MAV4211 and MAV1152
Set up and configuration

This manual is NOT for the end user - It is for the machine builder only
It is compulsory to read the present manual and its addendums, if provided, before system installation

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Set up and configuration

1 How to identify your own board

The following photo shows how to find the board identification label and an example of an identification label on the board

- **Board code**: this code identify the hardware and firmware type of the board
- **Serial number**: this code identify the single and unique board and firmware version

Fig. 1.1: Identification label on the board   Fig. 1.2: MAV4211 and MAV1152 sample labels
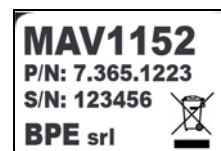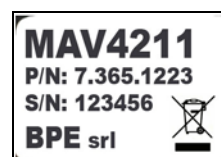
2 Operating logic

The MAV4211 electronic board is used to directly drive until four PWM solenoid valves.

The MAV1152 electronic board is used to directly drive until five ON/OFF and one PWM solenoid valves.

For more technical details see chapter "Technical data".

3 Technical data

3.1 MAV4211

BPE Electronics reserves the right to modify the technical data anytime, without advise
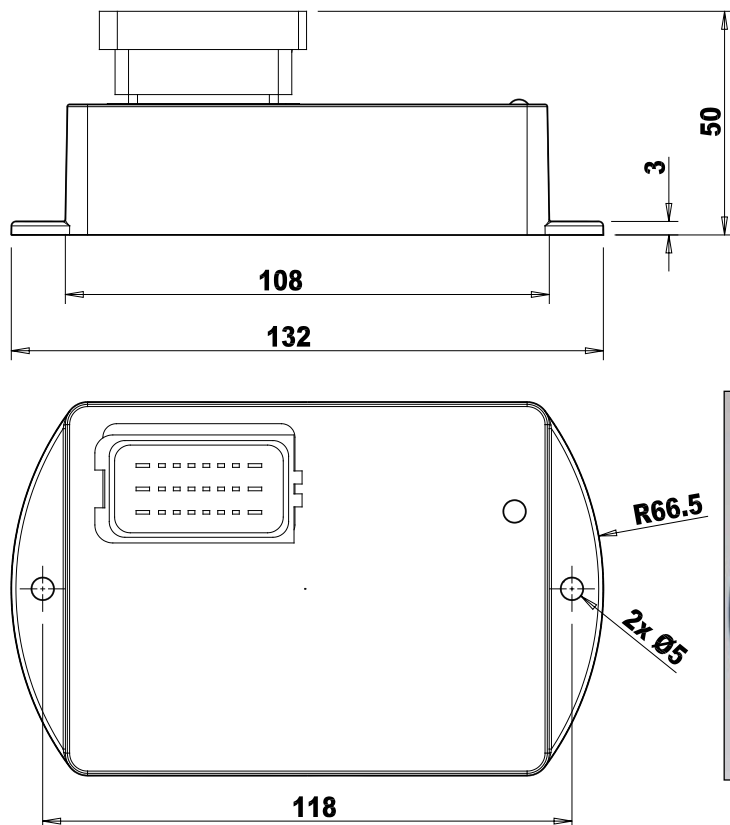
Fig.3.1.1: MAV4211 board dimensions
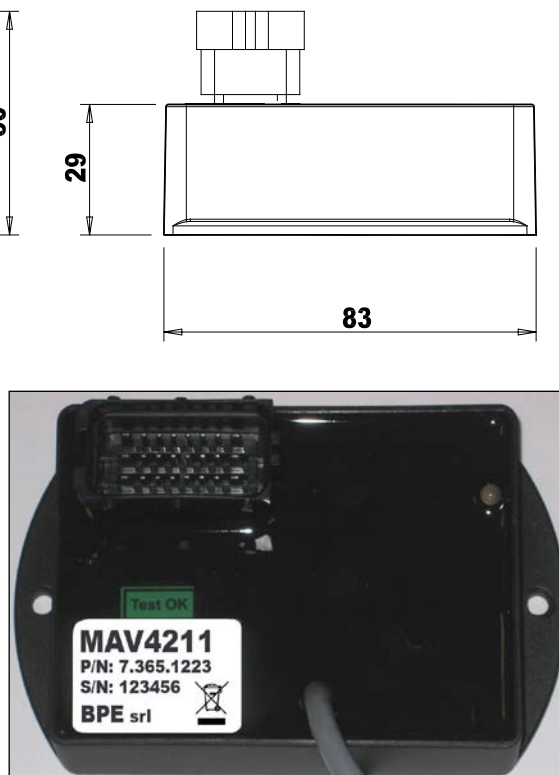
Fig.3.1.2: MAV4211 board photo

Power supply	9 to 33 Vdc	Protected against polarity reversal
Analog inputs for joystick	four 0 to 5 Vdc or four 0 to10 Vdc or four 4 to 20 mA	Protected against short circuits and operator errors
Digital inputs	3 (only one if CAN connection is used)	Configurable on request
ON/OFF digital outputs	-	-
Proportional PWM outputs	4x2	Positive. Programmable from 70 to 250 Hz. Imax = 2 A. Protected against short circuits
Digital outputs	1	Positive. Imax = 3 A. Protected against short circuits [♦]
CAN connection	Yes	Instead of two digital inputs
Calibration/diagnostic	RS-232 serial port	-
Operating temperature	-40 to +70 °C	-
Standard protection grade	IP 67	-
Electrical connection	FCI SICMA2 24 ways	-
EMC: Immunity | Emission	EN 61000-6-2 | EN61000-6-3	-

[♦] Available and programmable on request with CAT3 *(EN 954-1)* or PLd *(EN 13849-1).*

3.2   MAV1152

BPE Electronics reserves the right to modify the technical data anytime, without advise
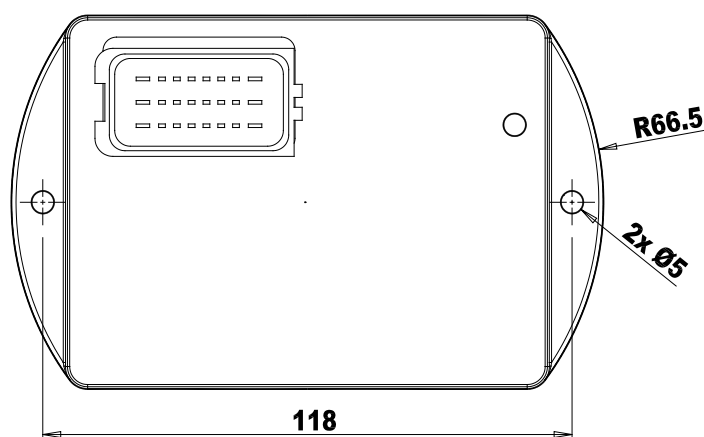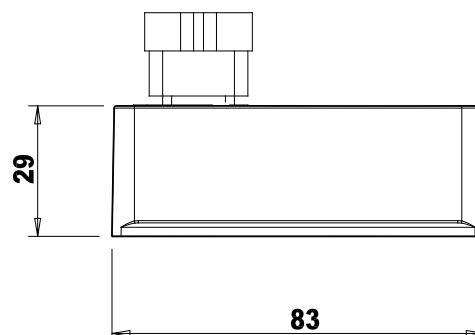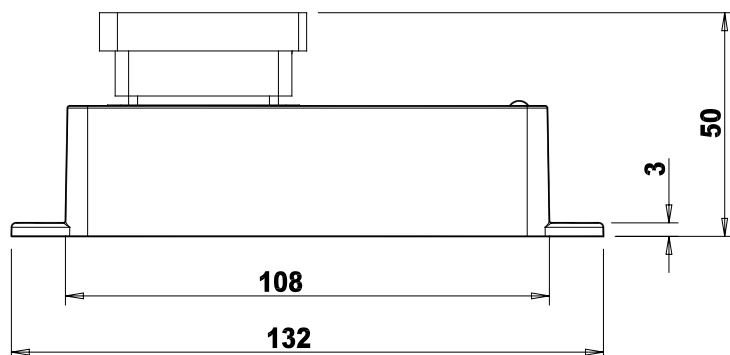
Fig.3.2.1: MAV1152 board dimensions

Fig.3.2.2: MAV1152 board photo

Power supply	9 to 33 Vdc	Protected against polarity reversal
Analog inputs for joystick	five 0 to 5 Vdc or five 0 to10 Vdc or five 4 to 20 mA	Protected against short circuits and operator errors
Digital inputs	3 (1, if CAN connection is used)	Configurable on request
ON/OFF digital outputs	5x2	Positive. Imax = 3 A. Protected against short circuits
Proportional PWM outputs	1	Positive. Programmable from 70 to 250 Hz. Imax = 2 A. Protected against short circuits
Digital outputs	1	Positive. Imax = 3 A. Protected against short circuits [♦]
CAN connection	Yes	Instead of two digital inputs
Calibration/diagnostic	RS-232	-
Operating temperature	-40 to +70 °C	-
Standard protection grade	IP 67	-
Electrical connection	FCI SICMA2 24 poles	-
EMC conformity	EN 61000-6-2, EN61000-6-3	Heavy industrial

[♦] Available and programmable on request with CAT3 *(EN 954-1)* or PLd *(EN 13849-1).*

4 Safety

4.1 Electrical safety circuits and system checks

The board is protected against:

- polarity reversal on power supply
- short circuit on the outputs
- analogue inputs range control (disabled)

See chapter "Electrical connections" for more details.

4.2 Immunity

The system meets the following specifications:

EN 61000-6-2   EN 61000-6-3

The system is comply with category B (EN 954-1) and PL b (EN13849-1).

5 The BPEterminal

The BPETerminal is the software made by BPE to work with its boards. With the help of the BPETerminal it is possible to set up the MAV electronic board currents, ramps, frequencies, analogue inputs, operation mode, operative parameters etc.

See BPETerminal manuals for its system requirements.

6 Electrical connections and board map

To give the power supply to the MAV electronic board, connect it directly to the battery.

6.1 Board map
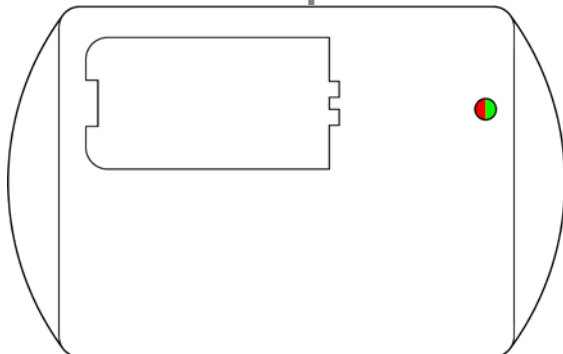
Fig. 6.1.1: MAV electronic board and green/red bi-colour LED

6.2 Setup

Cables choice

Cabling has to be realized so as to warrant a correct wiring insulation of all parts accessible from operator (insulation resistance > 1 GΩ x cm). Installation has to be made without wires having radius of curvature too small and without machine moving cause crushes or tractions. The cables properties must be function of the custom application.

Minimum suggested characteristics

24 poles connector external 2.8 mm terminals (A1 and A8, B1 and B8, C1 and C8)	1,5 mm^2
24 poles connector internal 1.5 mm terminals (A2 to A7, B2 to B7, C2 to C7)	1 mm^2
Serial port communication:	standard RS-232

Excepting special cases, the above cables are not furnished by BPE Electronics

6.3 Electrical wiring harness

The MAV electronic board counterpart connector is <u>not</u> supplied by default. Part numbers to order it are shown in the following tables.

FCI Sicma connector counterpart part numbers

FCI Sicma part number	No. of pieces	Description
211 PC249S0005	1	FCI Sicma black connector female housing 24 ways
211 CC292160	18	Female terminals 1.5 mm
211 CC392120	6	Female terminals 2.8 mm
211 A247001	1	Locking cam for 24 ways female housing
210 A015019	20	Filler plug

Salvarani optional rubber cap for FCI Sicma connectors

Salvarani part number	No. of pieces	Description
406243.03	1	Rubber cap

Schlemmer optional rigid plastic cap for FCI Sicma connectors

Schlemmer part number	No. of pieces	Description
7807795	1	Rigid plastic cap

The Schlemmer will replace the Salvarani.

BPE Electronic full counterpart connector for MAV boards

BPE Electronis part number	No. of pieces	Description
7.003.054	1	211 PC249S0005 - FCI Sicma black connector female housing 24 ways
	1	211 A247001 - Locking cam for 24 ways female housing
	18	211 CC292160 - Female terminals 1.5 mm
	6	211 CC392120 - Female terminals 2.8 mm
	20	210 A015019 - Filler plug
	1	406243.03 - Rubber cap

6.4 MAV4211 on board 24 ways FCI SICMA connector

A
B
C
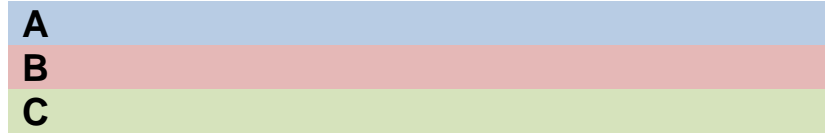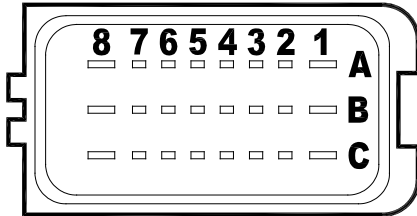
Fig. 6.4.1: Board mounted FCI Sicma 24 ways connector layout

⚠️ Joystick negative power supply input MUST be DIRECTLY connected to C1 using the shortest possible connection

6.4.1 Operating mode "4211"

ℹ️ For operating mode "4211" only!

[*] See "Operating Modes Selection" chapter

Pole	Meaning	Notes
A1	**Positive power supply**	The contact must be directly connected to the positive power supply [1]
C1	**Negative power supply (also joystick negative)**	The contact must be directly connected to the negative power supply. Joystick negative MUST be <u>directly connected to C1</u> with shortest possible connection between joystick and MAV4211 board
C7	**Positive power supply for joysticks**	Power supply for potentiometric joystick. +5 V_{DC} only [2]
B4	**Analogue input for channel No. 1**	Bi-directional joystick No. 1
C4	**Analogue input for channel No. 2**	Bi-directional joystick No. 2
B3	**Analogue input for channel No. 3**	Bi-directional joystick No. 3
C3	**Analogue input for channel No. 4**	Bi-directional joystick No. 4
C6	**PWM output for channel "No. 1, side A"**	Maximum current 2 A [3]
B8	**PWM output for channel "No. 1, side B"**	Maximum current 2 A [3]
C8	**PWM output for channel "No. 2, side A"**	Maximum current 2 A [3]
A5	**PWM output for channel "No. 2, side B"**	Maximum current 2 A [3]
B1	**PWM output for channel "No. 3, side A"**	Maximum current 2 A [3]
B2	**PWM output for channel "No. 3, side B"**	Maximum current 2 A [3]
A2	**PWM output for channel "No. 4, side A"**	Maximum current 2 A [3]
A3	**PWM output for channel "No. 4, side B"**	Maximum current 2 A [3]
A6	PWM negative for channel No. 1	For solenoid valve connected to channel No. 1
B6	PWM negative for channel No. 2	For solenoid valve connected to channel No. 2
B7	PWM negative for channel No. 3	For solenoid valve connected to channel No. 3
A7	PWM negative for channel No. 4	For solenoid valve connected to channel No. 4
B5	**Start-up safety control input**	See chapter "*Movement clearance activation mode*" for more details
A8	**Output for hydraulic power pre-selection**	Maximum current 3 A [3]
A4	•	Available for custom functions on request
C2	•	Available for custom functions on request
C5	•	Not used

[1] It is compulsory to use an external 15 A fast fuse

[2] MAV4211 can give +5 V_{DC} only. If you need 10, 12, 24 V_{DC} or other values you must use a battery or an external power supply. I_{MAX}=50 mA protected against short circuits

[3] Protected against short circuits

6.4.2 Operating mode "1142"

For operating mode "1142" only!

(*) See "Operating Modes Selection" chapter

Pole	Meaning	Notes
A1	**Positive power supply**	The contact must be directly connected to the positive power supply [1]
C1	**Negative power supply (also joystick negative)**	The contact must be directly connected to the negative power supply. Joystick negative MUST be directly connected to C1 with shortest possible connection between joystick and MAV4211 (1142) board
C7	**Positive power supply for joysticks**	Power supply for potentiometric joystick. +5 V_{DC} only [2]
B4	**Analogue input for channel No. 1**	Bi-directional joystick No. 1
C4	**Analogue input for channel No. 2**	Bi-directional joystick No. 2
B3	**Analogue input for channel No. 3**	Bi-directional joystick No. 3
C3	**Analogue input for channel No. 4**	Bi-directional joystick No. 4
C6	**ON/OFF output for channel "No. 1, side A"**	Maximum current 2 A [3]
B8	**ON/OFF output for channel "No. 1, side B"**	Maximum current 2 A [3]
C8	**ON/OFF output for channel "No. 2, side A"**	Maximum current 2 A [3]
A5	**ON/OFF output for channel "No. 2, side B"**	Maximum current 2 A [3]
B1	**ON/OFF output for channel "No. 3, side A"**	Maximum current 2 A [3]
B2	**ON/OFF output for channel "No. 3, side B"**	Maximum current 2 A [3]
A2	**ON/OFF output for channel "No. 4, side A"**	Maximum current 2 A [3]
A3	**PWM output**	Maximum current 2 A [3]
A6	●	Not used
B6	●	Not used
B7	●	Not used
A7	PWM negative	For PWM solenoid valve
B5	**Start-up safety control input**	See chapter "*Movement clearance activation mode*" for more details
A8	**Output for hydraulic power pre-selection**	Maximum current 3 A [3]
A4	●	Available for custom functions on request
C2	●	Available for custom functions on request
C5	**ON/OFF output for channel "No. 4, side B"**	Maximum current 2 A [3]

[1] It is compulsory to use an external 15 A fast fuse

[2] MAV4211 can give **+5** V_{DC} only. If you need 10, 12, 24 V_{DC} or other values you must use a battery or an external power supply. I_{MAX}=50 mA protected against short circuits

[3] Protected against short circuits

MAV4211 and MAV1152
Set up and configuration

6.5 MAV1152 on board 24 ways FCI SICMA connector

	A
	B
	C
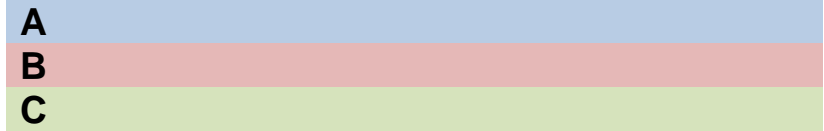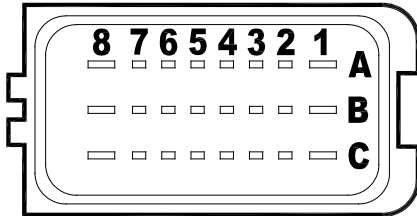
Fig. 6.5.1: Board mounted FCI Sicma 24 ways connector layout

Pole	Meaning	Notes
A1	**Positive power supply**	The contact must be directly connected to the positive power supply [1]
C1	**Negative power supply**	The contact must be directly connected to the negative power supply
B6	**Positive power supply for joysticks**	Positive power supply for potentiometric joystick. +5 V_{DC} only [2]
B7	**Negative power supply for joystick**	Negative power supply for potentiometric joystick. +0 V_{DC}
B4	**Analogue input for channel No. 1**	Bi-directional joystick No. 1
B5	**Analogue input for channel No. 2**	Bi-directional joystick No. 2
C3	**Analogue input for channel No. 3**	Bi-directional joystick No. 3
C6	**Analogue input for channel No. 4**	Bi-directional joystick No. 4
C7	**Analogue input for channel No. 5**	Bi-directional joystick No. 5
A8	**ON/OFF output for channel "No. 1, side A"**	Maximum current 3 A [3]
B1	**ON/OFF output for channel "No. 1, side B"**	Maximum current 3 A [3]
A6	**ON/OFF output for channel "No. 2, side A"**	Maximum current 3 A [3]
B8	**ON/OFF output for channel "No. 2, side B"**	Maximum current 3 A [3]
C8	**ON/OFF output for channel "No. 3, side A"**	Maximum current 3 A [3]
A5	**ON/OFF output for channel "No. 3, side B"**	Maximum current 3 A [3]
C5	**ON/OFF output for channel "No. 4, side A"**	Maximum current 3 A [3]
C4	**ON/OFF output for channel "No. 4, side B"**	Maximum current 3 A [3]
A2	**ON/OFF output for channel "No. 5, side A"**	Maximum current 3 A [3]
A3	**ON/OFF output for channel "No. 5, side B"**	Maximum current 3 A [3]
B2	**PWM output**	Maximum current 2 A [3]
A4	**Negative power supply for PWM output**	Negative power supply for PWM solenoid valve
A7	**Output for hydraulic power pre-selection**	Maximum current 3 A [3]
C2	**Start-up safety control input**	See chapter "*Movement clearance activation mode*" for more details
B3	●	Available for custom functions on request

[1] It is compulsory to use an external 15 A fast fuse

[2] MAV4211 can give **+5** V_{DC} only. If you need 10, 12, 24 V_{DC} or other values you must use a battery or an external power supply. I_{MAX}=50 mA protected against short circuits

[3] Protected against short circuits

7 MAV configuration

After every parameters modification it is compulsory to power off and power on the MAV board[*]

[*] Before power off the board, save the MAV configuration and send it to the electronic board

7.1   Operating modes selection

7.1.1 Outputs selection

The MAV operating modes are the following:

Mode	Board	Operating Mode	Meaning
4x2 PWM	MAV4211	"4211"	To use the board to drive four PWM solenoid valves
4x2 ON/OFF	MAV4211	"1142"	To use the board to drive four ON/OFF and one PWM solenoid valves
5x2 ON/OFF	MAV1152	"1152"	To use the board to drive five ON/OFF and one PWM solenoid valves

- **MAV4211 and MAV1152 are two different hardware versions**
- **MAV1152 cannot operate as 4x2 or 5x2 PWM**
- **MAV1152 has only one operating mode: 5x2 ON/OFF**

Operating mode "1142" has different electrical wiring harness than standard "4211" operating mode!

7.1.2 Simultaneous allowed movements

For the 4x2 and 5x2 ON/OFF output versions only it is possible to select how many movements can be activated at the same time. Minimum value is one movement, maximum value is four movements (five for MAV1152).

7.1.3 Movements activation management

It is possible to choose how to manage the activation of simultaneous movements.

Condition	Choice n. 1	Choice n. 2
When is activated another movement	Put all outputs to zero and start to follow the lower input	Start to follow the lower input
If too many movements are activated at the same time	Ignore the latest movements in excess	Put all outputs to zero

For example: when another movement is activated it is possible to choose to put all outputs to zero and start to follow the lower input or to choose to instantly start to follow the lower input.

7.2 Movement clearance activation mode
7.2.1 Movement clearance activation mode configuration

The MAV board has a movement clearance activation safety control that must be correctly set up before starting to use the board

The MAV board has a movement safety control that must be correctly set up before starting to use the board. It is a mix of hardware (electrical wiring harness) and software (parameters configuration).
The two possible configurations are:

- «Enable input» operating mode
- «Person present input» operating mode

7.2.1.1 «Enable input» configuration mode

The «enable input» configuration mode needs the use of *Movement safety control input* (B5 for MAV4211, C2 for MAV1152). The *Movement safety control input* works as follow:

MAV4211
- B5 connected to A1 (positive power supply): **joysticks are <u>enabled</u>**
- B5 <u>not</u> connected to A1 (positive power supply): **joysticks are <u>disabled</u>**

MAV1152
- C2 connected to A1 (positive power supply): **joysticks are <u>enabled</u>**
- C2 <u>not</u> connected to A1 (positive power supply): **joysticks are <u>disabled</u>**

The MAV has one hydraulic pre-selection output that automatically goes on when at least one joystick is activated (and movements are enabled – B5/C2 connected to A1) and that goes off when all the joysticks signals are gone to zero. The hydraulic pre-selection deactivation delay is user configurable.

7.2.1.1.1 Joystick Centre position check

During the MAV power on the joysticks position is checked and if it is different from Centre position (and movements are enabled – B5/C2 connected to A1), the MAV will go in error condition. The Centre position check duration is user configurable for each section.
It is available an error auto reset option to automatically reset the error condition after the joysticks are put in Centre position for a time equal or greater than a defined time. Otherwise the only way to exit alarm condition is to power off the MAV board.

7.2.1.2   « Person present input» configuration mode

The «person present input» configuration mode needs the use of *Movements safety control input* (B5 for MAV4211, C2 for MAV1152). The *Movements safety control input* works as follow:

MAV4211

- B5 connected to A1 (positive power supply) and all joysticks already in Centre position: **joysticks are enabled**
- B5 connected to A1 (positive power supply) and at least one joystick already outside Centre position: **joysticks are <u>disabled</u>**
- B5 **<u>not</u>** connected to A1 (positive power supply): **joysticks are <u>disabled</u>**

MAV1152

- C2 connected to A1 (positive power supply) and all joysticks already in Centre position: **joysticks are enabled**
- C2 connected to A1 (positive power supply) and at least one joystick already outside Centre position: **joysticks are <u>disabled</u>**
- C2 **<u>not</u>** connected to A1 (positive power supply): **joysticks are <u>disabled</u>**

The MAV has one hydraulic pre-selection output that automatically goes on when B5/C2 input is activated (with all input signals already at Centre position) and that goes off when B5/C2 input goes to zero. *The hydraulic pre-selection deactivation delay is always equal to zero for this operating mode*.

If, at the MAV power on, B5/C2 is connected to A1 during the person present check time the MAV will go in alarm condition. The only way to exit alarm condition is to power off the MAV board.
The person present check time is user configurable.

7.3   Input configuration

7.3.1 Input signal type

The MAV can operate with some types of analogue inputs: from 0 to 5 V_{DC}, from 0 to 10 V_{DC} and from 4 to 20 mA. *It is possible to select only one input type at time*. This is the input full range, with another selection it is possible to activate the range control (for example from 10% to 90%).

7.3.2 Enabled sections

Every section can be enabled or disabled. If it is disabled its output does not work. By default all section are enabled.

7.3.3 Input signal range control

Every section can have an input signal range control. It can be enabled or disabled. If it is enabled it is possible to set the range from 0 to 100%. Every section can have its own range. It is possible to lock all range to the same value.

Be careful!!!
With <u>disabled</u> input signal range control you lose any control on outputs: they can be enabled also in the wrong conditions!!!

MAV4211_MAV1152_e   Ver.2.06 r.1.00 - 13/03/2013   13/18
BPE S.r.l. – Novellara (RE) - Italy
☎ ++39 0522 662357/654175   📠 ++39 0522 653740   ✉ bpecom@bpe.it   🖥 www.bpe.it

7.3.4 Signal range thresholds

These are the minimum and maximum thresholds to set the input signal valid work range. Normally they are set to 10% and 90%, that means from 0.5 to 4.5 V_{DC} if the input reference is +5 V_{DC}.

7.3.5 Person present/Enable check time

It is the period during which the person present input signal must be equal to zero.

7.3.6 Input signal «dead band»

It is possible to set a "dead band" for the input signal around centre position. When the input signal is inside the «dead band» it is ignored.

A dead band equal to 200 for a 0 to 5 V_{DC} centred at 2.5 V_{DC} means 2.5±0.50 V_{DC}

Standard range is [50…200] (it means ±2.5% to ±10%). Other value may be possible but must be discussed with BPE Electronics.

> ⚠️ After every «dead band» modification it is compulsory to store again the input maximum value

7.4 Outputs configuration

It is possible to swap side "A" and "B" for every section in case of wrong wiring harness.

7.5 Frequencies configuration

It is possible to set the PWM frequency for every section. Default value is 150 Hz.

7.6 Ramps configuration

It is possible to set both (rise and descent) ramps for every section and every side. Default value is 1 second.

7.7 Currents configuration

It is possible to set both (minimum and maximum) currents for every section and every side. Default value are 400 and 1700 mA.

8 Calibration

> Before start the calibration procedure, read this chapter until its end, to better understand the calibration procedure in all its completeness

During this phase, never cut off power supply to the board so as not to lose data storage.

Carry out the after assembly checks, if you have not completed them, as shown in chapter "Checks and maintenance".

> Centre and maximum calibration are compulsory for every new installation o system change. Maximum values are <u>always</u> positive.

8.1 Centre position calibration

Let's now look at the setting procedure:
1. Power off the MAV board and all connected devices (solenoid valves, joystick etc.).
2. The LED will blink fast with all three colours: green, red and yellow.
3. Connect to the MAV a computer with BPEterminal software correctly installed. Power on the PC (if not already on) and execute the BPEterminal software.
4. Power on the MAV board.
5. Wait until the MAV board is completely on and connect the BPEterminal software with it (see BPEterminal software manual on how to do it) opening the correct device user interface for your MAV version.
6. Go to the "Commands" section of the BPEterminal software.
7. Check that all your joysticks (or other type of input device) are in Centre position.
8. Press "Centre" push button on BPEterminal software and follow the program instructions.
    a. Note: it is possible to set the Centre position for all input devices or only one. To do it press the correct push button on BPEterminal software and follow the program instructions.
9. If you like, you can check on "Commands monitor" output field that the input signal value are correct.
10. Power off the MAV board and remove the connection with the computer.
11. Power on the MAV board and test it.

8.2 Maximum stroke calibration

Let's now look at the setting procedure:
1. Power off the MAV board and all connected devices (solenoid valves, joystick etc.).
2. The LED will blink fast with all three colours: green, red and yellow.
3. Connect to the MAV a computer with BPEterminal software correctly installed. Power on the PC (if not already on) and execute the BPEterminal software.
4. Power on the MAV board.
5. Wait until the MAV board is completely on and connect the BPEterminal software with it (see BPEterminal software manual on how to do it) opening the correct device user interface for your MAV version.
6. Go to the "Commands" section of the BPEterminal software.
7. Put that all your joysticks (or other type of input device) in their maximum position.
8. Press "Max" push button on BPEterminal software and follow the program instructions.
    a. Note: it is possible to set the maximum position for all input devices or only one. To do it press the correct push button on BPEterminal software and follow the program instructions.
9. If you like, you can check on "Commands monitor" output field that the input signal value are correct.
10. Power off the MAV board and remove the connection with the computer.
11. Power on the MAV board and test it.

9 Diagnostic

9.1 LED visualizations for all boards

The LED error codes are shown in the following table:

Colour	Blinks	Meaning	Possible solution
Green	On	Normal status	●
Red	1	Input signal out of range for section n. 1	Check input signal range for section n. 1
Red	2	Input signal out of range for section n. 2	Check input signal range for section n. 2
Red	3	Input signal out of range for section n. 3	Check input signal range for section n. 3
Red	4	Input signal out of range for section n. 4	Check input signal range for section n. 4
Red	5	Input signal out of range for section n. 5	Check input signal range for section n. 5 (MAV1152 only)
Red	6	●	●
Red	7	B5 (C2 for MAV1151) movement clearance activation check failed	See chapter "Safety check set up" on how to set up and use the start-up safety check input
Yellow	1	Memory error	Try to power off and power on the board. Try to change (and save) a parameter and power off and power on the board. Ask to BPE srl
Yellow	2	Memory error	Try to power off and power on the board. Try to change (and save) a parameter and power off and power on the board. Ask to BPE srl

LED messages:

Colour	Blinks	Meaning	Thing to do
Green	1	Shown after enabling/disabling of a special function	You must power off and power on the board
Green	2	Shown after the input signal type is changed	You must power off and power on the board
Green	3	Shown after the dead band is changed	You must power off and power on the board

10 Precautions checks and maintenance
10.1 Precautions

• You must connect power supply wires directly to the battery.
• Cut off power supply before every check or replacement.
• Do not weld on machine structure before removing power supply (positive and negative) and detaching boxes from vehicle frame or possible connections towards vehicle frame.
• Provide suitable mechanical protections for connection wires, paying particular attention for transducers.
• Do not place board, transducers or cabling close to sources of heat, electromagnetic interferences or power transmissions.
• Do not touch directly boards, transducers and boxes with flushing or degreaser fluids under pressure.
• Do not hole the board box.

10.2 Checks and maintenance

> **Installation, assembling, calibration, ordinary and extraordinary maintenance has to be done from skilled staff, in his right mind and not under the effects of alcohol or other drugs**

A correctly mounted system will not need special maintenance through its operative life.
In this chapter you can find some checks for system functionality. Due to the safety functions of the system, if these checks are not carried out it can be very dangerous for the operator.

Assembly checks
Check that the electrical wiring harness is as shown in the "Electrical connections" chapter.

After assembly checks
When you assemble the system for the first time you must made some checks:
• Check the power supply to verify it is correct (range and noise absence)
• Check the box lock and gland clamp
• Check the board shut down through main power supply switch

Ordinary maintenance to be made at the beginning of every duty cycle
• Visual check of, board box and connection wires
• Check of power supply to verify it is correct
• Check the equipment correct operation

Extraordinary maintenance
The extraordinary maintenance operations has to be made by skilled workers only. Ask BPE Electronics or its reseller/or importer. Extraordinary maintenance is considered to be everything that is not described in ordinary maintenance and in procedure of device installation. Warning: only skilled workers are allowed to make this type of maintenance; sanction: loss of every responsibility by BPE Electronics The data to contact BPE Electronics are reported at each page bottom of this manual.

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11 Addendum A: Special functions

Power off and power on the MAV board after every special function modification or activation / de-activation

11.1 Mutually exclusive joystick mode

In this mode the MAV board can be connected with up to two biaxial joysticks and works as the following operating mode:

«The MAV board recognizes which is the first joystick that is moved outside its zero dead-band, then the two PWM output channels are controlled by this joystick, that becomes the leading one; the other one is simply ignored even if it is moved too. When the leading joystick is brought back into its zero dead-band and kept in it for at least 500 ms after the output current has gone to zero, the board will be able again to recognize the new leading joystick that will control the two PWM output channels.»

This function is not available for MAV1152

Since there are two biaxial joysticks, the maximum stroke calibration for each axis has to be one at time

Joystick negative power supply input MUST be DIRECTLY connected to C1 using the shortest possible connection

The electrical connection are displayed in the following table:

Pole	Meaning	Notes
A1	**Positive power supply**	The contact must be directly connected to the positive power supply [1]
C1	**Negative power supply (also joystick negative)**	The contact must be directly connected to the negative power supply. Joystick negative MUST be <u>directly connected to C1</u> with shortest possible connection between joystick and MAV4211 board
C7	**Positive power supply for joysticks**	Power supply for potentiometric joystick. $+5\ V_{DC}$ only [2]
B4	**Analogue input for channel No. 1**	Joystick No. 1 X axis
C4	**Analogue input for channel No. 2**	Joystick No. 1 Y axis
B3	**Analogue input for channel No. 3**	Joystick No. 2 X axis
C3	**Analogue input for channel No. 4**	Joystick No. 2 Y axis
C6	**PWM output for channel "No. 1, side A"**	Controlled by Joystick No. 1 or No. 2 X axis. Maximum current 2 A [3]
B8	**PWM output for channel "No. 1, side B"**	Controlled by Joystick No. 1 or No. 2 X axis. Maximum current 2 A [3]
C8	**PWM output for channel "No. 2, side A"**	Controlled by Joystick No. 1 or No. 2 Y axis. Maximum current 2 A [3]
A5	**PWM output for channel "No. 2, side B"**	Controlled by Joystick No. 1 or No. 2 Y axis. Maximum current 2 A [3]
B1	**PWM output for channel "No. 3, side A"**	●
B2	**PWM output for channel "No. 3, side B"**	●
A2	**PWM output for channel "No. 4, side A"**	●
A3	**PWM output for channel "No. 4, side B"**	●
A6	PWM negative for channel No. 1	For solenoid valve connected to channel #1
B6	PWM negative for channel No. 2	For solenoid valve connected to channel #2
B7	PWM negative for channel No. 3	For solenoid valve connected to channel #3
A7	PWM negative for channel No. 4	For solenoid valve connected to channel #4
B5	**Start-up safety control input**	See chapter "*Movement clearance activation mode*" for more details
A8	**Output for hydraulic power pre-selection**	Maximum current 3 A [3]
A4	●	Available for custom functions on request
C2	●	Available for custom functions on request
C5	●	Not used

[1] It is compulsory to use an external 15 A fast fuse
[2] MAV can give $+5\ V_{DC}$ only. If you need 10, 12, 24 V_{DC} or other values you must use a battery or an external power supply. $I_{MAX}=50$ mA protected against short circuits
[3] Protected against short circuits