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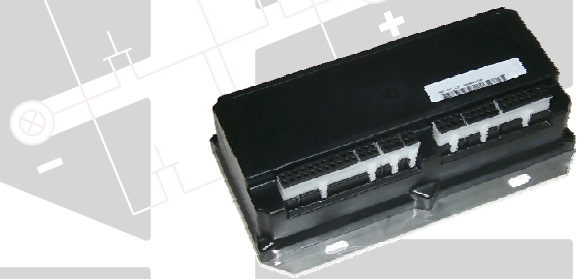
EN

User Manual

MHYRIO FLASH CONTROLLER

(MULTIFUNCTIONAL HYDRAULIC REMOTE I/O)



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
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 is one of this modules born 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] .....24/36/48/80 V
Output for ON-OFF valves [n°] 3
Output for proportional valves [n°] 8
Incremental Encoder (phase A and B) [n°] 1
Digital inputs [n°].....8
Analog inputs [n°].....2
RS-232 [n°] 1
CAN [n°].....1
Protection.....IP64

Mhyrio is produced to work with one defined battery voltage (the required voltage has to be specified in the order).

2.2 Input

Digital inputs: accepts PNP type sensor or switches connected to the positive. The voltage can be battery voltage or 24 V if the valves are supplied at 24 V (specify in the order).
Analog inputs: Mhyrio Flash accepts two analog inputs. The range have to be specified in the order (0-20 mA, 0-5 V, 0-10 V, 0-VBatt).
13 V, 200 mA output is provided to supply potentiometer or similar device.
Encoder: encoder electronic output can be PNP, NPN or PUSH PULL type. Encoder supply is 13 V. Maximum frequency is 500 Hz.
ON-OFF valves drivers programmable and can drive the coil in full conduction or in PWM mode for supply the coil at the nominal programmed voltage independently by the battery voltage. Option: 0-12; 1-24; 2-36; 3-48; 4-72; 5-80.
Proportional valves are driven in current mode with fixed frequency. The voltage 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.

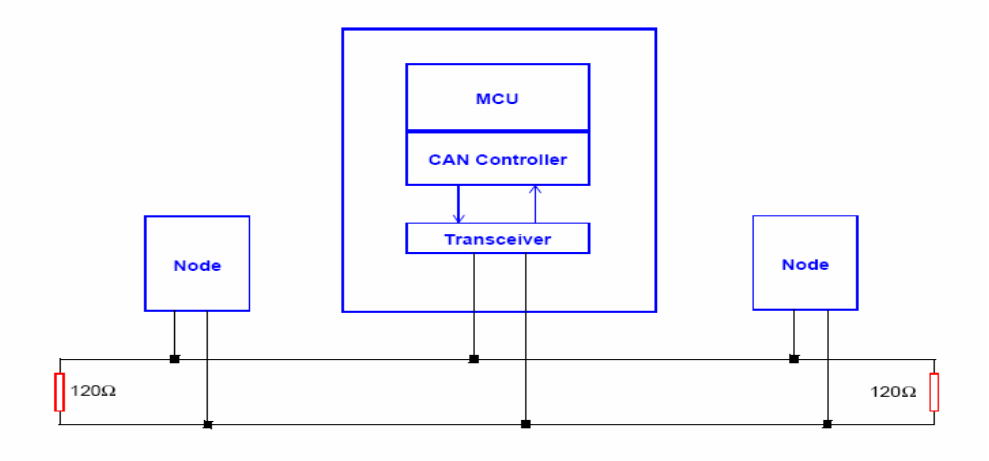
3.2 Installation of the hardware

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.

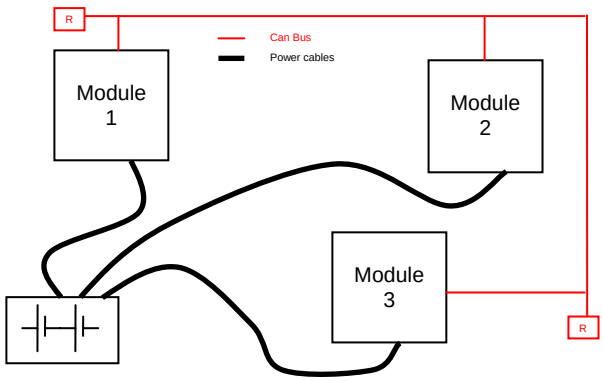
3.2.1 Wirings: CAN connections and possible interferences

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.

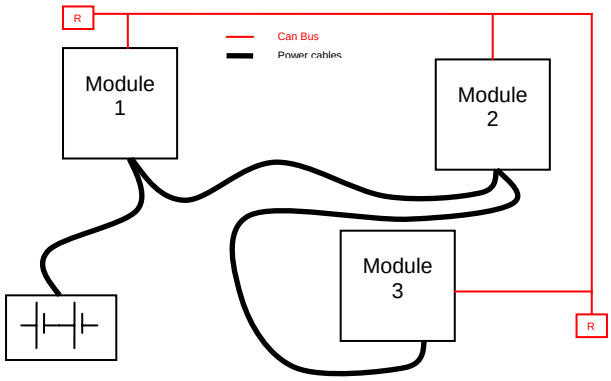
Wrong Layout:



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.

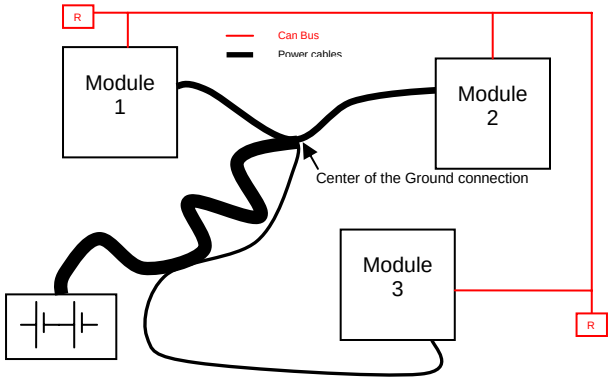
Correct Layout:



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 IP64.

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.

On the connection pins A13 and B3 is output a positive coming from the valves positive voltage but controlled with an electronic high-side switch. This positive can be used to feed one or more valves involved in safety problems. In this way MHYRIO FLASH opens not only the negative side of the valve coil, but also the positive one.
The positive switch is tested by the microprocessor at every key switching on, by feedbacking this output voltage to the µC A/D converter.
Furthermore, it is possible to input a positive for valves, independent by the Mhyrio Flash supply, to input B6. It is strongly suggested that this positive is cut by a device controller by another intelligent module, which is thus able to open the valves positive in case of Mhyrio Flash failures or malfunctioning.
Thus the more safe solution is:

- **PEV supplied to B6, controlled by another intelligent module.**
- **Positive to group 1 valves (lifting-lowering), taken by outputs A13 and B3.**

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 Flash has been designed to work on a CAN-BUS system. So, it follows the commands received by CAN communication and broadcast the input status and the encoder counting on the CAN.
The 8 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. These can be:

- function 1-2-3
- function 1-2-4

3 and 4 cannot be activate at the same time.

FUNCTION1	is related to EVP1 and 2 (outputs G8, G7); typically this function is lifting-lowering.
FUNCTION2	is related to EVP3 and 4 (outputs G6, G5); typically this function is reach in/out.
FUNCTION3	is related to EVP5 and 6 (outputs G4, G3); typically this function is tilting fw/rev.
FUNCTION4	is related to EVP7 and 8 (outputs G2, G1); typically this function is shifting right/left.

5 DESCRIPTION OF THE CONNECTORS

5.1 Connector CNA: ZAPI Minifit 22 poles

A1	I2	Digital Input N° 2
A2	I3	Digital Input N° 3
A3	I4	Digital Input N° 4
A4	I5	Digital Input N° 5
A5	I6	Digital Input N° 6
A6	PEV	Positive supply of digital input devices
A7	I7	Digital Input N° 7
A8	OPT I8	Digital Input N° 8
A9	GND	Negative supply
A10	CANH	CAN high signal
A11	CANT2	CAN high signal output
A12	I1	Digital Input N°1
A13	PEVS	Positive of electrovalves (safety)
A14	PEV	Positive supply of digital input devices
A15	PEV	Positive supply of digital input devices
A16	PEV	Positive supply of digital input devices
A17	PEV	Positive supply of digital input devices
A18	GND	Negative supply
A19	GND	Negative supply
A20	GND	Negative supply
A21	GND	Negative supply
A22	CANT1/CANL	CAN low signal output/CAN low signal

5.2 Connector CNB: ZAPI Minifit 6 poles

B1	CANH	CAN high signal
B2	KEY	Key input
B3	PEVS	Positive of electrovalves (safety)
B4	CANL	CAN low signal
B5	-BATT	Negative supply
B6	PAUX	Positive supply for electrovalves

5.3 Connector CNC: ZAPI Minifit 6 poles

C1	AN1	Analog input N°1
C2	GND	Negative supply

C3	GND	Negative supply
C4	AN2	Analog input N°2
C5	+12	+12V supply
C6	+12	+12V supply

5.4 Connector CND: ZAPI Minifit 4 poles

D1	GND	Encoder negative supply
D2	A	Encoder phase A input
D3	+12	Encoder positive supply
D4	B	Encoder phase B input

5.5 Connector CNE: ZAPI Minifit 8 poles

E1	PCLRXD	Serial communication interface
E2	NCLRXD	Serial communication interface
E3	PCLTXD	Serial communication interface
E4	NCLTXD	Serial communication interface
E5	GND	Negative supply
E6	+12	+12V supply
E7	BOOT	Flash memory bootstrap
E8	GND	Flash memory bootstrap

5.6 Connector CNF: ZAPI Minifit 10 poles

F1	R	Resistance
F2	NEV3	Negative of ON/OFF electrovalve N°3
F3	NEV2	Negative of ON/OFF electrovalve N°2
F4	NEV1	Negative of ON/OFF electrovalve N°1
F5	PEV	Positive of ON/OFF electrovalve N°3
F6	Z	Zero
F7	AS1	Analog select #1
F8	AS2	Analog select #2
F9	PEV	Positive of ON/OFF electrovalve N°1
F10	PEV	Positive of ON/OFF electrovalve N°2

AS1 and AS2 select the software versions when more than one Mhyrio is installed on the same truck. There are 9 possibilities:
Z..... OPEN
Z..... R
Z..... Z
OPEN..... OPEN
OPEN..... R

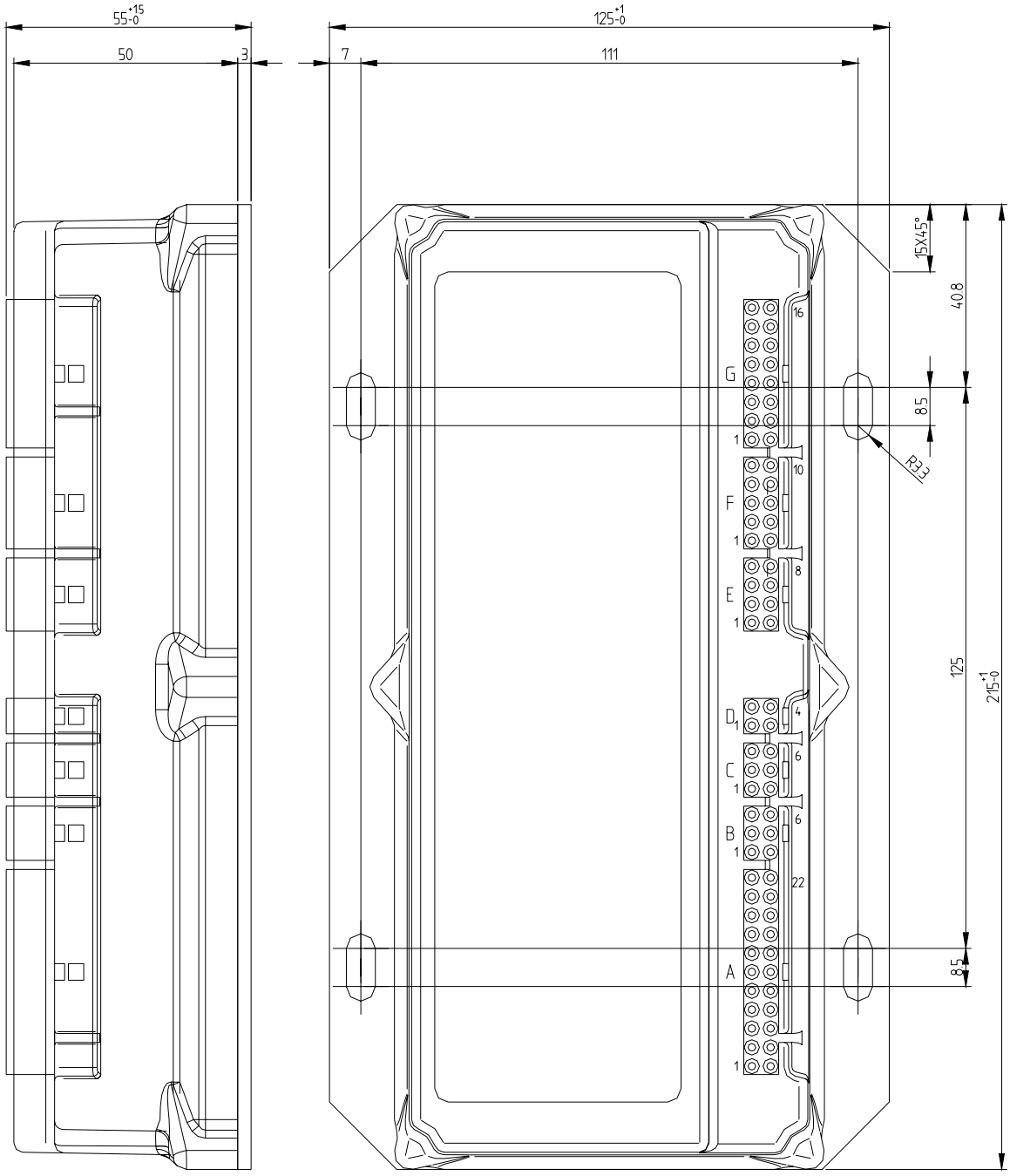
OPEN.....Z
R.....OPEN
R.....R
R.....Z

5.7 Connector CNG: ZAPI Minifit 16 poles

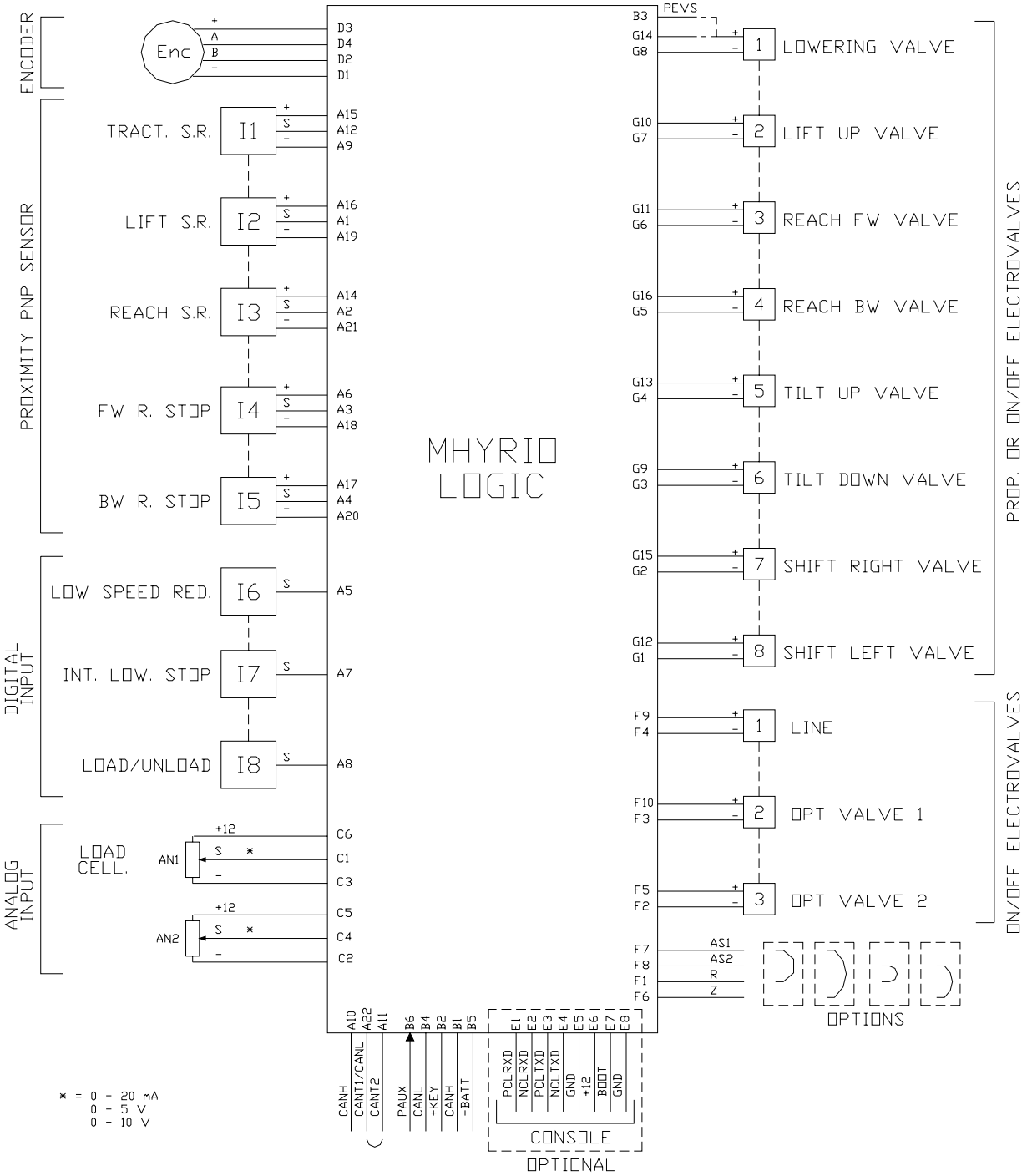
G1	NEV8	Negative of the proportional electrovalve N°8
G2	NEV7	Negative of the proportional electrovalve N°7
G3	NEV6	Negative of the proportional electrovalve N°6
G4	NEV5	Negative of the proportional electrovalve N°5
G5	NEVP4	Negative of the proportional electrovalve N°4
G6	NEVP3	Negative of the proportional electrovalve N°3
G7	NEVP2	Negative of the proportional electrovalve N°2
G8	NEVP1	Negative of the proportional electrovalve N°1
G9	PEV	Positive of the proportional electrovalve N°6
G10	PEV	Positive of the proportional electrovalve N°2
G11	PEV	Positive of the proportional electrovalve N°3
G12	PEV	Positive of the proportional electrovalve N°8
G13	PEV	Positive of the proportional electrovalve N°5
G14	PEV	Positive of the proportional electrovalve N°1
G15	PEV	Positive of the proportional electrovalve N°7
G16	PEV	Positive of the proportional electrovalve N°4

6 DRAWINGS

6.1 Mechanical drawing



6.2 Functional drawing



PAUX (B6) = SUPPLY FOR ELECTROVALVES CAN BE +BATTERIE OR 24VOLT.
PEVS (B3) = POSITIVE FOR SAFETY ELECTROVALVES USED ONLY FOR LOWERING.

CONN A = ZAPI MINIFIT CONNECTOR - 22 POLES
CONN B = ZAPI MINIFIT CONNECTOR - 6 POLES
CONN C = ZAPI MINIFIT CONNECTOR - 6 POLES
CONN D = ZAPI MINIFIT CONNECTOR - 4 POLES
CONN E = ZAPI MINIFIT CONNECTOR - 8 POLES
CONN F = ZAPI MINIFIT CONNECTOR - 10 POLES
CONN G = ZAPI MINIFIT CONNECTOR - 16 POLES

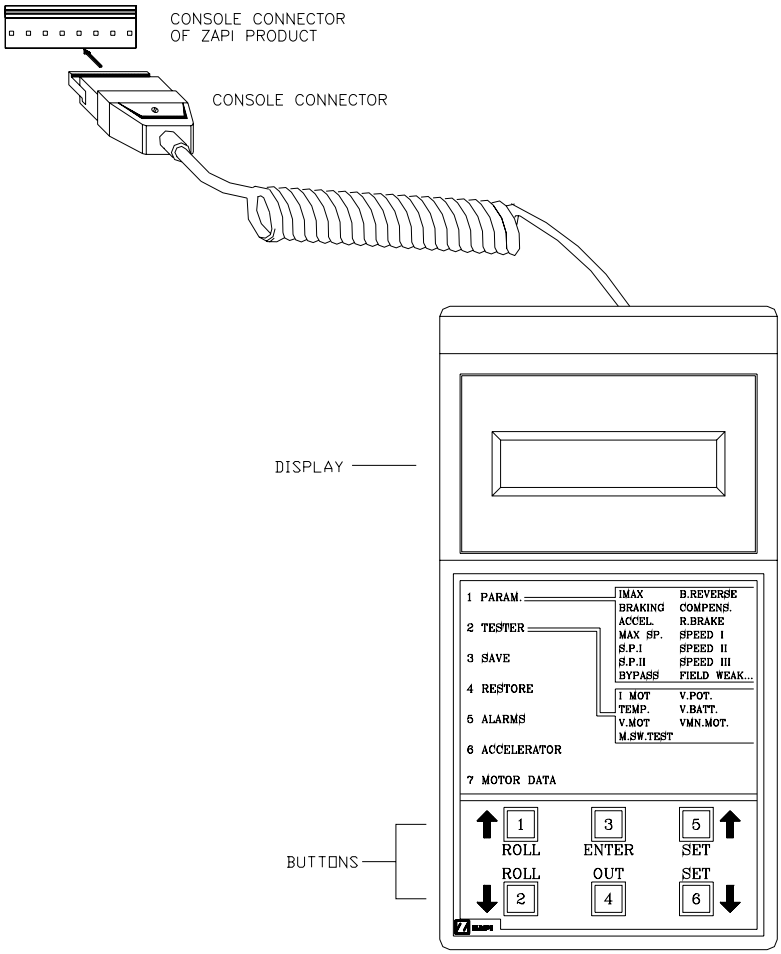
7 PROGRAMMING & ADJUSTMENTS USING DIGITAL CONSOLE

7.1 Adjustments via console

Adjustment of Parameters and changes to the controller's configuration are made using the Digital Console. Mhyrio Flash has not an external connector for console connection. The Console must be connected to the console connector of another ZAPI product that communicates with MHYRIO FLASH via CAN-BUS line.

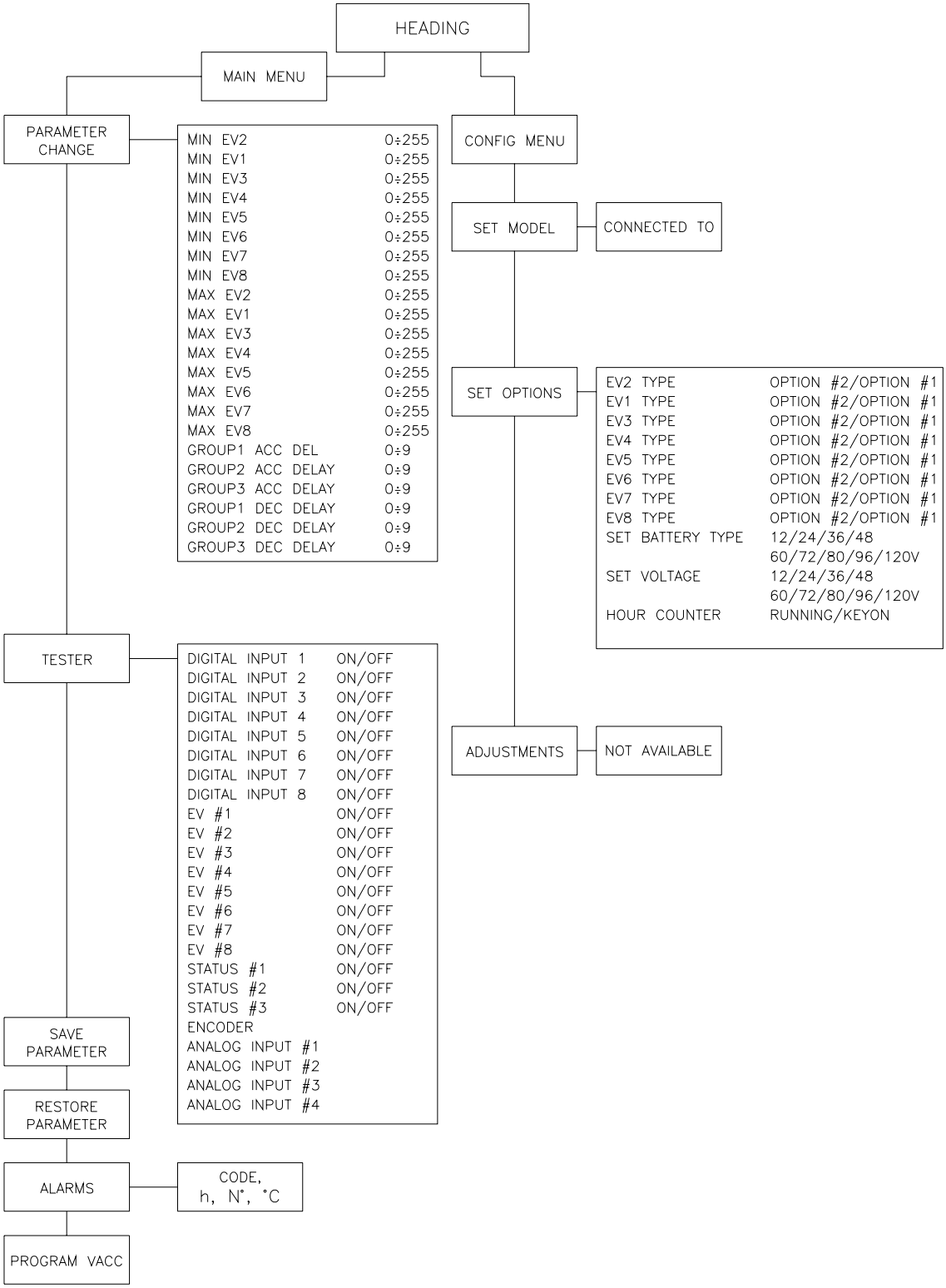
Pay attention to the polarity of the Console Connector when connecting to the controller. The bevel on the connector should be uppermost.

7.2 Description of console and connection



Digital consoles used to communicate with MHYRIO FLASH 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)

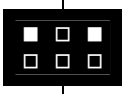
The options can be set on the “SET OPTIONS” Menu.

Function	*Option*	*Meaning*
EV2 TYPE	**OPTION #1**	It sets EV2 to ON-OFF valve type.
	OPTION #2	It sets EV2 to PROPORTIONAL valve type.
EV1 TYPE	**OPTION #1**	It sets EV1 to ON-OFF valve type.
	OPTION #2	It sets EV1 to PROPORTIONAL valve type.
EV3 TYPE	**OPTION #1**	It sets EV3 to ON-OFF valve type.
	OPTION #2	It sets EV3 to PROPORTIONAL valve type.
EV4 TYPE	**OPTION #1**	It sets EV4 to ON-OFF valve type.
	OPTION #2	It sets EV4 to PROPORTIONAL valve type.
EV5 TYPE	**OPTION #1**	It sets EV5 to ON-OFF valve type.
	OPTION #2	It sets EV5 to PROPORTIONAL valve type.
EV6 TYPE	**OPTION #1**	It sets EV6 to ON-OFF valve type.
	OPTION #2	It sets EV6 to PROPORTIONAL valve type.
EV7 TYPE	**OPTION #1**	It sets EV7 to ON-OFF valve type.
	OPTION #2	It sets EV7 to PROPORTIONAL valve type.
EV8 TYPE	**OPTION #1**	It sets EV8 to ON-OFF valve type.
	OPTION #2	It sets EV8 to PROPORTIONAL valve type.
SET Battery Type	**12/24/36/ /48/60/72/ /80/96/120V**	This parameter sets the battery nominal voltage, that is the key input voltage (MHYRIO FLASH supply)
SET Voltage	**12/24/36/ /48/60/72/ /80/96/120V**	This parameter sets the on/off valves coil nominal voltage
HOUR COUNTER	**Running**	Mhyrio Flash internal hourcounter is incremented when one function is active
	Key on	Mhyrio Flash internal hourcounter is always incremented when Mhyrio Flash is supplied

Flow chart showing how to make changes to Option Menu.

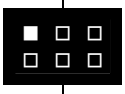
1) Opening Zapi Menu.

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



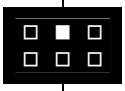
3) The Display will show: SET MODEL.

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



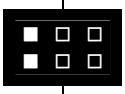
5) SET OPTIONS appears on the display.

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



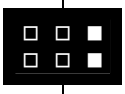
7) The display will shows the first option.

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



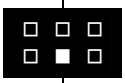
9) Desired option appears.

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.

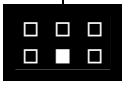


13) Confirmation request appears.

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 may be made by Zapi using standard default settings, settings to Customer Specifications, 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.
CONNECTION OF THE CONSOLE TO THE CONTROLLER MUST BE MADE WITH THE KEY SWITCH TURNED OFF.
The following Parameters can be modified:

1) **MIN EV2**
   This parameter adjusts the minimum current of valve 2, if it is set as proportional (see "set options menu").
2) **MIN EV1**
   This parameter adjusts the minimum current of valve 1, if it is set as proportional (see "set options menu").
3) **MIN EV3**
   This parameter adjusts the minimum current of valve 3, if it is set as proportional (see "set options menu").
4) **MIN EV4**
   This parameter adjusts the minimum current of valve 4, if it is set as proportional (see "set options menu").
5) **MIN EV5**
   This parameter adjusts the minimum current of valve 5, if it is set as proportional (see "set options menu").
6) **MIN EV6**
   This parameter adjusts the minimum current of valve 6, if it is set as proportional (see "set options menu").
7) **MIN EV7**
   This parameter adjusts the minimum current of valve 7, if it is set as proportional (see "set options menu").
8) **MIN EV8**
   This parameter adjusts the minimum current of valve 8, if it is set as proportional (see "set options menu").
9) **MAX EV2**
   This parameter adjusts the maximum current of valve 2, if it is set as proportional (see "set options menu").
10) **MAX EV1**
    This parameter adjusts the maximum current of valve 1, if it is set as proportional (see "set options menu").
11) **MAX EV3**
    This parameter adjusts the maximum current of valve 3, if it is set as proportional (see "set options menu").
12) **MAX EV4**
    This parameter adjust the maximum current of valve 4, if it is set as proportional (see "set options menu").
13) **MAX EV5**
    This parameter adjusts the maximum current of valve 5, if it is set as proportional (see "set options menu").

14) **MAX EV6**
This parameter adjusts the maximum current of valve 6, if it is set as proportional (see "set options menu").

15) **MAX EV7**
This parameter adjusts the maximum current of valve 7, if it is set as proportional (see "set options menu").

16) **MAX EV8**
This parameter adjusts the maximum current of valve 8, if it is set as proportional (see "set options menu").

17) **GROUP1 ACC DELAY**
Lift/lowering valves current acceleration delay: this parameter sets the valve 1 and 2 current ramp, to change from 0 A to operating current.

18) **GROUP2 ACC DELAY**
Group 2 valves current acceleration delay: this parameter sets the valve 3 and 4 (group 2) current ramp, to change from 0 A to operating current.

19) **GROUP3 ACC DELAY**
Group 3 and 4 valves current acceleration delay: this parameter sets the valve 5 and 6 (group 3), 7 and 8 (group 4) current ramp, to change from 0 A to operating current.

20) **GROUP1 DEC DELAY**
Lift/lowering valves current deceleration delay: this parameter sets the valve 1 and 2 closing ramp, to change the coil current from operating current to 0 A.

21) **GROUP2 DEC DELAY**
Group 2 valves current deceleration delay: this parameter sets the valve 3 and 4 (group 2) closing ramp, to change the coil current from operating current to 0 A.

22) **GROUP3 DEC DELAY**
Group 3 and 4 valves current deceleration delay: this parameter sets the valve 5 and 6 (group 3), 7 and 8 (group 4) closing ramp, to change the coil current from operating current to 0 A.

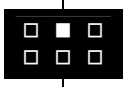
7.6 Adjustments table

PARAMETERS		PROGRAMMED LEVEL									
	UNIT	0	1	2	3	4	5	6	7	8	9
GROUP1 ACC DELAY	sec.	0.5	0.7	0.9	1.1	1.4	1.6	1.8	2.0	2.3	2.5
GROUP2 ACC DELAY	sec.	0.25	0.35	0.45	0.55	0.70	0.80	0.90	1.00	1.15	1.25
GROUP3 ACC DELAY	sec.	0.25	0.35	0.45	0.55	0.70	0.80	0.90	1.00	1.15	1.25
GROUP1 DEC DELAY	sec.	0.5	0.7	0.9	1.1	1.4	1.6	1.8	2.0	2.3	2.5
GROUP2 DEC DELAY	sec.	0.25	0.35	0.45	0.55	0.70	0.80	0.90	1.00	1.15	1.25
GROUP3 DEC DELAY	sec.	0.25	0.35	0.45	0.55	0.70	0.80	0.90	1.00	1.15	1.25

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

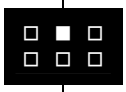
1) Opening Zapi Menu.

2) Press ENTER to go into the GENERAL MENU.



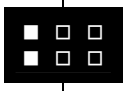
3) The Display will show: PARAMETER CHANGE.

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



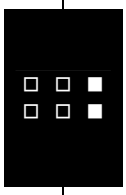
5) The Display will show the first parameter.

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



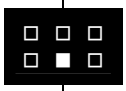
7) The names of the Parameters appear on the Display.

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 Description of the tester function

The most important input or output signals can be measured in real time using the TESTER function of the console. The Console acts as a multimeter able to read voltage, current and temperature. The following listing shows the measurements that may be made:

1) DIGITAL INPUT 1
It indicates the state of the digital input 1 (CNA12). Options:
- ON = active entry of closed switch (equal to battery positive potential)
- OFF = inactive entry of open switch (equal to GND potential)

2) DIGITAL INPUT 2
It indicates the state of the digital input 2 (CNA1). Options:
- ON = active entry of closed switch (equal to battery positive potential)
- OFF = inactive entry of open switch (equal to GND potential)

3) DIGITAL INPUT 3
It indicates the state of the digital input 3 (CNA2). Options:
- ON = active entry of closed switch (equal to battery positive potential)
- OFF = inactive entry of open switch (equal to GND potential)

4) DIGITAL INPUT 4
It indicates the state of the digital input 4 (CNA3). Options:
- ON = active entry of closed switch (equal to battery positive potential)
- OFF = inactive entry of open switch (equal to GND potential)

5) DIGITAL INPUT 5
It indicates the state of the digital input 5 (CNA4). Options:
- ON = active entry of closed switch (equal to battery positive potential)
- OFF = inactive entry of open switch (equal to GND potential)

6) DIGITAL INPUT 6
It indicates the state of the digital input 6 (CNA5). Options:
- ON = active entry of closed switch (equal to battery positive potential)
- OFF = inactive entry of open switch (equal to GND potential)

7) DIGITAL INPUT 7
It indicates the state of the digital input 7 (CNA7). Options:
- ON = active entry of closed switch (equal to battery positive potential)
- OFF = inactive entry of open switch (equal to GND potential)

8) DIGITAL INPUT 8
It indicates the state of the digital input 8 (CNA8). Options:
- ON = active entry of closed switch (equal to battery positive potential)
- OFF = inactive entry of open switch (equal to GND potential)

9) EV #1
It indicates the state of the electrovalve 1 (CNG8). Options:
- ON = active entry of closed switch (equal to battery positive potential)
- OFF = inactive entry of open switch (equal to GND potential)

10) EV #2
It indicates the state of the electrovalve 2 (CNG7). Options:
- ON = active entry of closed switch (equal to battery positive potential)
- OFF = inactive entry of open switch (equal to GND potential)

11) EV #3
It indicates the state of the electrovalve 3 (CNG6). Options:
- ON = active entry of closed switch (equal to battery positive potential)
- OFF = inactive entry of open switch (equal to GND potential)

12) EV #4

It indicates the state of the electrovalve 4 (CNG5). Options:

- ON = active entry of closed switch (equal to battery positive potential)
- OFF = inactive entry of open switch (equal to GND potential)

13) EV #5

It indicates the state of the electrovalve 5 (CNG4). Options:

- ON = active entry of closed switch (equal to battery positive potential)
- OFF = inactive entry of open switch (equal to GND potential)

14) EV #6

It indicates the state of the electrovalve 6 (CNG3). Options:

- ON = active entry of closed switch (equal to battery positive potential)
- OFF = inactive entry of open switch (equal to GND potential)

15) EV #7

It indicates the state of the electrovalve 7 (CNG2). Options:

- ON = active entry of closed switch (equal to battery positive potential)
- OFF = inactive entry of open switch (equal to GND potential)

16) EV #8

It indicates the state of the electrovalve 8 (CNG1). Options:

- ON = active entry of closed switch (equal to battery positive potential)
- OFF = inactive entry of open switch (equal to GND potential)

17) STATUS #1

It indicates the state of the STATUS1 electrovalve (CNF4). Options:

- ON = active entry of closed switch (equal to battery positive potential)
- OFF = inactive entry of open switch (equal to GND potential)

18) STATUS #2

It indicates the state of the STATUS2 electrovalve (CNF3). Options:

- ON = active entry of closed switch (equal to battery positive potential)
- OFF = inactive entry of open switch (equal to GND potential)

19) STATUS #3

It indicates the state of the STATUS3 electrovalve (CNF2). Options:

- ON = active entry of closed switch (equal to battery positive potential)
- OFF = inactive entry of open switch (equal to GND potential)

20) ENCODER

It indicates the digital count of encoder. This value will be acquired by SICOS. In this menu, it's present only for functionality check of encoder.

21) ANALOG INPUT #1

It indicates the voltage relative to analog input 1. The value is between 0 and 255. Every step corresponds to 1/256 of maximum voltage.

22) ANALOG INPUT #2

It indicates the voltage relative to analog input 2. The value is between 0 and 255. Every step corresponds to 1/256 of maximum voltage.

23) ANALOG INPUT #3

It indicates the state of the AS1 analog select (CNF7).

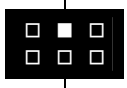
24) ANALOG INPUT #4

It indicates the state of the AS2 analog select (CNF8).

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

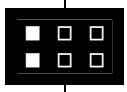
1) Opening Zapi Menu.

2) Press ENTER to go into the GENERAL MENU.



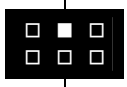
3) The Display will show: PARAMETER CHANGE.

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



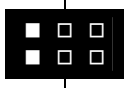
5) The Display shows: TESTER.

6) Press ENTER to go into the TESTER function.



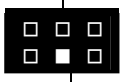
7) The first variable to be tested is shown on the Display.

8) Press either ROLL UP or ROLL DOWN buttons.



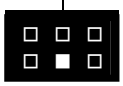
9) Next variable for measurement appears.

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.

7.8 Description of the console save function

The SAVE PARAM. function is allowed in the MHYRIO FLASH 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.

7.9 Description of the console restore function

The RESTORE PARAM function is allowed in MHYRIO FLASH 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 FLASH controller will not work correctly.

7.10 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 allows completely control of every ZAPI product without changing the position of the Console connector. This is the only way to connect ZAPI Console to Mhyrio Flash controller because the Console connector is not present in Mhyrio Flash controller.

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.

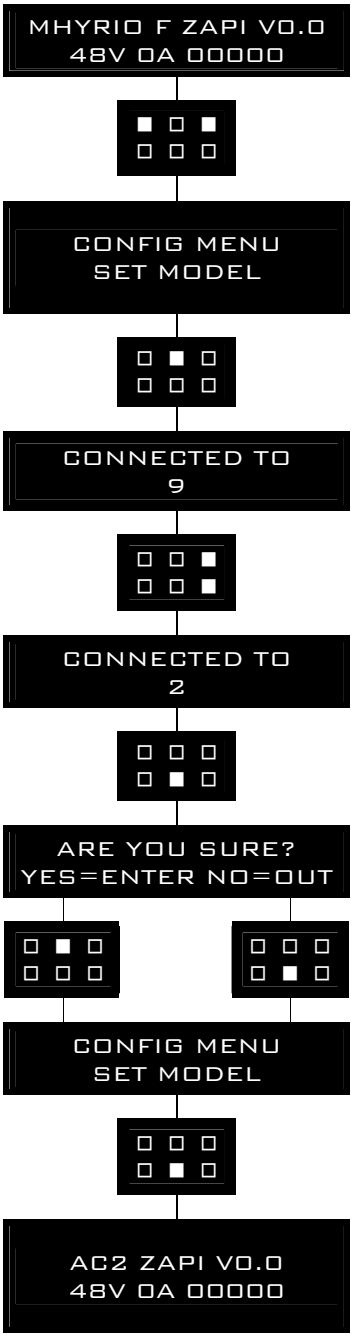
9) Confirmation request appears.

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 product to Console.

PARAMETER	CONNECTED PRODUCT
1	SICOS
2	TRACTION CONTROLLER
5	PUMP CONTROLLER
6	EPS
9	MHYRIO FLASH

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 Opening ZAPI Menu.

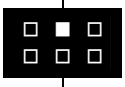
7.11 Description of alarms menu

The microprocessor in the controller remembers 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.

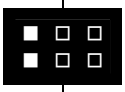
1) Opening Zapi Display.

2) Press ENTER to go into the General menu.



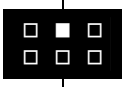
3) The Display will show:

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



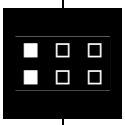
5) The Display will show:

6) Press ENTER to go into the ALARMS function.



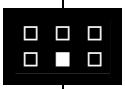
7) The Display will show the most recent Alarm.

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



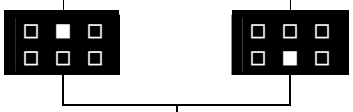
9) If an Alarm has not occurred, the Display will show: ALARM NULL.

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

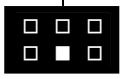


11) The Display will ask: “CLEAR LOGBOOK?”.

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 inhibits machine operation. If the fault continues 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 FLASH controller does not receive any message from the SICOS 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) **SHUNT VALVES**
   There is a short across the valve coil. Replace the hardware.
4) **DRIVER OPENED**
   The high side switch that drives positive to valves (used for safety related valves) is opened when it should be closed.
5) **DRIVER EVP GR1**
   One of the MOS (or more than one) that drives the valves 1, 2 is shorted.
6) **DRIVER EVP GR2**
   One of the MOS (or more than one) that drives the valves 3, 4 is shorted.
7) **DRIVER EVP GR3**
   One of the MOS (or more than one) that drives the valves 5, 6, 7, 8 is shorted.
8) **DRIVER SHORTED**
   The high side switch that drives positive to valves (used for safety related valves) is closed when it should be opened.

9 RECOMMENDED SPARE PARTS FOR CONTROLLER

Part Number	Description
C12358	Minifit Connector 4 pins Female
C12359	Minifit Connector 6 pins Female
C12414	Minifit Connector 8 pins Female
C12500	Minifit Connector 10 pins Female
C12404	Minifit Connector 16 pins Female
C12499	Minifit Connector 22 pins Female
C12777	Female Minifit 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.