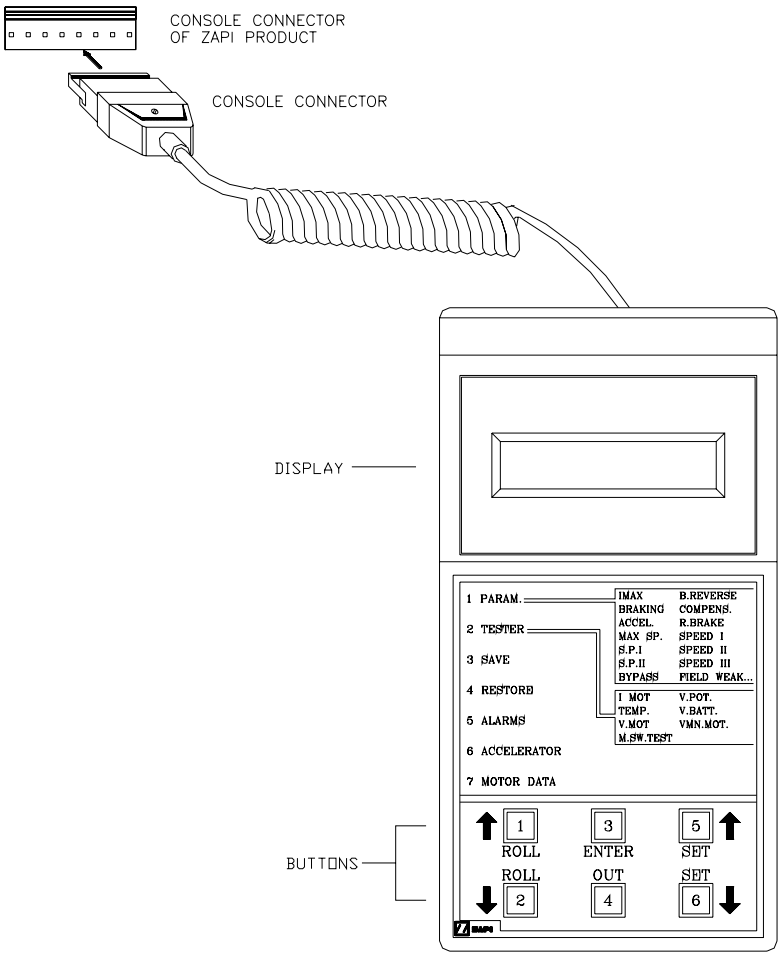


7 PROGRAMMING & ADJUSTMENTS USING DIGITAL CONSOLE

7.1 Adjustments via console

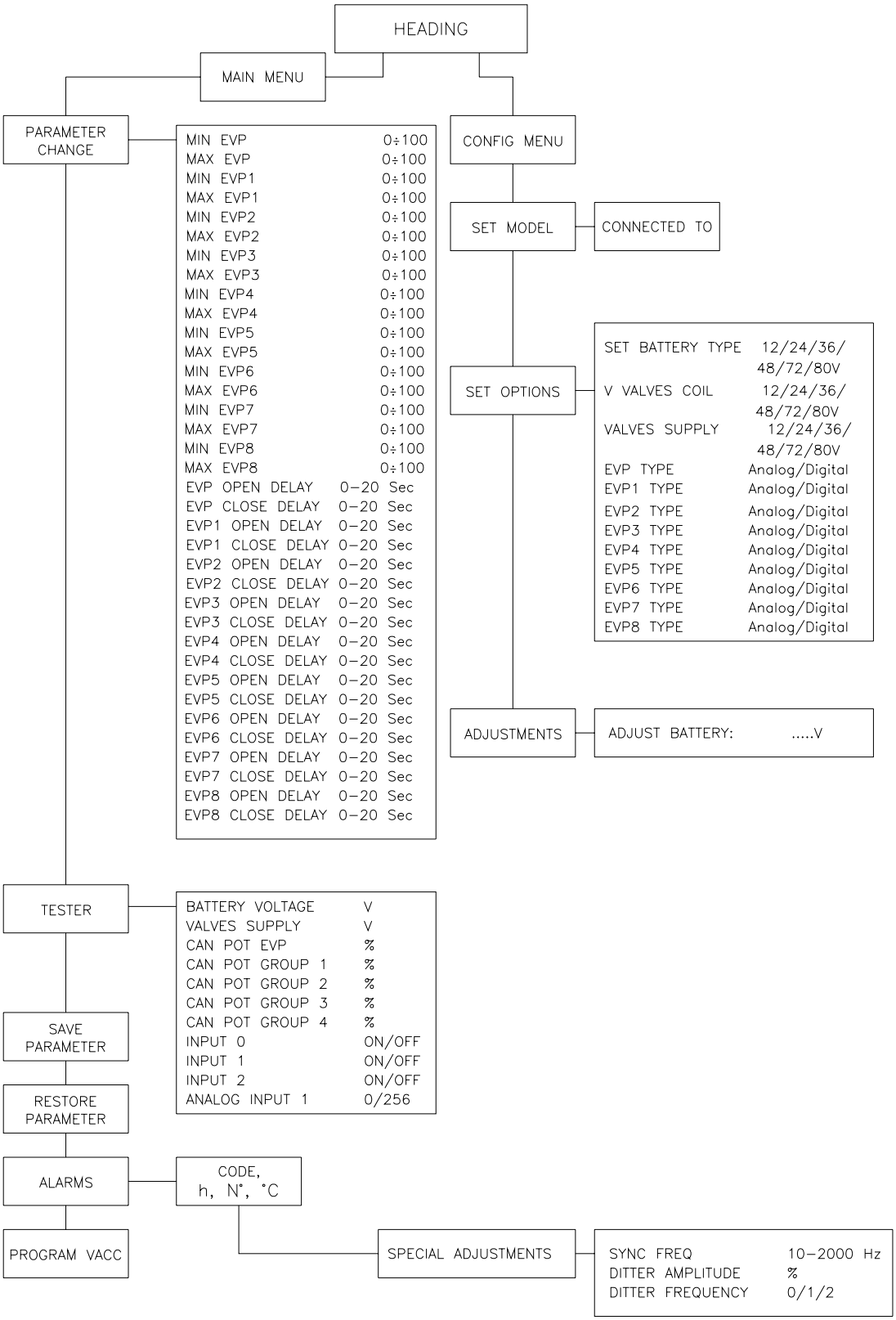
Adjustment of Parameters and changes to the controller's configuration are made using the Digital Console. Zapi console can be connected directly to Mhyrio CB (connector A), or it can be physically connected to another controller in the CANBUS net, then virtually connected to Mhyrio CB (which is node 9 of the net).

7.2 Description of console and connection



Digital consoles used to communicate with MHYRIO controllers must be fitted with EPROM CK ULTRA, minimum "Release Number 3.06".

7.3 Description of standard console menu



7.4 Description of programmable functions (options)

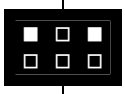
The options can be set on the “SET OPTIONS” Menu.

Function	*Option*	*Meaning*
SET Battery Type	**12/24/36/ /48/72/80V**	This parameter sets the battery nominal voltage, that is the key input voltage (MHYRIO supply)
V VALVES COIL	**12/24/36/ /48/72/80V**	This parameter sets the on/off valves coil nominal voltage
VALVES SUPPLY	**12/24/36/ /48/72/80V**	This parameter sets the voltage of the valve's coil positive supply
EVP TYPE	**DIGITAL**	It sets EVP single to ON-OFF valve type
	ANALOG	It sets EVP single to PROPORTIONAL valve type
EVP1 TYPE	**DIGITAL**	It sets EVP1 to ON-OFF valve type
	ANALOG	It sets EVP1 to PROPORTIONAL valve type
EVP2 TYPE	**DIGITAL**	It sets EVP2 to ON-OFF valve type
	ANALOG	It sets EVP2 to PROPORTIONAL valve type
EVP3 TYPE	**DIGITAL**	It sets EVP3 to ON-OFF valve type
	ANALOG	It sets EVP3 to PROPORTIONAL valve type
EVP4 TYPE	**DIGITAL**	It sets EVP4 to ON-OFF valve type
	ANALOG	It sets EVP4 to PROPORTIONAL valve type
EVP5 TYPE	**DIGITAL**	It sets EVP5 to ON-OFF valve type
	ANALOG	It sets EVP5 to PROPORTIONAL valve type
EVP6 TYPE	**DIGITAL**	It sets EVP6 to ON-OFF valve type
	ANALOG	It sets EVP6 to PROPORTIONAL valve type
EVP7 TYPE	**DIGITAL**	It sets EVP7 to ON-OFF valve type
	ANALOG	It sets EVP7 to PROPORTIONAL valve type
EVP8 TYPE	**DIGITAL**	It sets EVP8 to ON-OFF valve type
	ANALOG	It sets EVP8 to PROPORTIONAL valve type

Flow chart showing how to make changes to Option Menu.

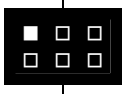
1) Opening Zapi Menu.

2) Press ROLL UP & SET UP buttons together to enter the SET MENU.



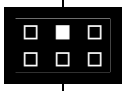
3) The Display will show: SET MODEL.

4) Press ROLL UP or ROLL DOWN buttons until SET OPTIONS Menu appears.



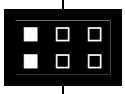
5) SET OPTIONS appears on the display.

6) Press ENTER to go into the SET OPTIONS Menu.



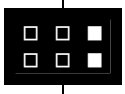
7) The display will shows the first option.

8) Press ROLL UP or ROLL DOWN buttons until desired option appears.



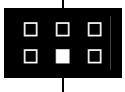
9) Desired option appears.

10) Press SET UP or SET DOWN buttons in order to modify the value for selected option.



11) New value for selected option appears.

12) Press OUT to exit the Menu.

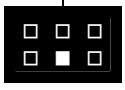


13) Confirmation request appears.

14) Press ENTER to accept the changes, or press OUT if you do not accept the changes.

15) SET OPTIONS Menu appears.

16) Press OUT again. Display now shows the Opening Zapi Menu.



7.5 Description of parameters that may be programmed (parameter change)

In addition to the Configuration, Parameter settings can be factory set (Zapi default parameters), or the customer can make changes according to the application, using a Digital Console. During the setting up procedure on the machine, the Console can remain connected to the controller during travel. The Parameters can be modified in real time, during operation. Pay attention to the polarity of the Console Connector. Refer to chapter 7.1 and 7.2 of this Manual for connection details.
CONNECTION OF THE CONSOLE TO THE CONTROLLER MUST BE MADE WITH THE KEY SWITCH TURNED OFF.
The following Parameters can be modified:

1) **MIN EVP**
   This parameter adjusts the minimum current of the SINGLE valve, if it is set as proportional (see "set option menu").
2) **MAX EVP**
   This parameter adjusts the MAXIMUM current of the SINGLE valve, if it is set as proportional (see "set option menu").
3) **MIN EVP1**
   This parameter adjusts the minimum current of valve 1, if it is set as proportional (see "set option menu").
4) **MAX EVP1**
   This parameter adjusts the maximum current of valve 1, if it is set as proportional (see "set option menu").
5) **MIN EVP2**
   This parameter adjusts the minimum current of valve 2, if it is set as proportional (see "set option menu").
6) **MAX EVP2**
   This parameter adjusts the maximum current of valve 2, if it is set as proportional (see "set option menu").
7) **MIN EVP3**
   This parameter adjusts the minimum current of valve 3, if it is set as proportional (see "set option menu").
8) **MAX EVP3**
   This parameter adjusts the maximum current of valve 3, if it is set as proportional (see "set option menu").
9) **MIN EVP4**
   This parameter adjusts the minimum current of valve 4, if it is set as proportional (see "set option menu").
10) **MAX EVP4**
    This parameter adjusts the maximum current of valve 4, if it is set as proportional (see "set option menu").
11) **MIN EVP5**
    This parameter adjusts the minimum current of valve 5, if it is set as proportional (see "set option menu").
12) **MAX EVP5**
    This parameter adjusts the maximum current of valve 5, if it is set as proportional (see "set option menu").

13) MIN EVP6
This parameter adjusts the minimum current of valve 6, if it is set as proportional (see "set option menu").

14) MAX EVP6
This parameter adjusts the maximum current of valve 6, if it is set as proportional (see "set option menu").

15) MIN EVP7
This parameter adjusts the minimum current of valve 7, if it is set as proportional (see "set option menu").

16) MAX EVP7
This parameter adjusts the maximum current of valve 7, if it is set as proportional (see "set option menu").

17) MIN EVP8
This parameter adjusts the minimum current of valve 8, if it is set as proportional (see "set option menu").

18) MAX EVP8
This parameter adjusts the maximum current of valve 8, if it is set as proportional (see "set option menu").

19) EVP OPEN DELAY
Single proportional valve current ramping up time: this parameter sets the single valve current ramp, to change from 0 A to operating current.

20) EVP CLOSE DELAY
Single proportional valve current ramping down time: this parameter sets the single valve closing ramp, to change from operating current to 0 A.

21) EVP1 OPEN DELAY
EVP1 proportional valve current ramping up time: this parameter sets the EVP1 valve current ramp, to change from 0 A to operating current.

22) EVP1 CLOSE DELAY
EVP1 proportional valve current ramping down time: this parameter sets the EVP1 valve closing ramp, to change the coil current from operating current to 0 A.

23) EVP2 OPEN DELAY
EVP2 proportional valve current ramping up time: this parameter sets the EVP2 valve current ramp, to change from 0 A to operating current.

24) EVP2 CLOSE DELAY
EVP2 proportional valve current ramping down time: this parameter sets the EVP2 valve closing ramp, to change the coil current from operating current to 0 A.

25) EVP3 OPEN DELAY
EVP3 proportional valve current ramping up time: this parameter sets the EVP3 valve current ramp, to change from 0 A to operating current.

26) EVP3 CLOSE DELAY
EVP3 proportional valve current ramping down time: this parameter sets the EVP3 valve closing ramp, to change the coil current from operating current to 0 A.

27) EVP4 OPEN DELAY
EVP4 proportional valve current ramping up time: this parameter sets the EVP4 valve current ramp, to change from 0 A to operating current.

28) EVP4 CLOSE DELAY
EVP4 proportional valve current ramping down time: this parameter sets the EVP4 valve closing ramp, to change the coil current from operating current to 0 A.

29) EVP5 OPEN DELAY
EVP5 proportional valve current ramping up time: this parameter sets the EVP5 valve current ramp, to change from 0 A to operating current.

30) EVP5 CLOSE DELAY
EVP5 proportional valve current ramping down time: this parameter sets the EVP5 valve closing ramp, to change the coil current from operating current to 0 A.

31) EVP6 OPEN DELAY
EVP6 proportional valve current ramping up time: this parameter sets the EVP6 valve current ramp, to change from 0 A to operating current.

32) EVP6 CLOSE DELAY
EVP6 proportional valve current ramping down time: this parameter sets the EVP6 valve closing ramp, to change the coil current from operating current to 0 A.

33) EVP7 OPEN DELAY
EVP7 proportional valve current ramping up time: this parameter sets the EVP7 valve current ramp, to change from 0 A to operating current.

34) EVP7 CLOSE DELAY
EVP7 proportional valve current ramping down time: this parameter sets the EVP7 valve closing ramp, to change the coil current from operating current to 0 A.

35) EVP8 OPEN DELAY
EVP8 proportional valve current ramping up time: this parameter sets the EVP8 valve current ramp, to change from 0 A to operating current.

36) EVP8 CLOSE DELAY
EVP8 proportional valve current ramping down time: this parameter sets the EVP8 valve closing ramp, to change the coil current from operating current to 0 A.

7.6 Adjustments range

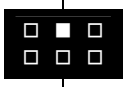
MIN EVP, EVP1÷EVP8: range 0÷100, 250 steps. (*)
MAX EVP, EVP1÷EVP8: range 0÷100, 250 steps. (*)
EVP, EVP1÷EVP8 OPEN DELAY: range 0÷20 sec.
EVP, EVP1÷EVP8 CLOSE DELAY: range 0÷20 sec.

(*) NOTE: with the standard shunt resistances of the proportional valves circuits, the coil current range corresponding to 0÷100 is 0÷1 A.

Flow Chart showing how to make Program changes using Digital Console fitted with Eprom CK ULTRA.

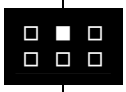
1) Opening Zapi Menu.

2) Press ENTER to go into the GENERAL MENU.



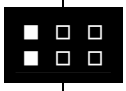
3) The Display will show: PARAMETER CHANGE.

4) Press ENTER to go into the PARAMETER CHANGE menu.



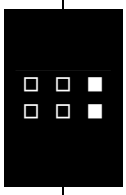
5) The Display will show the first parameter.

6) Press ROLL UP and ROLL DOWN buttons until desired parameter appears.



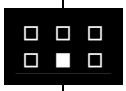
7) The names of the Parameters appear on the Display.

8) When the desired Parameter appears, the Display will show a Level Number that will be between 0 and 9.
Press either SET UP or SET DOWN buttons to change the Level value.



9) The Display will show the New Level.

10) When you are satisfied with the results of the changes you have made, Press OUT.



11) The Display asks: “ARE YOU SURE?”.

12) Press ENTER to accept the changes, or press OUT if you do not wish to accept the changes and wish to make further modifications to the parameters.

13) The Display will show: PARAMETER CHANGE.

7.7 Special Adjustment menu

In the Special Adjustments menu (which is a submenu of the Alarm menu), it is possible to adjust the following parameters:

1) **SYNC FREQ**
   It is the carrier frequency of the proportional valve coils drivers. The default value is 1000 Hz, it can be adjusted in the 10 to 2000 Hz. The resolution is 10 Hz (it can be adjusted in steps of 10 Hz).
2) **DITTER AMPLITUDE**
   It is the dither signal amplitude. The dither signal is a square wave which is superposed to the proportional valves set point. In this way the proportional valves response to set point variations is optimized. This parameter is a percentage of the valves maximum current. It can be adjusted in the 0% to 20.3% by nine levels. Setting the parameter to 0% means the dither isn't used.
3) **DITTER FREQUENCY**
   It is the dither signal frequency. It can be used one of three:
   - 0: the dither signal frequency is 62.5 Hz
   - 1: the dither signal frequency is 83 Hz
   - 2: the dither signal frequency is 125 Hz.

7.8 Tester menu

Following parameters can be measured in real time in the TESTER menu:

1) **BATTERY VOLTAGE**
   Level of battery voltage measured at the input of the key switch.
2) **VALVES SUPPLY**
   Level of voltage at the positive valve supply input (B2).
3) **CAN POT EVP**
   Single proportional valve current set point, received by canbus.
4) **CAN POT GROUP 1**
   Group 1 proportional valves current set point, received by canbus.
5) **CAN POT GROUP 2**
   Group 2 proportional valves current set point, received by canbus.
6) **CAN POT GROUP 3**
   Group 3 proportional valves current set point, received by canbus.
7) **CAN POT GROUP 4**
   Group 4 proportional valves current set point, received by canbus.
8) **INPUT 0**
   Level of DIGITAL INPUT 0:
   - ON / +VB: input active, switch closed
   - OFF / COND: input not active, switch open.
9) **INPUT 1**
   Level of DIGITAL INPUT 1:
   - ON / +VB: input active, switch closed
   - OFF / COND: input not active, switch open.
10) **INPUT 2**
    Level of DIGITAL INPUT 2:
    - ON / +VB: input active, switch closed

- OFF / COND: input not active, switch open.

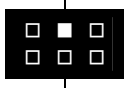
11) ANALOG INPUT 1

Voltage of the analog input.

Flow Chart showing how to use the TESTER function of the Digital Console.

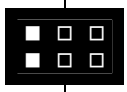
1) Opening Zapi Menu.

2) Press ENTER to go into the GENERAL MENU.



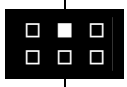
3) The Display will show: PARAMETER CHANGE.

4) Press ROLL UP or ROLL DOWN button until TESTER menu appears on the display.



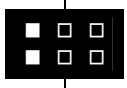
5) The Display shows: TESTER.

6) Press ENTER to go into the TESTER function.

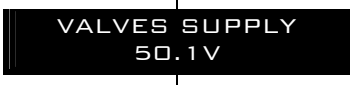


7) The first variable to be tested is shown on the Display.

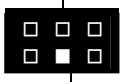
8) Press either ROLL UP or ROLL DOWN buttons.



9) Next variable for measurement appears.

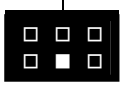


10) When you have finished, Press OUT.



11) The Display shows: TESTER.

12) Press OUT again and return to Opening Zapi Menu.



Remember it is not possible to make any changes using TESTER. All you can do is measure as if you were using a pre-connected multimeter.

7.9 Description of the console save function

The SAVE PARAM. function is allowed in the MHYRIO controller, but it's useless because console cannot save all parameters correctly.
Use of this function don't create problems to the console functionality and to the others ZAPI device functionality.
In order to perform SAVE FUNCTION, use ZAPI PC Win console.

7.10 Description of the console restore function

The RESTORE PARAM function is allowed in MHYRIO controller, but ZAPI recommend don't use this because should make several problems to the

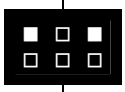
controller.
As a result of using this function, all parameters will be overwritten with incorrectly values and MHYRIO controller will not work correctly.
In order to perform RESTORE FUNCTION, use ZAPI PC Win console.

7.11 Description of the set model Function

The only parameter present in SET MODEL function is CONNECTED TO.
By setting this parameter, operator can connect ZAPI Console to every ZAPI product connected to CAN-BUS line. This functionality allow completely control of every ZAPI product without changing the position of the Console connector.

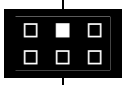
1) Opening Zapi Menu.

2) Press ROLL UP & SET UP buttons together to enter SET MENU.



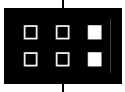
3) The Display will show: SET MODEL.
If another menu is displayed, press ROLL UP or ROLL DOWN until SET MODEL appears.

4) Press ENTER to go into the SET MODEL Menu.



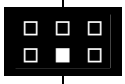
5) The display will shows the first option, only CONNECTED TO option is present in this menu.

6) Press SET UP or SET DOWN buttons in order to select the desired value for selected option.



7) New desired value appears.

8) Press OUT to exit the Menu.

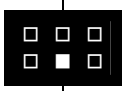


9) Confirmation request appears.

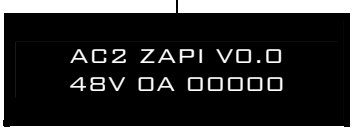
10) Press ENTER to accept the changes, or press OUT if you do not accept the changes.

11) SET MODEL Menu appears.

12) Press OUT again. Console now disconnects and reconnects.



13) Display now shows the Opening Zapi Menu of the ZAPI product corresponding to option selected at point 7.



The table below indicates which parameter can be set to connect ZAPI products to Console.

PARAMETER	CONNECTED PRODUCT
1	SICOS
2	TRACTION CONTROLLER
3	MASTER CONTROLLER
4	SLAVE CONTROLLER
5	PUMP CONTROLLER
6	EPS
9	MHYRIO

The range for this parameter is 0~32, but only above number are enabled. If operator selects a not specified value, ZAPI Console reconnects the product physically connected to Console. To have a confirmation of the product connected, see the console headline.

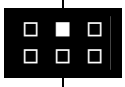
7.12 Description of alarms menu

The microprocessor in the controller records the last five Alarms that have occurred. Items remembered relative to each Alarm are: the code of the alarm, the number of times the particular Alarm occurred, the Hour Meter count, and the controller temperature. This function permits deeper diagnosis of problems as the recent history can now be accessed.

Flow Chart showing how to use the ALARMS function via the Digital Console.

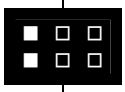
1) Opening Zapi Display.

2) Press ENTER to go into the General menu.



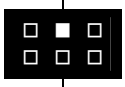
3) The Display will show:

4) Press ROLL UP or ROLL DOWN button until PARAMETER CHANGE appears on the display.



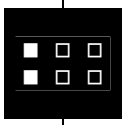
5) The Display will show:

6) Press ENTER to go into the ALARMS function.



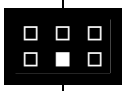
7) The Display will show the most recent Alarm.

8) Each press of the ROLL UP button brings up following Alarms. Pressing ROLL DOWN returns to the most recent.



9) If an Alarm has not occurred, the Display will show: ALARM NULL.

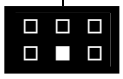
10) When you have finished looking at the Alarms, press OUT to exit the ALARMS menu.



11) The Display will ask: “CLEAR LOGBOOK?”.

12) Press ENTER for Yes, or OUT for NO.

13) Press OUT to return to the Opening Zapi Display.



8 CONTROLLER DIAGNOSTIC

8.1 Analysis of alarms displayed on the console

1) **EEPROM KO**
   Fault in the area of memory where the adjustment parameters are stored. This Alarm does not inhibit machine operation but operation goes on with default values; if fault is still present when the Key Switch is re-cycled, replace the logic. If the fault disappears, the previously stored Parameters will have been replaced by the default parameters.
2) **CAN BUS KO**
   There is a problem related to the CAN-BUS line. The error is signalled if the MHYRIO controller does not receive any message from the CAN-BUS line. First of all, check the wiring. If it is ok, the problem is on the logic board, which must be replaced.
3) **WATCHDOG**
   The test is made in both running and standby. It is a self-diagnosing test within the logic. If an alarm should occur, replace the logic.
4) **WRONG SET BATTERY**
   This fault is signalled if the battery voltage is non consistent with the set battery programmed in the 'set option' menu.
5) **UNDERVOLTAGE**
   This fault is signalled if an undervoltage condition is detected in the MHYRIO power supply.
6) **FF VALVES**
   Flip-flop circuit, that manages on/off valve drivers short-circuit protection, does not reset in the correct way. The problem is probably in the hardware circuit.
7) **COIL SHORTED**
   ON/OFF valves drivers are protected against coil short circuit; if a short is present across the coil, the flip-flop circuit is set and the alarm is signalled.
8) **EV DRIVER SHORT**
   One of the on/off valves driver is shorted; check the external connection, if it is ok the driver is probably damaged.
9) **EVP DRIVER SHORT**
   The single proportional valve driver is shorted; check the external connection, if it is ok the driver is probably damaged.
10) **EVPG1 DRIVER SHORT**
    One of the Group 1 valves drivers is shorted; check the external connection, if it is ok the driver is probably damaged.
11) **EVPG2 DRIVER SHORT**
    One of the Group 2 valves drivers is shorted; check the external connection, if it is ok the driver is probably damaged.
12) **EVPG3 DRIVER SHORT**
    One of the Group 3 valves drivers is shorted; check the external connection, if it is ok the driver is probably damaged.
13) **EVPG4 DRIVER SHORT**
    One of the Group 4 valves drivers is shorted; check the external connection, if it is ok the driver is probably damaged.
14) **EV DRIVER KO**
    One of the On/Off valves drivers is open (it does not close when it is commanded by the microcontroller).

15) **EVP DRIVER KO**
The single proportional valve driver is open (it does not close when it is commanded by the microcontroller).
16) **EVPG1 DRIVER KO**
One of the Group 1 valves drivers is open (it does not close when it is commanded by the microcontroller).
17) **EVPG2 DRIVER KO**
One of the Group 2 valves drivers is open (it does not close when it is commanded by the microcontroller).
18) **EVPG3 DRIVER KO**
One of the Group 3 valves drivers is open (it does not close when it is commanded by the microcontroller).
19) **EVPG4 DRIVER KO**
One of the Group 4 valves drivers is open (it does not close when it is commanded by the microcontroller).
20) **HI SIDEDRIVER KO**
The high side driver which supply the valves coils positive is shorted or open.
21) **WAITING FOR PEV**
There isn't the valves positive power supply. Check B2 input then verify the VALVES SUPPLY parameter is correctly set.

9 RECOMMENDED SPARE PARTS FOR CONTROLLER

Part Number	Description
C12531	Ampseal Connector 23 pins Female
C12530	Ampseal Connector 14 pins Female
C12796	Female ampseal pin harness side

10 PERIODIC MAINTENANCE TO BE REPEATED AT TIMES INDICATED

Check the wear and condition of the Contactors' moving and fixed contacts. Electrical Contacts should be checked every ..... 3 MONTHS

Check the Foot pedal or Tiller microswitch. Using a suitable test meter, confirm that there is no electrical resistance between the contacts by measuring the volt drop between the terminals. Switches should operate with a firm click sound. Microswitches should be checked every ..... 3 MONTHS

Check the Battery cables, cables to the controller and cables to the motor. Ensure the insulation is sound and the connections are tight. Cables should be checked every..... 3 MONTHS

Check the mechanical operation of the pedal or tiller. Are the return springs ok. Do the potentiometers wind up to their full or programmed level. Check every..... ..... 3 MONTHS

Check the mechanical operation of the Contactor(s). Moving contacts should be free to move without restriction. Check every..... 3 MONTHS

Checks should be carried out by qualified personnel only and any replacement parts used should be original. Beware of NON ORIGINAL PARTS. The installation of this electronic controller should be made according to the diagrams included in this Manual. Any variations or special requirements should be made after consulting a Zapi Agent.
The supplier is not responsible for any problem that arises from wiring methods that differs from information included in this Manual. During periodic checks, if a technician finds any situation that could cause damage or compromise safety, the matter should be bought to the attention of a Zapi Agent immediately. The Agent will then take the decision regarding operational safety of the machine.
Remember that Battery Powered Machines feel no pain.

NEVER USE A VEHICLE WITH A FAULTY ELECTRONIC CONTROLLER.