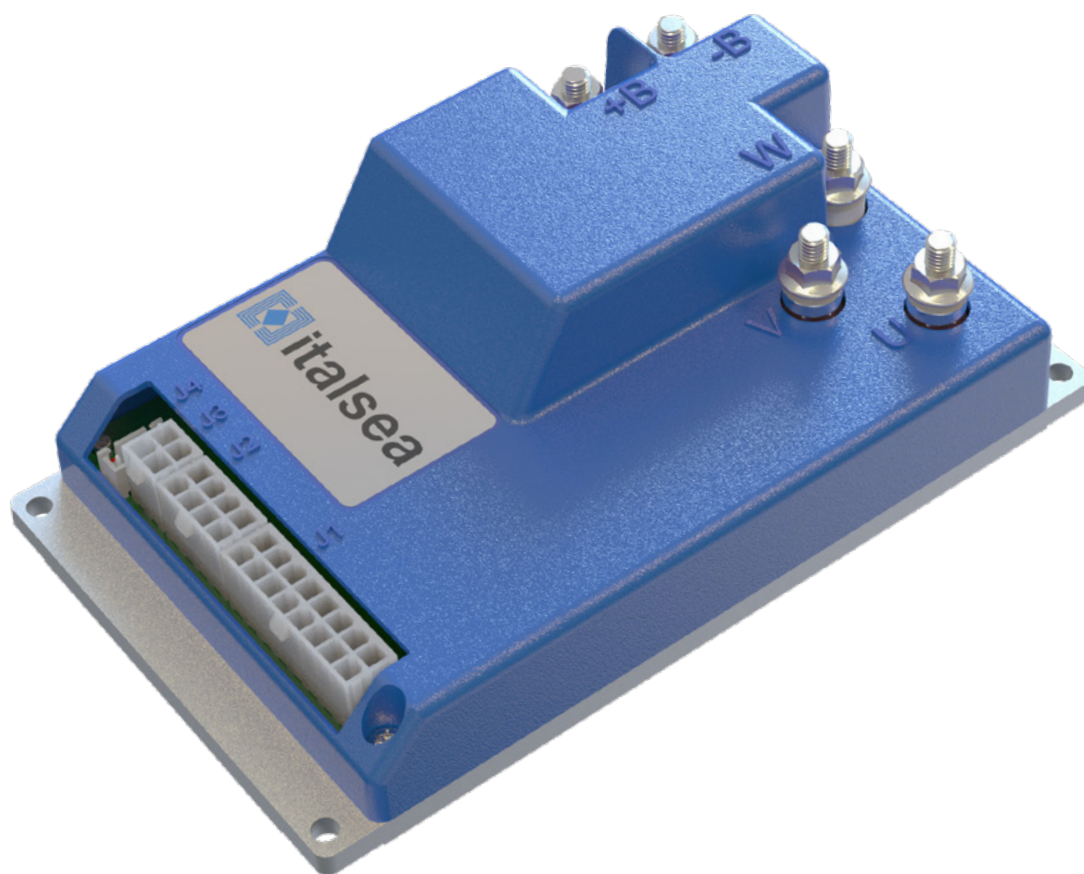


7BL00097

MICROPROCESSOR CONTROLLER FOR BLDC MOTORS



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1. SAFETY INSTRUCTIONS

The controls described in this manual are to be considered and are sold as finished products to be installed only by qualified personnel. Installation must be done in accordance with all safety regulations for the prevention of risks and accidents applicable in the country of use.

Notes before energizing:

The controls for electric motors are able to produce high forces and rapid movements, therefore a high degree of attention is required in their use, especially in the installation and application development phases.

The controls must be installed in a closed electrical panel so that none of its parts can be reached in the presence of voltage.

Working on electric vehicles is potentially dangerous. Take all available precautions against burns, direct contact or inhalation of acids, etc. (wear safety glasses, gloves, etc.).

Always follow the recommendations provided by the manufacturer of the batteries as they can deliver high currents in the event of short circuits: completely disconnect the batteries before any intervention on the system (wiring operations, checks on connections and various operations).

Controls for moving electric vehicles could cause you to lose control and create dangerous situations.

Disconnect the traction motor or lift the vehicle (also make other motors that could cause damage to persons or property in appropriate safety) before starting any work on the circuits / connections.

The controls are protected against moisture by surface painting and direct circuit contacts with a partially open cover. Place the controls in a dry, clean and ventilated position; avoid contact, in any form, with liquids such as water, detergents, acids, oxides, etc.

The controls are high-powered devices and include various safety management of the electric vehicle.

The complete safety of the application cannot be left to control alone but must be integrated with the risk analysis of the entire system by the manufacturer of the final machine.

Provide suitable fuses, battery disconnect switches (power switches, contactors, etc.), safety electro-brakes or mechanical brakes and any other external component to safeguard the system and increase the safety level of the electric vehicle.

In the event of a breakdown or serious alarm, assess in relation to the application whether the action of disconnecting power from the motors is the best solution in terms of vehicle safety.

Avoid excessive length connections between controls, power source and motors.

The controls use the high-frequency PWM technology which may produce electromagnetic disturbances, partially already filtered inside the circuits but which may not be sufficient in the final system due to the complexity or execution of the system itself. It is advisable to build the system with cables of reduced length and to appropriately separate the power cables from the signal ones. If necessary, use shielded cables or external filters to reduce electromagnetic disturbances.

2. INTRODUCTION

The 7BL00097 is a controller designed for brushless PM motors powered by battery 24V - 36V.

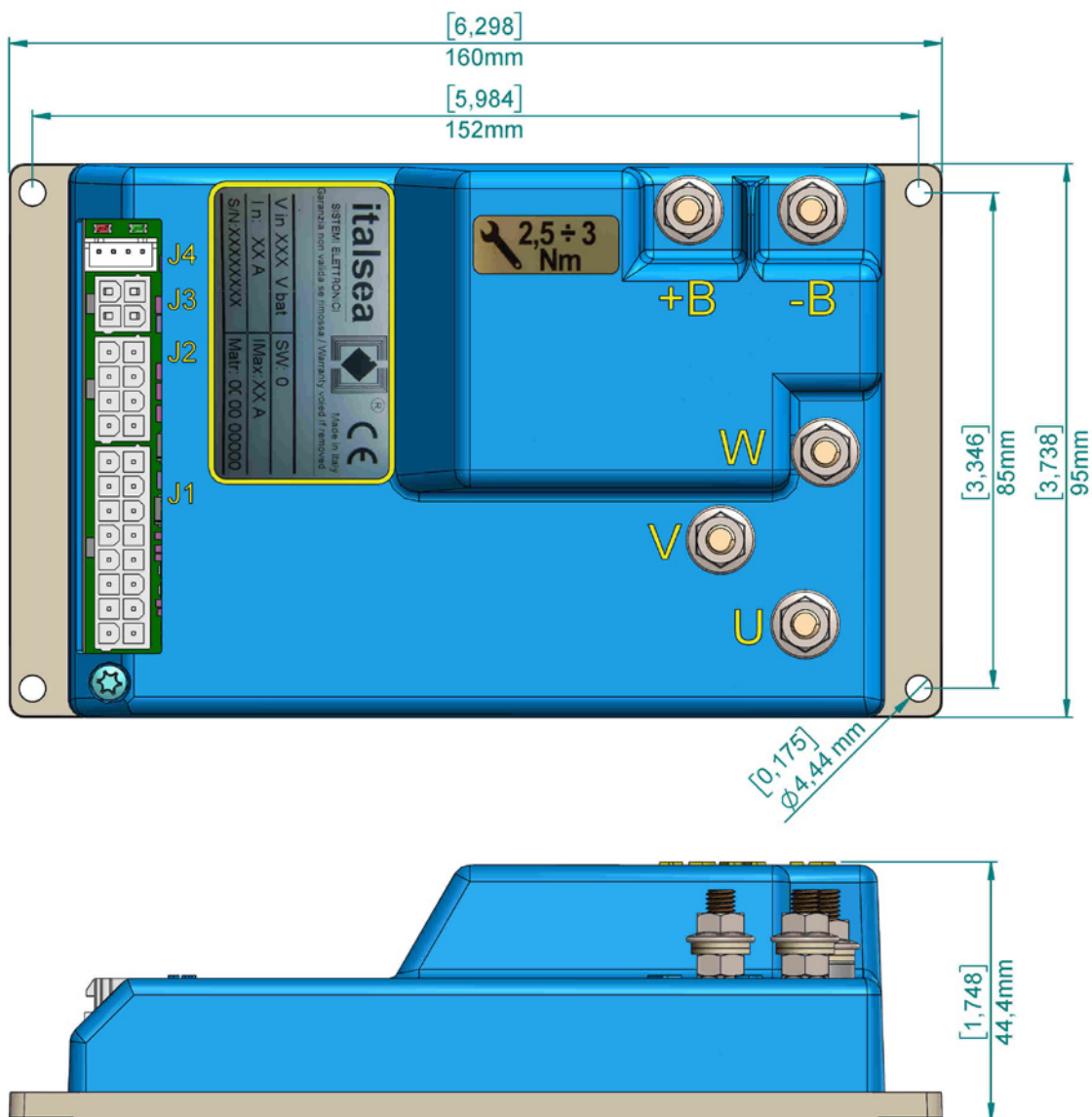
The controller is equipped with a powerful microprocessor for digital control of the speed, current regulation and failures of the motor; an efficient diagnostics of the failures and wrong wiring connections, programmability of the main parameters.

The chopper is designed in accordance with the EC standards related to the product.

2a. Features

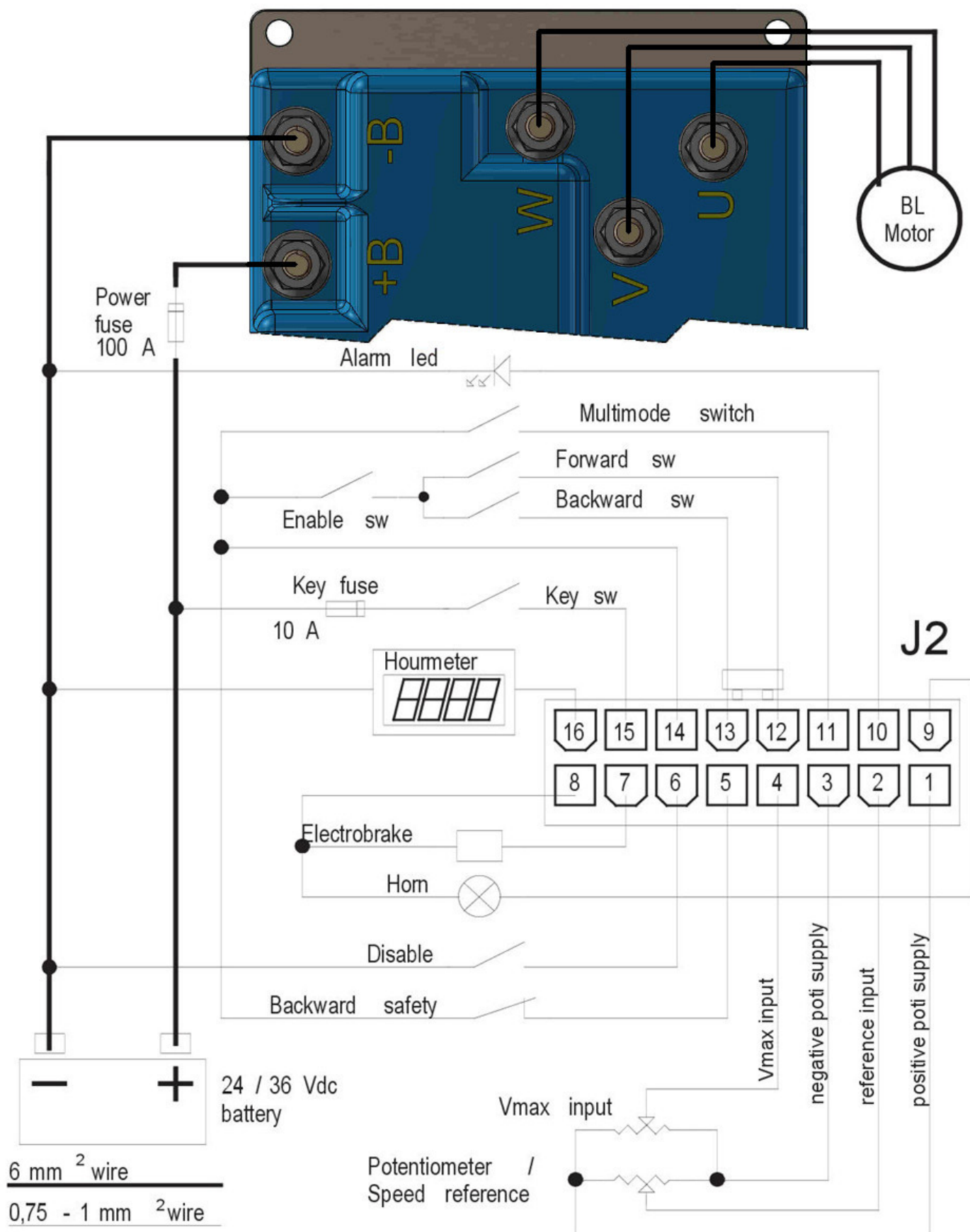
Supply	24 / 36V (Battery)
Rated current	30 Arms
Max current(@25°C)	90 Arms
Frequency	16 KHz
Max heatsink temperature	90 °C
Operating temperature	-10°C / 40°C
Speed reference	Voltage (0-5Vdc/10Vdc) / Potentiometer 1-10 kΩ
Regenerative breaking	Only for battery applications
On board main relay	24V-40A
Parameters programmable	
Safety	Output short circuit protection
	Mosfet short circuit protection
	Thermal protection
	Low voltage and overvoltage protection
	Reverse battery protection
	Overcurrent protection (function of temperature)
	Potentiometer and wirings fault
Protection	Conformal coating of PCB

2b. Mechanical drawing



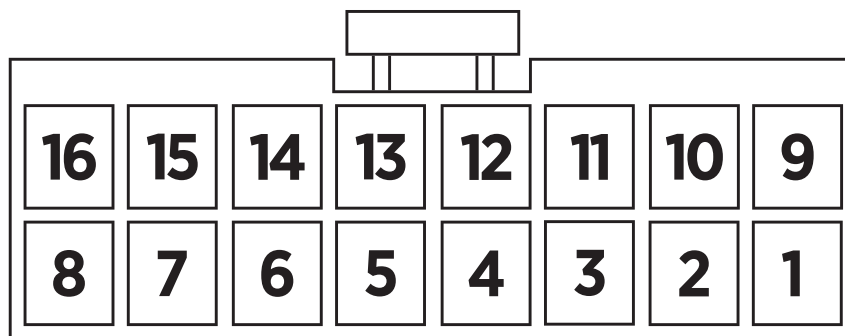
Locate the inverter in a place protected against mechanical abuse, water and dirty. Fix it with all the screws on a metal surface (aluminum if possible) to reduce the heat and so for longer period of work. If during the standard operations the thermal protection is activated very often an additional heath-sink or fan is requested to assure longer periods of work.

2c. Wiring diagram



3. I/O CONNECTOR

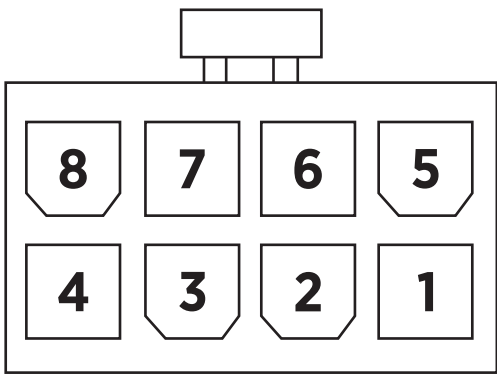
J1-16v Molex connector (Molex p/n.39012160, contacts p/n.39000038)



Pin 1	HI-POT INPUT Positive Potentiometer Supply
Pin 2	C-POT INPUT Central Potentiometer, or Voltage (0-5Vdc) Speed Reference Input
Pin 3	LO-POT INPUT Negative Potentiometer Supply, or Gnd Voltage Speed Reference Input
Pin 4	Pin 2:V_MAX (OPTIONAL) Max Speed input voltage (0-5V) or Max speed input potentiometer (>100K Ω)
Pin 5	PUSH Default N.C. input contact (+V_Batt/Pin14) for Backward safety. This input is active when open
Pin 6	DISABLE INPUT Default N.O. input to +V_Batt
Pin 7	ELECTROBRAKE COIL (-) Output active low 2 Amps max (short circuit protected) + internal diode
Pin 8	OUTPUT SUPPLY COMMON (+) Supply pin for external loads (electrobrake, horn); connected to +V_Batt
Pin 9	HORN Output active low (close to -Battery) for the horn or light backward direction (2 Amps max, short circuit protected, internal diode)
Pin 10	ALARM Connection for the diagnostic Blinking Led indicator (5Vdc-10mA) output: the number of blinks indicates the alarm type (example 5 blinks -> Alarm 5)
Pin 11	MODE 1 INPUT Default N.O. input to +V_Batt
Pin 12	FORWARD SWITCH N.O. input to +V_Batt
Pin 13	BACKWARD SWITCH N.O. input to +V_Batt
Pin 14	COMMON HIGH +V_Batt output for switches
Pin 15	KEY IN Key switch input (+V_Batt)
Pin 16	HOURL-METER OUTPUT

4. MOTOR ENCODER/HALL SENSORS CONNECTOR

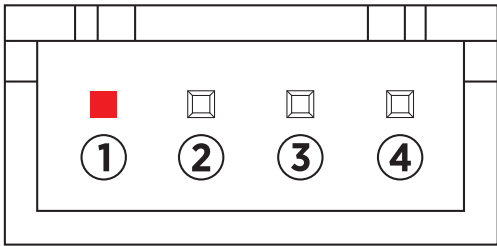
J2-8v Molex connector



PIN 1	Positive supply (14V)
PIN 2	Hall sensor U
PIN 3	Hall sensor W
PIN 4	Temperature sensor optional (negative)
PIN 5	Negative supply (-Battery)
PIN 6	Hall sensor V
PIN 7	Encoder A
PIN 8	Encoder B

5. CAN BUS SERIAL COMMUNICATION CONNECTOR

J4-4v JST B4B-XH-A

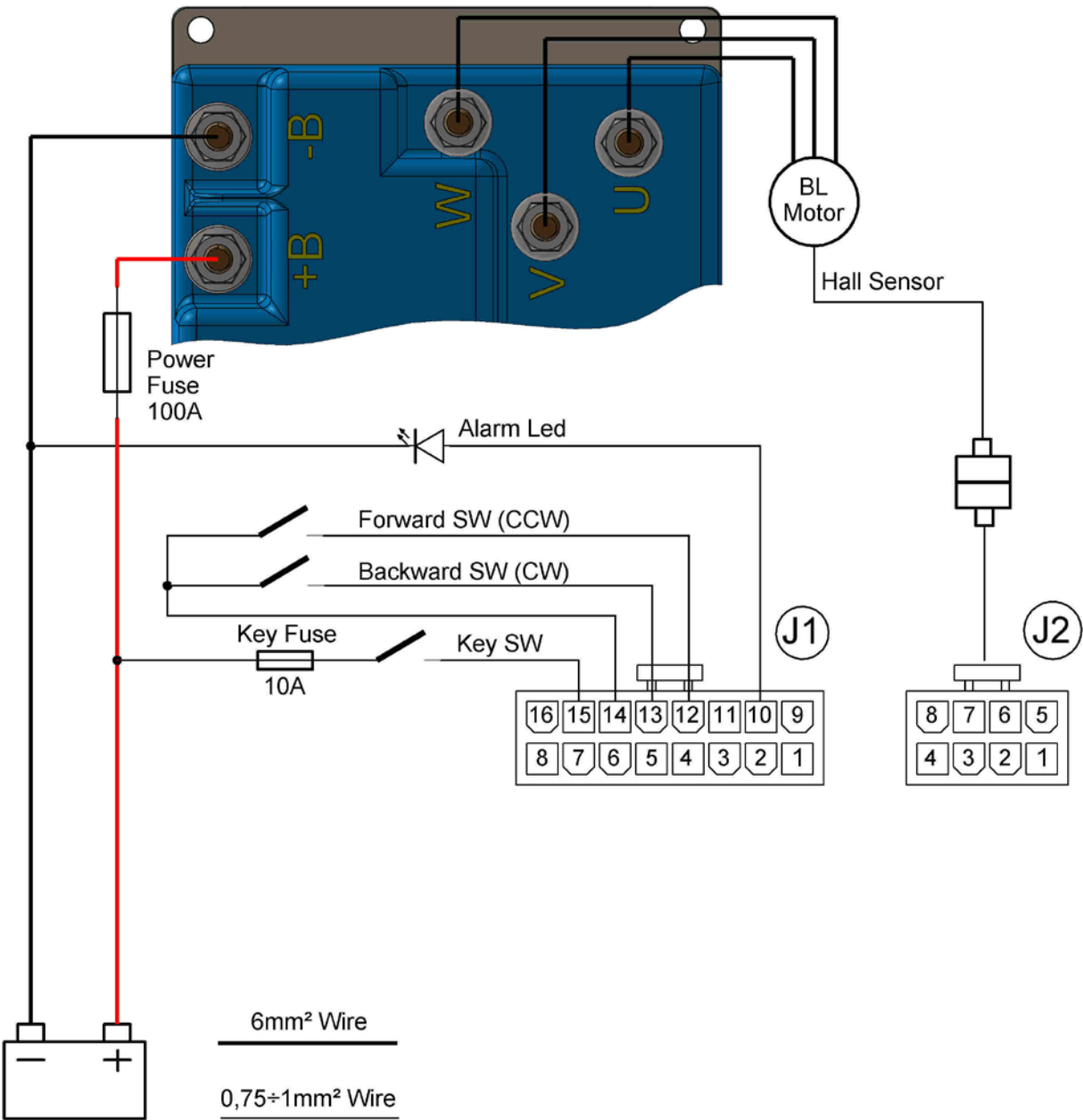


PIN 1	CAN_L signal
PIN 2	CAN_H signal
PIN 3	N.C. (+5V supply if necessary for external device max 20mA)
PIN 4	negative reference supply

J3-4v Molex connector (Molex p/n.3901240, contacts p/n. 39000038)

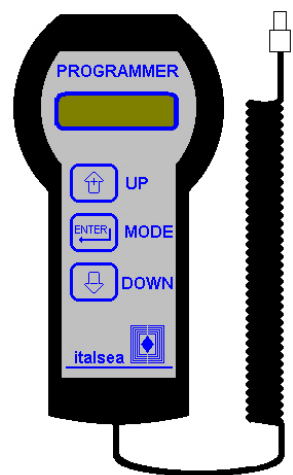
Used for handheld programmer

6. WIRING DIAGRAM FIXED SPEED



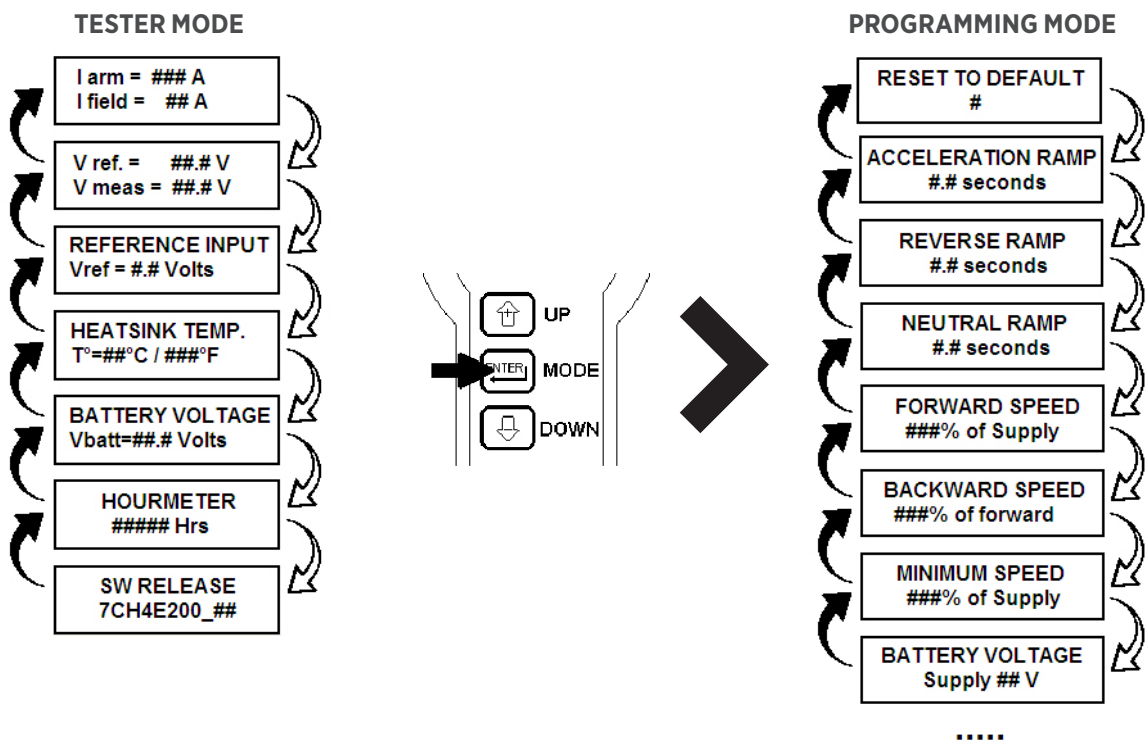
7. CONTROLLER SETTING

7PROGLCD HANDHELD PROGRAMMER



LCD 16X2	Displays parameters, alarms and measures (description and value)
UP Key	Rolls up parameters and increases values
MODE Key	Confirms a selection and the change of value
DOWN Key	Rolls down parameters and decreases values

At power-on, handheld programmer displays the “Tester Mode” pages. In this pages, you’ll find the motor current and voltage, speed reference input, internal aluminum heat-sink temperature, battery voltage, hour-meter and software release. To start the programming function push the button “MODE”, and the first parameter will appear; pushing the “UP” button the number of the parameter will be increased and with the “DOWN” button the number will be decreased. When a parameter is selected, push the button “MODE” to enter in the change menu, change the value with the buttons “UP” and “DOWN”, then confirm the value with the button “MODE”. To return to the TESTER menu push together the buttons “MODE” and “UP”, or wait few seconds.



IMPORTANT NOTE: the parameters modified with the handheld programmer are saved in Eeprom. The effective saving happens when the user comes back to the tester mode (exits from parameters modification mode). It is important **NOT TO SWITCH OFF THE INVERTER WHEN IT IS STILL IN PROGRAMMING MODE.**

8. TESTER MODE

The quantities visualized in the programmer are the following:

SOFTWARE RELEASE 7BL00097_3.1	Software version loaded in the board
SPEED REFERENCE 5,7V 1000rpm	Speed reference (reference input voltage, rpm)
CURRENT 23Arms SPEED 1001rpm	Actual current and speed
BATTERY VOLTAGE 25,3Volt	Actual battery voltage
OVERLOAD LEVEL: 15% (at 23Arms)	Actual overload level (at 100% there is alarm)
HEATSINK TEMP 29C° 84F°	Actual heatsink temperature
J1:5,11 EN:a,B,U,v,W	Ext. inputs state, encoder and hall sensors state
HOURLMETER 53hrs, 16min	Working time

9. ALARMS

Handheld programmer can display the failures or alarms: in the following table there is the list, the meaning of this alarms, and how to solve the problem.

DISPLAY	ALARM	WHAT TO DO
ALARM 01 FW/BW Switch ON	Forward/Backward switch closed at power-on	Put the speed reference to zero and open the FW/BW switch.
ALARM 02 ENCODER FAIL	Encoder signals failure	Check encoder connections.
ALARM 03 Pot. FAULT	Potentiometer fault	Check the potentiometer's wires.
ALARM 04 Ref OUT Neutral	Potentiometer out of neutral position at power-on	Move the potentiometer to neutral position or if it is in neutral position yet, calibrate the speed reference.
ALARM 05 Over temperature	Thermal protection	Wait few minutes and check the motor current.
ALARM 06 POWER STAGE	Controller's power stage damaged	Change the controller.
ALARM 07 OVERCURRENT	Over-current: short circuit	Check the motor's wires: if ok, and the controller repeats this alarm, change it.
ALARM 08 POWER FUSE/RELAY	Power fuse or main contactor damaged	Controller detects a failure on the external power fuse or power connections. If the controller repeats this alarm and the power connections are ok, change it.
ALARM 09 UNDERVOLTAGE	Under-voltage	Check battery's charge.
ALARM 10 OVERVOLTAGE	Over-voltage	Battery voltage upper than 45V: check the battery.
ALARM 11 OVERLOAD CURRENT	Overload protection	Check the motor working current and parameters "rated current" and "overload time".
ALARM 12 DISABLE ON	Disable switch on	Check the input switch: this alarm will reset by power-off.
ALARM 13 KEY-OFF	Key-off sequence detected	Check the key switch connections.
ALARM 14 EEPROM FAIL	E ² prom fail	Check your settings: if the controller repeats this alarm, change it.
ALARM 15 OVERSPEED	Over-speed	Check regulation parameters.

10. NORMAL PARAMETERS

NUMBER	NAME	MINIMUM	MAXIMUM	DEFAULT	DESCRIPTION
0	PAR_DEF	0	1	0	default parameters setting
1	PAR_ACC	5	100	30	acceleration [sec/10]
2	PAR_INV	5	100	30	reverse braking [sec/10]
3	PAR_DEC	5	100	30	braking [sec/10]
4	PAR_VMIN	10	1000	100	minimum speed [rpm]
5	PAR_VNOM	100	10000	1800	maximum no load speed [rpm]
6	PAR_MA	10	100	100	maximum forward speed [%]
7	PAR_MI	10	100	100	maximum backward speed [%]
8	PAR_BATT	24	48	24	nominal battery voltage[V]
9	PAR_VBLOW	50	100	75	low battery limit[%]
10	PAR_INOM	10	50	25	nominal current [Arms]
11	PAR_IMAX	20	95	50	current limit [Arms]
12	PAR_12	0	30000	0	
13	PAR_TNOM	10	120	15	i ² t time [sec]
14	PAR_14	0	30000	0	
15	PAR_REF	0	4	0	reference type ⁽¹⁾
16	PAR_BM_REF	30	500	100	potentiometer dead band [mV]
17	PAR_17	0	30000	0	
18	PAR_EF	0	300	10	brake delay [sec/10]
19	PAR_I_MM	10	100	70	multimode current limit [%]
20	PAR_V_MM	10	100	50	multimode speed [%]
21	PAR_T_ASC	0	50	30	anti crushing time [sec/10]
22	PAR_V_ASC	3	50	30	anti crushing speed [%]
23	PAR_TMOT	90	150	120	maximum motor temperature [°C]
24	PAR_MOT_DIR	0	1	1	motor direction ⁽²⁾
25	PAR_CNFI_5	0	1	1	5-J1 configuration ⁽³⁾
26	PAR_CNFI_6	0	1	0	6-J1 configuration ⁽³⁾
27	PAR_CNFI_11	0	1	0	11-J1 configuration ⁽³⁾
28	PAR_PUD_5	0	1	0	5-J1 pull up/dw ⁽⁴⁾
29	PAR_PUD_6	0	1	1	6-J1 pull up/dw ⁽⁴⁾
30	PAR_PUD_11	0	1	0	11-J1 pull up/dw ⁽⁴⁾
31	PAR_PUD_12	0	1	0	12-J1 pull up/dw ⁽⁴⁾
32	PAR_PUD_13	0	1	0	13-J1 pull up/dw ⁽⁴⁾
33	PAR_33	0	30000	0	
34	PAR_ALL01	0	1	0	ALL01 enable/disable ⁽⁵⁾
35	PAR_ALL03	0	1	0	ALL03 enable/disable ⁽⁵⁾
36	PAR_ALL04	0	1	0	ALL04 enable/disable ⁽⁵⁾
37	PAR_ALL12	0	1	0	ALL12 enable/disable ⁽⁵⁾

11. PARAMETERS UNDER PASSWORD

NUMBER	NAME	MINIMUM	MAXIMUM	DEFAULT	DESCRIPTION
38	PAR_PWD	0	30000	0	password
39	PAR_KP_CUR	1	30000	180	current loop proportional gain
40	PAR_KI_CUR	1	30000	70	current loop integral gain
41	PAR_KP_VEL	1	30000	50	speed loop proportional gain
42	PAR_KI_VEL	1	30000	30	speed loop integral gain
43	PAR_KF_VEL	10	500	200	speed filter constant
44	PAR_KI_FW	0	30000	150	flux weakening integral gain
45	PAR_AWDIFF	80	100	95	small movements anti-windup
46	PAR_CPOLI	1	32	4	motor polar couples
47	PAR_R_STA	0	30000	14	stator resistance [Ohm/1000]
48	PAR_L_SQ	0	30000	8	synchronous q inductance [Henry/100000]
49	PAR_PM_FLX	0	30000	166	permanent magnets linked flux [Weber/10000]
50	PAR_HAL_ACT	0	1	0	hall active status ⁽⁶⁾
51	PAR_ABI_ENC	0	2	0	encoder enable ⁽⁷⁾
52	PAR_ENC_PUL	16	256	32	encoder pulses per revolution per channel
53	PAR_SP_DB	10	1000	50	speed dead band [%]
54	PAR_54	0	30000	0	
55	PAR_VBADJ	800	1200	1000	voltage measurement adjust [thousandths]
56	PAR_IMADJ	800	1200	1000	current measurement adjust [thousandths]
57	PAR_POT_DIR	0	1	0	reference direction (in wigwag)
58	PAR_POT_L	0	4095	0	backward potentiometer maximum [bit]
59	PAR_POT_O	0	4095	320	stop potentiometer [bit]
60	PAR_POT_H	0	4095	3520	forward potentiometer maximum [bit]
61	PAR_61	0	30000	0	
62	PAR_62	0	30000	0	
63	PAR_63	0	30000	0	

12. PARAMETERS SAVED AT SWITCH-OFF

NUMBER	NAME	MINIMUM	MAXIMUM	DEFAULT	DESCRIPTION
64	PAR_CNT_S	0	3599	0	hour meter seconds [s]
65	PAR_CNT_H	0	60000	0	hour meter hours [h]
66	PAR_NUM_WRI	0	60000	0	data-flash writing number
67	PAR_67	0	65535	0	
68	PAR_68	0	65535	0	
69	PAR_69	0	65535	0	
70	PAR_70	0	65535	0	
71	PAR_71	0	65535	0	

Notes:

(1)	0=s. ended, 1=0÷Vmax, 2=wig-wag 1, 3=wig-wag 2, 4=micro fw-bw
(2)	0=clockwise, 1=counter clockwise
(3)	0=NO, 1=NC
(4)	0=pull up, 1=pull down
(5)	0=enabled, 1=disabled
(6)	0=normal, 1=reversed
(7)	0=disabled, 1=enabled, 2=enabled + reversed

13. RESET TO DEFAULT PARAMETER

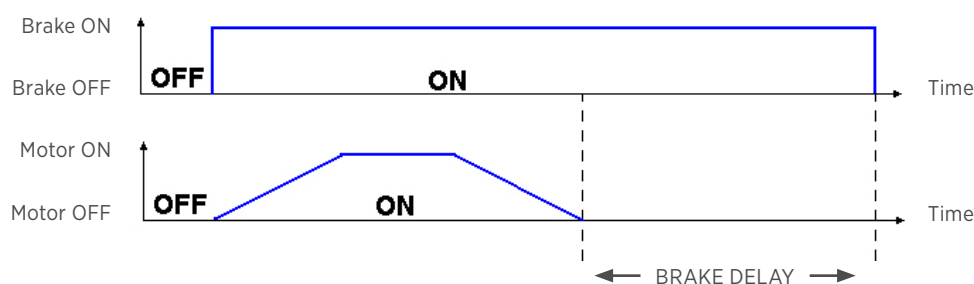
RESET TO DEFAULT
#####

DEFAULT:	0
MIN:	no
MAX:	1

To reset all the parameters, set 1, save, exit from programming mode and power-off; at the next power-on, the controller will update the defaults settings.

14. ELECTROBRAKE OUTPUT SETTING

Controller supplies the electro-brake coil when the motor is running: the coil is powered-off with delay when the speed reference and direction switches are in stop position.



BRAKE DELAY
#. # seconds

DEFAULT:	2.0
MIN:	0.0
MAX:	30.0

14a. Encoder configuration

Encoder can be enabled and configured with parameters; the enabling parameter also decide the direction of the encoder and can assume three values:

- encoder not enabled;
- encoder enabled;
- encoder enabled and reversed (A and B channels exchanged);

15. SPEED REFERENCE SETTINGS

15a. Speed reference's type

Speed reference's type and range may be set by the sequences that follow:

SPEED REFERENCE
#####

+

UP

ENTER

MODE

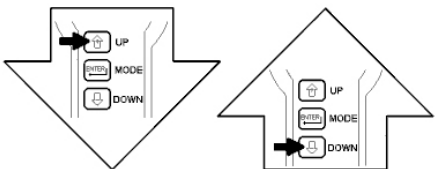
DOWN

Choose "SPEED REFERENCE" page,
and confirm it by "MODE" button

The controller can work mainly with 6 kinds of speed reference:

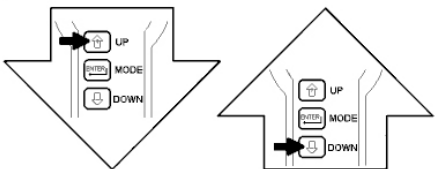
CALIBRATION
single-ended

Single-ended potentiometer:
potentiometer with two direction switches.



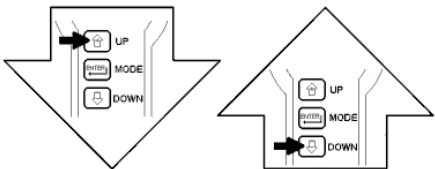
CALIBRATION
voltage 0-max

Voltage 0-max:
analogue signal with direction switches.



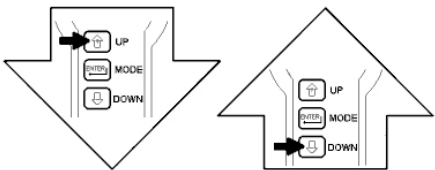
CALIBRATION
wigwag 1

Wigwag1 potentiometer:
potentiometer with middle stop position and enable switches.



CALIBRATION
wigwag 2

Wigwag2 potentiometer:
potentiometer with middle stop position without enable switches,



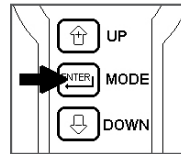
CALIBRATION
FW/BW

Fw/Bw switches:
internal speed reference (controller uses internal parameters "forward speed" and "backward speed"): only direction switches are used

15b. Single ended calibration

Step 1:

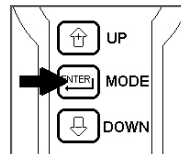
SPEED REFERENCE
single-ended



Choose “single-ended” option, and confirm it by “MODE” button.

Step 2:

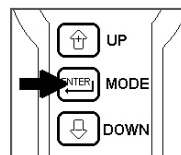
CALIBRATION
Stop pos = ## V



Set the potentiometer or throttle at **STOP / NEUTRAL** position, and confirm it by “MODE” button.

Step 3:

CALIBRATION
Max pos = ## V



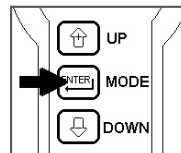
Set the potentiometer or throttle at **MAX** position, and confirm it by “MODE” button.

The single-ended reference range is calibrated.

15c. Voltage 0-MAX calibration

Step 1:

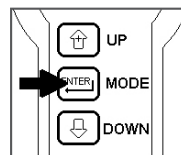
SPEED REFERENCE
voltage 0-max



Choose “voltage 0-max” option, and confirm it by “MODE” button.

Step 2:

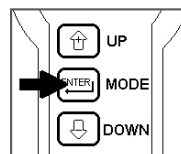
CALIBRATION
Stop pos = ## V



Set the voltage reference at **STOP / NEUTRAL** position, and confirm it by “MODE” button.

Step 3:

CALIBRATION
Max pos = ## V



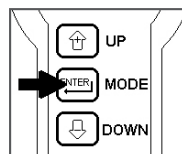
Set the voltage reference at **MAX** position, and confirm it by “MODE” button.

The voltage 0-max reference range is calibrated.

15d. Wigwags calibration

Step 1:

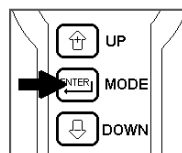
SPEED REFERENCE
wigwag #



Choose “wigwag 1” or “2” option, and confirm it by “MODE” button.

Step 2:

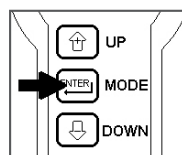
CALIBRATION
Stop pos = #.# V



Set the potentiometer or throttle at central **STOP / NEUTRAL** position, and confirm it by “MODE” button.

Step 3:

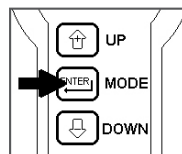
CALIBRATION
Max BW pos = #.# V



Set the potentiometer or throttle at **MAX BACKWARD** position, and confirm it by “MODE” button.

Step 4:

CALIBRATION
Max FW pos = #.# V



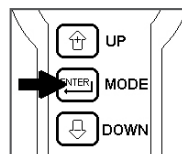
Set the potentiometer or throttle at **MAX FORWARD** position, and confirm it by “MODE” button.

The wigwag reference range is calibrated.

15e. FW/BW Calibration

Step 1:

SPEED REFERENCE
FW/BW



Choose “FW/BW” option, and confirm it by “MODE” button.

NOTE:

The controller will drive motor at the speed percentages set in pages “**FORWARD SPEED**” and “**BACKWARD SPEED**”.

16. REFERENCE'S DEADBAND

REF. DEADBAND
mV

DEFAULT:	200
MIN:	50
MAX:	500

Use this parameter to increase, or decrease the speed reference stop position range.

16a. Mode1 input settings

This input activates:

- maximum motor speed set at parameter "MODE1 SPEED"
- maximum motor current set at parameter "MODE1 CURRENT".

The input is always active.

MODE1 SPEED
% of MAX

DEFAULT:	50
MIN:	10
MAX:	100

MODE1 CURR.
% of MAX

DEFAULT:	70
MIN:	20
MAX:	100

16b. Backward safety settings

The function operates in the backward direction as a safety function for the operator. It is realized by mean of a contact that activates the function when switched: the machine will decelerate, will reverse the direction at a programmed speed for the programmed time, then will stop.

The normal operation will be obtained resetting the input, the direction switch if present and speed reference

BW SAFETY TIME
#. # seconds

DEFAULT:	0.0
MIN:	0
MAX:	5.0

BW SAFETY SPEED
% of MAX

DEFAULT:	30
MIN:	0
MAX:	50

16c. Low battery level

LOW BATTERY
##.# Volts

DEFAULT:	15
MIN:	10
MAX:	36

Low battery level: if battery voltage is lower than this value, after 1 second controller stops working and alarm is displayed.

16d. Motor current setting

CURRENT LIMIT
Arms

DEFAULT:	70
MIN:	20
MAX:	75

Maximum output motor's current: this value is used also to calculate the ammeter/overload protection.

17. OVERLOAD PROTECTION

In the programming mode set the rated current and overload time for the motor:

RATED CURRENT
Arms

OVERLOAD TIME
seconds

DEFAULT:	30
MIN:	10
MAX:	30

DEFAULT:	10
MIN:	10
MAX:	120

The protection will be activated each time the current overcome the value In and the overload time is as shorter as higher is the overload according to the function. After the integration time the controller will stop the machine and an alarm (A11) will be activated.

NOTE: ammeter time depends on heatsink temperature too; if the temperature is higher than 50°C the protection time is reduced (at 80°C is about 1/4 of calculated time).

18. DIGITAL INPUTS CONFIGURATION

Each pin 5, 6 and 11 hardware configuration (pin normally closed or open) can be set by user as need by further parameters. Once changed, power off to enable the changes.

Pin 5 hardware configuration (Backward safety input):

5-J1 HW CONFIG.
N.O. switch

5-J1 HW CONFIG.
N.C. switch

Stand-by input
Active input

Active input
Stand-by input

Pin 6 hardware configuration (Disable input):

6-J1 HW CONFIG.
N.O. switch

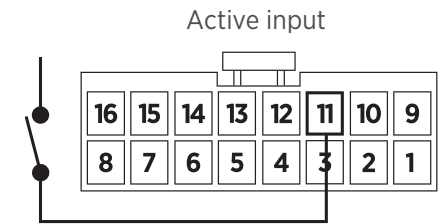
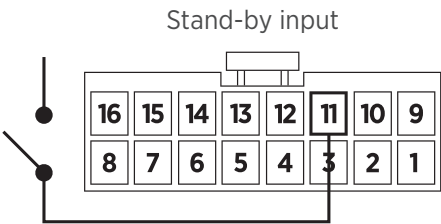
6-J1 HW CONFIG.
N.C. switch

Stand-by input
Active input

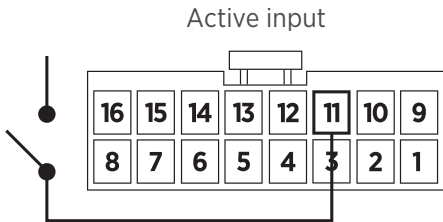
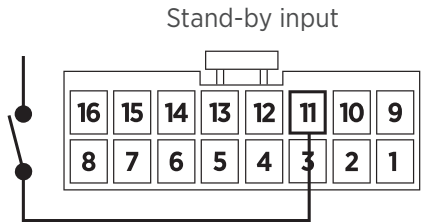
Stand-by input
Active input

Pin 11 hardware configuration (Mode 1 input):

11-J1 HW CONFIG.
N.O. switch



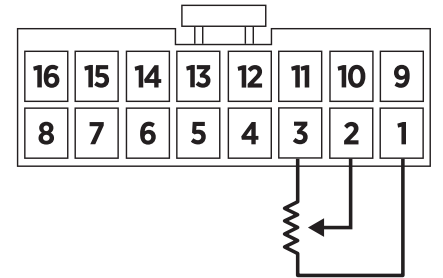
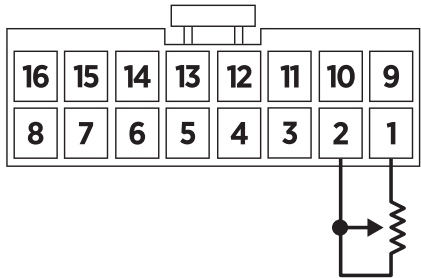
11-J1 HW CONFIG.
N.C. switch



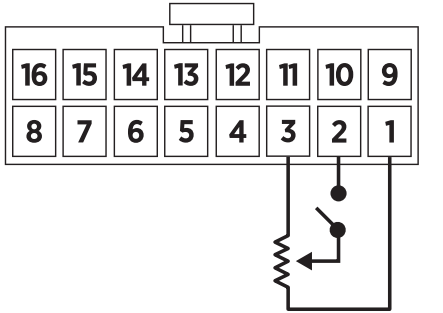
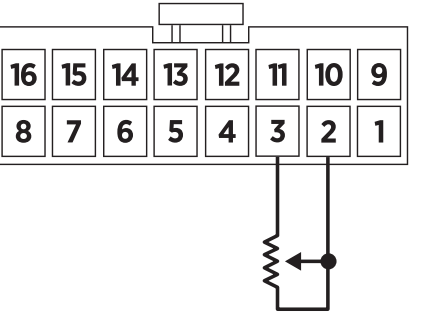
Pin's 2, 5, 6, 11, 12 and 13 internal pull-up or pull-down may be activate by next parameters.
Once changed, power off to enable the changes.

Pin 2 internal pull up/down selection (speed reference input):

2-J1 P.up-down
pull-down active

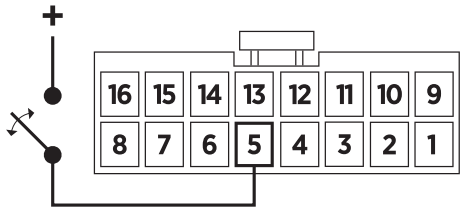


2-J1 P.up-down
pull-up active

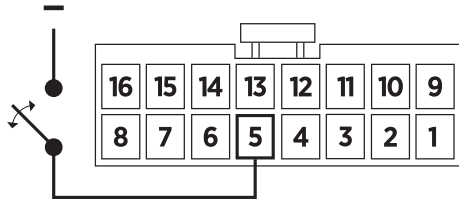


Pin 5 internal pull up/down selection (Backward safety input):

5-J1 P.up-down
pull-down active

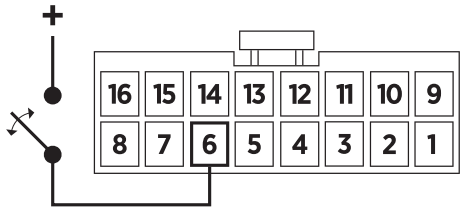


5-J1 P.up-down
pull-up active

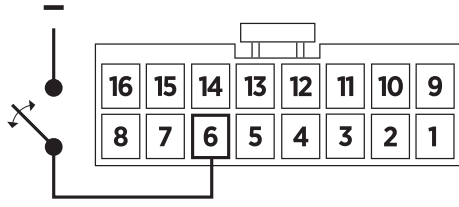


Pin 6 internal pull up/down selection (Disable input):

6-J1 P.up-down
pull-down active

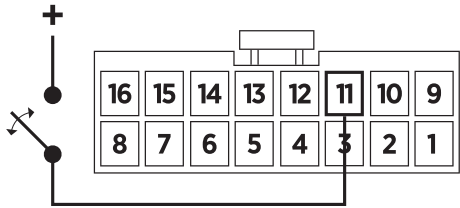


6-J1 P.up-down
pull-up active

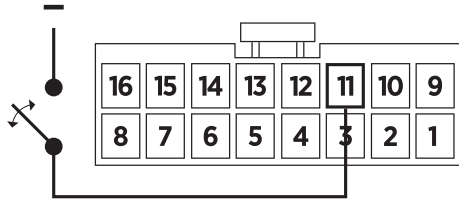


Pin 11 internal pull up/down selection (Model input):

11-J1 P.up-down
pull-down active

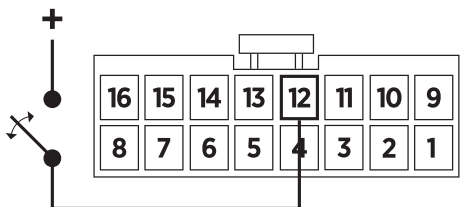


11-J1 P.up-down
pull-up active

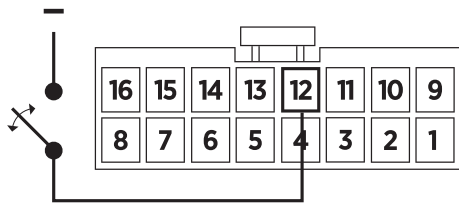


Pin 12 internal pull up/down selection (Forward switch input):

12-J1 P.up-down
pull-down active

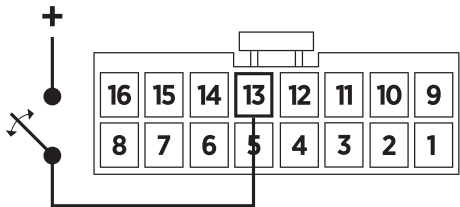


12-J1 P.up-down
pull-up active

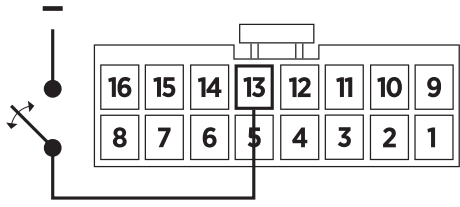


Pin 13 internal pull up/down selection (Backward switch input):

13-J1 P.up-down
pull-down active



13-J1 P.up-down
pull-up active



19. ALARMS ENABLE

ENABLE ALARM A1
ENABLE alarm

DEFAULT:	ENABLE
MIN:	ENABLE
MAX:	DISABLE

ENABLE ALARM A3
ENABLE alarm

DEFAULT:	ENABLE
MIN:	ENABLE
MAX:	DISABLE

ENABLE ALARM A4
ENABLE alarm

DEFAULT:	ENABLE
MIN:	ENABLE
MAX:	DISABLE

ENABLE ALARM A12
ENABLE alarm

DEFAULT:	DISABLE
MIN:	ENABLE
MAX:	DISABLE



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