Our Ref: Technical Manual RPU rev0.doc

TECHNICAL MANUAL
For RPU (Rieju Power Up) Instrumentation

Rel.	Release Disposal Aim	Date
0.0	First Emission	16.06.2006

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This document deletes and replaces all the previous releases.

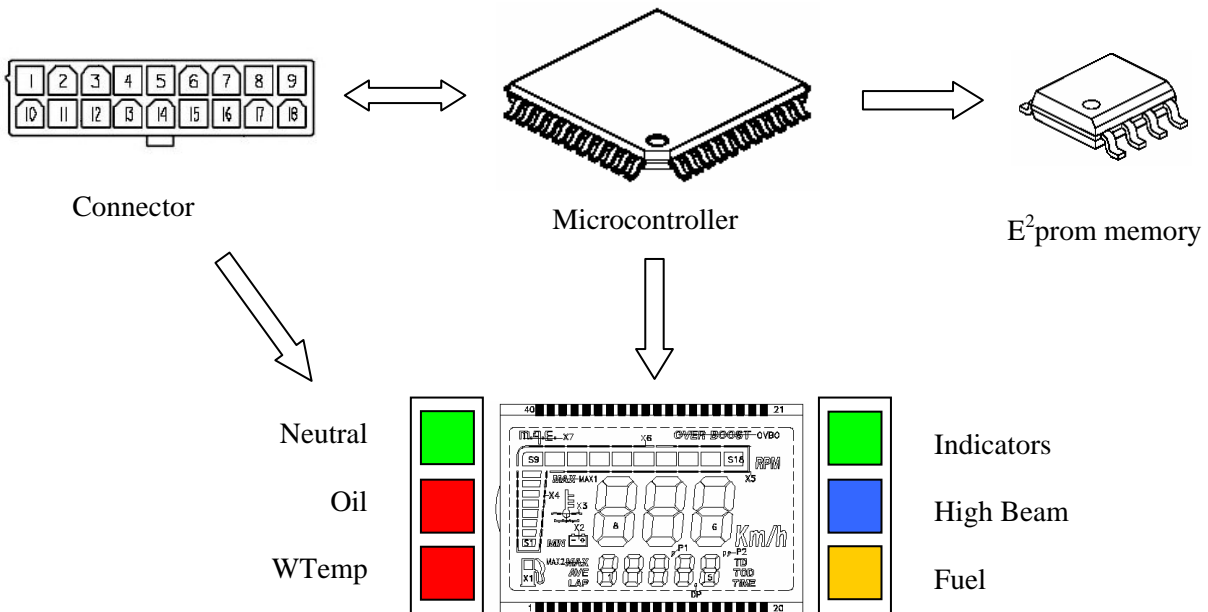Our Ref: Technical Manual RPU rev0.doc

1.0 PURPOSE

This document constitutes the technical manual with functional specifications for RPU dashboard.
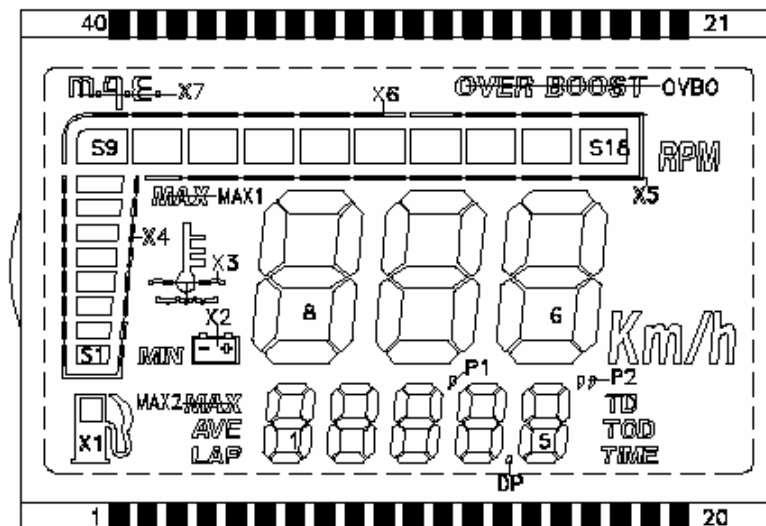
2.0 REFERENCES

M.A.E. electronic devices' general contract.

3.0 SYSTEM GENERAL DESCRIPTION

Connector   Microcontroller E^2prom memory

Neutral   Indicators

Oil   High Beam

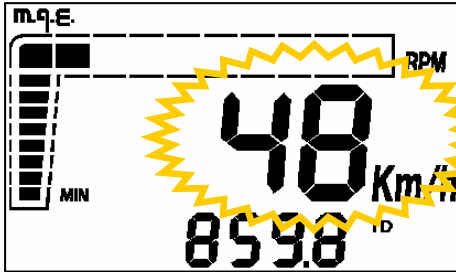WTemp   Fuel

4.0 COMPONENTS DEFINITION

4.1 LCD Display

Pic.1 Display general sight.

4.2 Mode button

The mode button must be normally open and it has to close on a positive (Vccmax 5V).

Our Ref: Technical Manual RPU rev0.doc

5.0   MAIN MENU FUNCTIONS

5.1   Instant speed function

The information is <u>always</u> visualized on the big 7 segments digits (digit 6÷8, see picture 2), independently from selected function or active alarm. The measurement unit is Km/h (You will see always logo Km/h), or, by accessing to <u>Set-Up</u> Menu, it is possible to select Mph unit measure; in this case the indication of speed won't be accompanied by any logo. Updating of the visualised value occurs every 0.5 seconds.

Pic. 2 Instant speed function

Circumference [mm]	Pulses/turn wheel	Max Speed	Overspeed	Resolution
Selected by end-user Min 1.000 Max 2.500	Selected by end-user Min. 1 Max 12	200 Km/h (124 Mph)	6% constant all over the scale	1 Km/h (1 Mph)

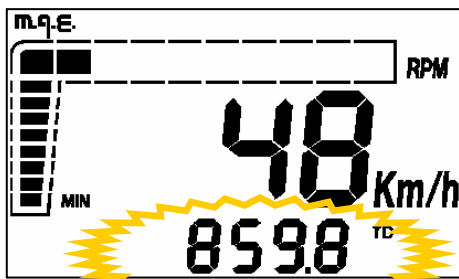### 5.2   Totalizer function (TOD)

The information is visualized on the small 7 segments digits (digit 1÷5) accompanied by *TOD* logo*,* as You can see in Pic.3. The data is permanently memorized in a non volatile memory (E^{2}prom refresh every Km).

- If the memory is empty You'll see numbers *00000* visualised.
- This information is always calculated in Km. Anyway it must be expressed in Km or Miles. You can select the chosen information by entering the Set-up menu.
- During normal using of the instrumentation it is not possible to set the information to zero.

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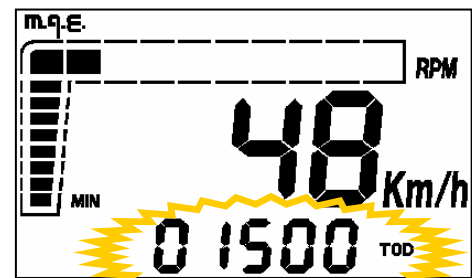
Pic. 3 TOD Function

5.3   Trip Function (TD)

This function describes the correct working/visualization of the board automatic partial totalizer. This function is always represented using digit 2÷5 and it is accompanied by the sign TD; the visualized data represents the vehicle covered distance expressed in Miles or Km (depending on the selected measurement unit), with resolution 0.1 (Miles or Km). This counter is automatic: in fact it automatically start with the first pulse arriving from speed sensor. The data isn't memorized in a permanent mode. It is possible setting the counter of this parameter to zero by pushing the mode button for about 3 sec. (in correspondence of the TD function) till the value *000.0* appears. It is possible setting to zero the TD function both when the vehicle is stopped and when it is running, this causes also the setting to zero of LAP and AVE functions. If the data gets over *999.9* the system automatically sets to zero TD, LAP and AVE functions and then starts again the counting.

Pic. 4 TD Function

<u>So: If there is no power supply the TD value is hopeless lost.</u>

Our Ref: Technical Manual RPU rev0.doc

5.4 Automatic Chronometer Function (LAP)

This function describes the correct working/visualization of the chronometer related to TD and AVE. The information is visualized on digit 1÷5 accompanied by the sign LAP. The data represents the effective route time of the vehicle (in the form mm:ss if hours = 0 and in the form hh:mm if hours > 0) related to parameter TD. So this is an automatic counter. It is automatically activated by the first pulse coming from the speed sensor (when LAP is operative, the digit that separates the hours from the minutes or the minutes from the seconds is shown blinking, while it is shown fixed when LAP is not operative) and it stops after 3 seconds from receiving of the last pulse which arrives
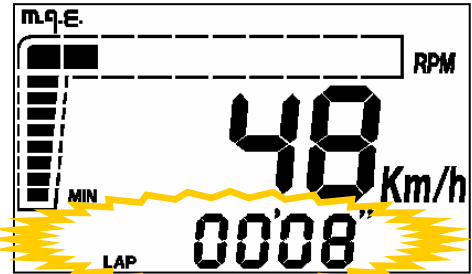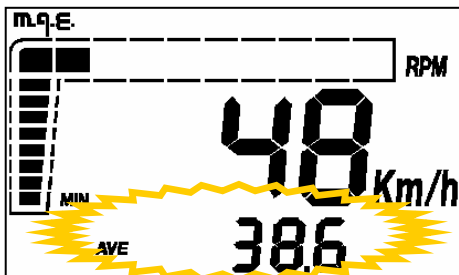

Pic. 5 LAP Function

from the speed sensor. The data is not showed in a permanently mode. It is possible to set to zero the counter of this parameter by pushing the mode button for about 03 sec.; in correspondence of the function LAP till when the value *00'00''*appears. The setting to zero of LAP, which is possible both when the vehicle is stopped or when the vehicle is running, produces the setting to zero of TD and AVE too. If the data gets over the value 23-59 (which means 23h59'59"), the system provides to set to zero LAP, TD and AVE, then it starts again the counting.
So: if there is no power supply the LAP value is hopeless lost.

5.5 Average Speed function (AVE)

The information is visualized on the small 7 segments digits (digit 1÷5), accompanied by AVE logo

Pic. 6 AVE Function

that stands for the visualized function. The data represents the average speed of the vehicle (expressed in Km/h or in Mph depending on the selected measurement unit) that is calculated as ratio between covered distance (TD) and the time used to cover this distance (LAP). The average speed is updated every 0,1 Km (or 0,1 Miles, depending by measurement unit selected). The data isn't saved in a permanently mode. It's possible to set to zero the counter of this parameter pushing the mode button for about 3 sec., in correspondence of the function AVE, till when the value *0.0* appears. The setting to zero of AVE, which is possible both when the vehicle is stopped or when the vehicle is running, produces the setting to zero of TD and LAP, too. AVE setting to zero is foreseen

also when LAP function arrives to *23:59:59* or when TD rises to value *999.9*.If the data overflow value 409, will be visualized ———.
So: if there is no power supply the AVE value is hopeless lost.

5.6 RevCounter Function (RPM)

The information is visualized on the small 7 segments digits 1÷5, accompanied by an information on the graphic bar and by the inscription RPM.

- Data is showed as round/min.
- Data is updated every 0,5sec.
- The resolution is 100 round/min and it is constant over the full scale.
- End scale: 12.000 round/min
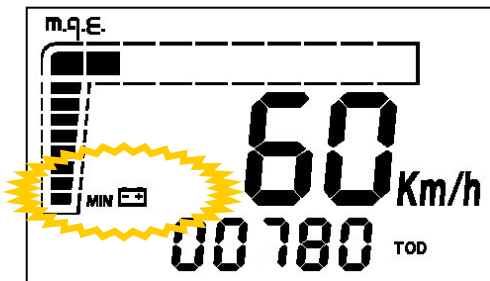- It's possible to select the pulses number for every engine round by entering the Set-Up menu.
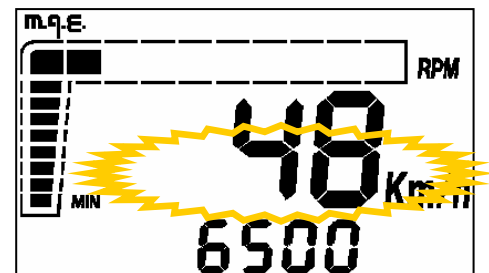
The graphic bar (updated every 0,5 sec.) is managed according to the following table:

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Rpm x100 [round/min]	Active Seg.	Rpm x100 [round/min]	Active Seg.	Rpm x100 [round/min]	Active Seg.
0	0	From 36 to 41	7	From 80 to 85	14
Till 14	1	From 42 to 47	8	From 86 to 91	15
From 15 to 17	2	From 48 to 53	9	From 92 to 93	16
From 18 to 20	3	From 54 to 61	10	From 94 to 95	17
From 21 to 23	4	From 62 to 67	11	From 96 to 97	18
From 24 to 29	5	From 68 to 73	12	Over 97	18+ Over boost
From 30 to 35	6	From 74 to 79	13		

5.7 Battery power alarm function

Pic. 8 Battery power alarm

When the measured voltage value is less or equal to 9,0V, the system activates the alarm routine. It's consists on the battery logo and the logo "*MIN*" blinking (independently from the visualized function). This indication doesn't compromise the instrumentation normal function. The alarm condition stops when the voltage exceeds again 9,5V; then the full sequence is repeated every time the voltage is less or equal to 9,0V and it is stopped over 9,5V. To avoid that power supply holes can cause not wanted alarms, the alarm indication is visualized only if the measured voltage is under the minimum level for at least 5 seconds in succession.

6.0 SET-UP MENU

The entry in the set menu-up is only possible when the vehicle is stopped, by pushing the mode button in correspondence of the function TOD for about 5 seconds; such menu allows the user to modify the following parameters:

- Wheel circumference (min 1.000mm max 2.500mm).
- Measurement unit (Km/h or Mph).
- Number of pulses coming from the speed sensor for every turn of the wheel (min 1 max 12).
- Number of pulses for every turn of the engine (min 1 max 6).

To make sure that the modifications produced inside the Set -Up Menu become operating it is necessary that the user completes the whole sequence of screen foreseen from the menu, having care than the menu exit of Set-Up (and consequent repositioning of the tool in the operating mode standard) happens only, and exclusively, through the use of the mode button; that is possible keeping pressed the mode button in correspondence of the value selected inside the screened concerning the modification of the number of pulses for engine turn (which is the last screen of the Set-Up menu), up when the tool will be positioned in the standard operating mode. If the menu exit happens through:
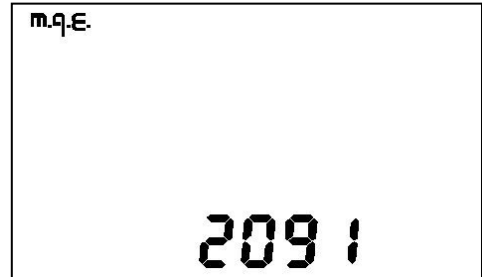
- Starting of the vehicle
- Turning on the key
- Not pushing the button for 20 seconds

the eventual modifications produced inside the Set -Up Menu would not be considered, and the system will arrange to restore the previous values.

Only in the case in which the procedure of Set-Up is completed in a correct way, the system proceeds with the saving in permanent memory of all the made selections.

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6.1 Wheel circumference regulation

Once inside the menu of Set-Up, the first parameter which can be modified is the circumference of the wheel. The display is introduced as showed in Pic. 9, where the only visible information (in correspondence of the digit 2÷5) is the circumference of the wheel, while all the other segments are turned off. It's possible modifying the various digits which constitute the value of the wheel circumference, leaving from the most significant digit and moving in series towards the least significant digit; starting from the selected data (that will be shown blinking with f = 1 Hz, Duty = 50%), a short pressure of the button will allow an unitary

Pic.9 Wheel circumference regulation

increase, while a long pressure will allow to select a different digit.
The selected circumference of the wheel is saved in memory.
Obs.1 **Regulation : from 1.000mm to 2.500mm with step of 1mm.**
Obs.2 **Once inside the regulation menu:**
- **If 20 sec. will pass without the button mode is not pushed, or**
- **If the vehicle is turned on (speed>0), or**
- **If the key is turned OFF**
the system will be automatically taken to the standard operating mode and the modifications possibly produced will be lost.

6.2 Measurement unit modification

Once finished the regulation of the circumference of the wheel, it is possible to modify the measurement unit keeping the button pressed for about 3 sec in correspondence of the least significant digit: now on the display the symbols Km/h and Mph will be shown and the selected value will be shown first blinking (f=1Hz, Duty=50%). The modification of such parameter takes place in analogy as described for the modification of the circumference of the wheel. The information concerning the selected measurement unit is saved in memory.
Obs.1 Changing measurement unit will set to zero TD, AVE and LAP.

Pic.10 Measure. unit regulation

Obs.2 **Once inside the regulation menu:**
- **If 20 sec. will pass without the button mode is not pushed, or**
- **If the vehicle is turned on (speed>0), or**
- **If the key is turned OFF**
the system will be automatically taken to the standard operating mode and the modifications possibly produced will be lost.

Our Ref: Technical Manual RPU rev0.doc

6.3 Modification of the impulses' number for every turn of the wheel

Pressing the mode button for about 3 sec in correspondence of the selected measurement unit (that will be shown blinking with f=1Hz, Duty=50%), it will be possible to modify the impulses' number of the wheel. Such parameter expresses the number of impulses that the speed sensor sends to the instrumentation for every turn of the wheel. The information concerning the number of impulses which the instrumentation receives from the speed sensor is saved in memory.

Pic.11 Regulation of number of pulses for every wheel turn

Obs.1 **Regulation interval: from 1 to 12 impulses / wheel turn.**
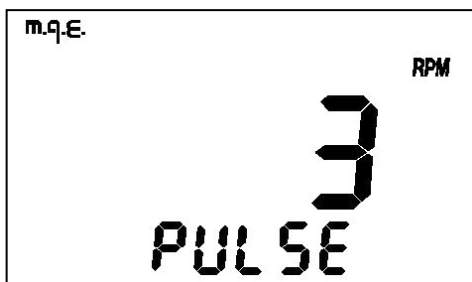**Obs.2** **Impulses can also NOT have the same distance.**
Obs.3 **Once inside the regulation menu:**
- **If will 20 sec. pass without the button mode is not pushed, or**
- **If the vehicle is turned on (speed>0), or**
- **If the key is turned OFF**

the system will be automatically taken to the standard operating mode and the modifications possibly produced will be lost.

6.4 Modification of the impulses' number for every turn of the engine

Pressing the mode button for about 3 sec in correspondence of the selected impulses' number for every turn of the wheel (that will be shown blinking with f=1Hz, Duty=50%), it will be possible to modify the number of impulses for every turn of the engine. Such parameter expresses the number of impulses that the vehicle sends to the instrumentation for every turn of the engine tree. This regulation is different from the previous one as the logo RPM is active (Pic. 12). The information concerning the number of impulses for every turn of the engine is saved in memory.

Pic.12 RPM number of impulses regulation

Obs.1 **Regulation: from 1 to 6 impulses / engine turn.**

Obs.2 **Once inside the regulation menu:**
- **If 20 sec. will pass without the button mode is not pushed, or**
- **If the vehicle is turned on (speed>0), or**
- **If the key is turned OFF**

the system will be automatically taken to the standard operating mode and the modifications possibly produced will be lost.

7.0 BACKLIGHT AND SIGNAL LIGHTS FUNCTION.

7.1 Neutral light
The system has to switch on the led when the input n.3 of the connector is low, concurrently with the positioning of the gearshift in the neutral position.
7.2 Oil light
The system receives the information to switch on the led from the microcontroller, depending on the input n.8 of the connector; a low state determinates the led lighting.

7.3 Radiator liquid temperature light

The system receives the information to switch on the led from the microcontroller, depending on the input n.10 of the connector; a low state determinates the led lighting.

7.4 Fuel Light

The system receives the information to switch on the led from the microcontroller, depending on the input n.9 of the connector; a low state determinates the led lighting.

7.5 Direction Lights Indicators

The system has to switch on the led when the inputs n.1 or n.2 of the connector are high, concurrently with the indicators turning on. The signal must already arrive to the instrumentation alternated.

7.6 High Beam Light

The system has to switch on the led when the input n.4 of the connector is high, concurrently with the high beam turning on.

7.7 LCD backlight

There is always LCD orange backlighting.

8.0 BUTTON MODE FUNCTION

The button mode is used to:
- allow functions scrolling .
- set to zero the TD, AVE and LAP values.
- modify the wheel circumference value, the measurement unit value, the number of impulses for every turn of the wheel or of the engine.

The function scrolling is always possible (it means the passage from one function to the following one) with the vehicle stopped or not. To update the instrumentation with the new function, it's enough briefly pushing the button (tmin = 1 sec.), when it will be left the display will show the new function. The setting to zero of TD, the management of the chronometer and of the average speed can be done both with the vehicle stopped or in movement as described in the previous paragraphs. The entering in the Set-up menu is possible only when the vehicle is stopped by pushing the mode button for about 5 seconds at the TOD function; the back-up of all data will be done only when the mode button will allow the exit from the Set-up menu.

Key	Button	Speed	Function
OFF	-	-	Mode button inhibited
ON	ON	>0	Entering in the Set-Up menu is inhibited
ON	ON	0	All functions are allowed

8.1 Sequence of the represented function

The function scrolling is always possible, with the vehicle stopped or not, by using the mode button as follows:

| TD	LAP	AVE	TOD	RPM

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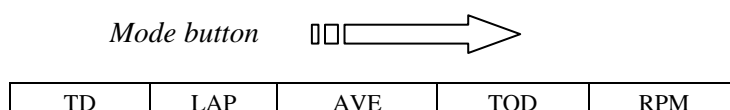
9.0 Start-Up

At the start-up (key from OFF to ON), the system gives to the user some information which are showed in following screens (or pages);

- *First page*: visualization of the release date and software's version. <u>This information is showed only during the first installation of the instrumentation.</u>
- *Second page*: display check ; all the display segments are ON for about 3 seconds.
- *Third page*: visualization of the wheel circumference, of the measurement unit selected (only if Km/h is selected), of the impulses' number for every turn of the wheel or of the engine, as showed in Pic. 15.
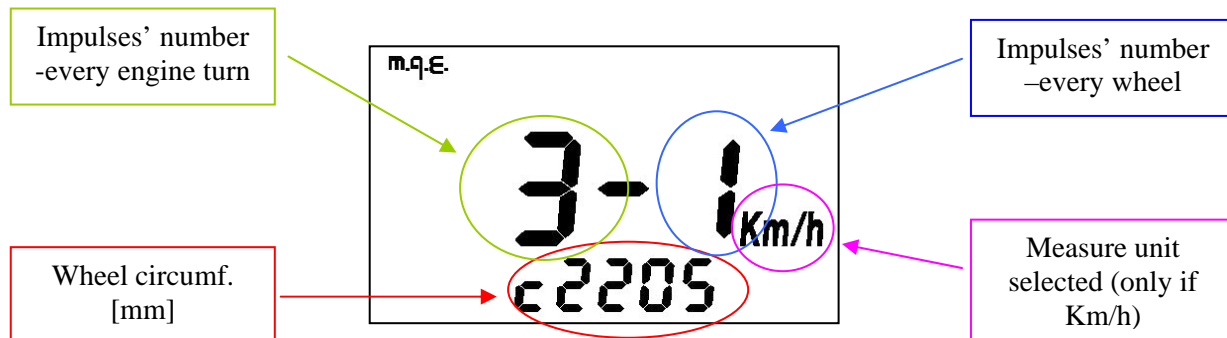
Pic.13 Third page

- During the visualization of the screens previously described, the system also checks the lights and the backlight: all the led will be ON (except of the neutral light: his check can be done directly by the user by positioning the gearshift on the neutral position). They will be switched off when the display check ends.
- After all the check, the system will show the normal visualization.

Obs. If during the start up phase the vehicle starts (speed>0), the instrumentation will interrupt the check and will immediately go to the standard operation mode.

10.0 Sleep-Mode

When the key is turned on the OFF position, the following operations will be done:
- Switching off of the display and the backlight.
- Switching off of all the led warning that are switched on.
- Entering in a sleep mode which has a low current consumption. In this phase the system stops every activities.

11.0 First Installation of the instrumentation

The default values of the instrumentation are:
- Circumference: 2.205 mm
- Measurement unit: Km/h for speed and Km for distance
- Impulses / Wheel turn: 1
- Impulses / engine turn: 1

To modify one of these parameters, see the [Set-Up](#) paragraph. During the first installation of the instrumentation the release date and the software version will be shown on the display.

Our Ref: Technical Manual RPU rev0.doc

12.0   E^{2}prom Erasing.

During the tests and the controls of the instrumentation, it's useful erasing the E^{2}prom memory. It's a procedure that should never be done by the user (in fact it needs that the vehicle battery or its fuse will be taken off).

To enter this procedure see following statements:

- take off the instrumentation from vehicle battery
- connect the cable related to input #10 to the ground
- press the button mode
- restore the connection with the vehicle battery keeping pressed the mode button

Now the system provides to reset all the data in the E^{2}prom memory and then returns to the normal condition (standard operatives mode).

DO NOT communicate this procedure to the user.
Erased Data CANNOT BE recovered.

13.0   AUTOMATIC TEST PROCEDURE

It's an useful procedure to verify the instrumentation through an automatic equipment. To enter this procedure see following statements:

- take off the instrumentation from the vehicle battery
- connect cables #8 and #10 to the ground
- press the button mode
- restore the connection with the vehicle battery

Now the system provides to the cyclic visualization (till 10 consecutives cycles) on the display of three steps that, suitably acquired and interpolated, allow the test of all the segments. At the end of the step, the visualization of the following step will happen through the pushing of the mode button. After 10 steps, the instrumentation will be forced to start (the same as if it was connected to the vehicle battery for the first time).

➢ Step1: Visualization of the speed and total distance covered
➢ Step2: Switching off of all the segments of the display (except of MAE logo that is always switched on)
➢ Step3: Switching on of all display segments

Our Ref: Technical Manual RPU rev0.doc

14.0 ELECTRICAL FEATURES

Maximum working features

Param. No.	Feature	Symbol	Min.	Max	Units
PM1	Max working voltage	V_{MAX}	—	17	V
PM2	Storage Temperature	T_{Sto}	-20	+85	°C
PM3	Max supplied current from pin 16	I_{Hall}		20	mA
PM4	Max current applicable to inputs	I_{InMax}	—	20	mA
PM5	Max current applicable to ouputs	I_{outMax}	—	20	mA

Normal working features

Param. No.	Feature	Simbol	Min.	Typ.	Max	Units
PO1	Supply voltage	V_{DD}	6,0[1]	12,0	16,0	V
PO2	Operative Temperature	T_{Op}	-20	—	+80	°C
PO3	Current absorption during On with all the light switched on (Vbatt=13,0V)	I_{on}	—	259,10	280,0	mA
PO4	Current absorption during On with all the light switched off (Vbatt=13,0V)	I_{on_spie}	—	105,10	110,0	mA
PO5	Current absorption during Sleep (Vbatt=13,0V)	I_{slp}	—	0,36	1,0	mA

[1]This parameter expresses the minimum voltage value which is applicable to the input, that does not compromise the correct working of the instrumentation; at this value the optoelectronic components (lights and backlights) are switched off.

ATTACHEMENT 1: CONNECTOR PIN OUT CONFIGURATION.
The connector is directly placed on the bottom side of the board.
Model: Molex cod. 39-28-1183 (cod. male) - 18 ways

Pos.	Meaning	Pos.	Meaning
1	Indicator	10	Water drill
2	Indicator	11	Key (P15)
3	Neutral	12	RPM
4	High Beam	13	GND
5	Hall sensor input	14	Positive Battery
6	Mode button (n.o. max 5V)	15	GND Hall sensor
7	NC	16	Vcc Hall sensor
8	Oil	17	NC
9	Fuel	18	NC

18 CKTS.

Male figure – Female insertion side.

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