Handheld Meteorological Station
RVM 96C

Ljubljana, 2005

CONTENTS

INTRODUCTION

Handheld meteorological station **RVM 96C** is a truly portable instrument for measuring, recording and reporting four basic meteorological parameters:

Wind speed and direction
Temperature
Atmospheric pressure
Relative humidity

In addition, instrument measures its horizontal orientation by means of an integrated electronic compass.

Its highlights are:

- Built-in electronic compass; accurate wind direction data without need for instrument orientation
- Illuminated LC display, capable of presenting current and historic data in numeric and graphic form
- Built-in calculations of mean values and extremes in selectable time intervals
- Scalar and vector wind processing
- Built-in storage of statistic data in the permanent internal memory (EEPROM) for 2048 intervals; data are not lost even when battery is empty or removed.
- Serial transmission of current and average data to the external computer
- High capacity rechargeable Li-ion battery

When in measuring mode, RVM 96C shows on its graphic LCD, depending on the selection, one of the following types of measured data:

- Instant data
- Average data of the last data processing interval
- Minimums of the last data processing interval
- Maximums of the last data processing interval

Operation parameters are selected and set through the menu-organized commands. Settings and constants are stored in EEPROM, so that they are unchanged when instrument is switched off and even when internal battery is removed.

At the end of each data processing interval, mean values and extremes are stored with time stamps to the EEPROM data storage. These data can be reviewed later on the display or transmitted serially to the external computer. RVM 96C can store data for up to 2048 data processing intervals. This means, that data for 85 days are stored, provided that data processing interval is set to 1 hour. Data are stored on FIFO principle (first in – first out – oldest data are replaced by the newest).

OPERATION

To switch RVM 96C on, press **ON**. LCD is initialized and microprocessor tested, followed by test of memory content. If memory error is detected, message *EEPROM ERROR* is shown on LCD and default values are restored. In this case, all constants and settings, different from the default ones, should be reentered. Under normal conditions, this situation should never appear.

Operation of RVM 96C is controlled by keyboard; some of the keys have double functions: upper ones are used in the measuring mode ("RUN MODE"), lower are used when operating in the menu mode. Keyboard layout is shown on the following picture:

```
        12/11/04   2:51  AVG
        Comp  :    155° SE
        Speed :     2.4 m/s
         Dir  :    134°Scal
        Temp  :    21.5°
        RH    :     43 %
        Press :   961.1mb
```

| MENU SET | AVG UP | MIN DOWN |
| ON LON | OFF | MAX BACK |
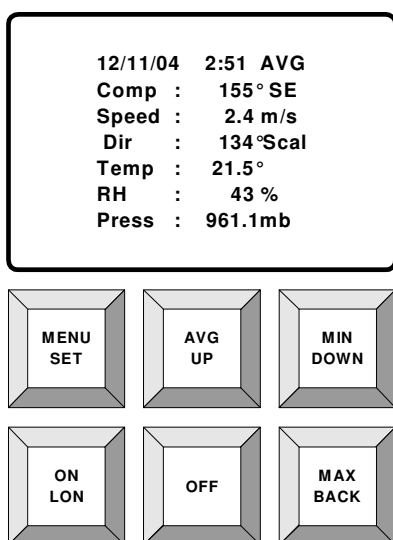
MENU / SET ... enter menu mode / confirm function
AVG / UP   ... show average values / UP in menu
MIN / DOWN ... show minimums / DOWN in menu
ON / LON   ... switch instrument ON / display illumination ON - OFF
OFF   ... switch instrument OFF
MAX/BACK ... show maximums / BACK in menu

After initialization, RVM 96C starts to measure in "RUN MODE" and display instant data according to the selected display type (MENU – DISPLAY TYPE). There are three possible types of displaying data:

Alphanumeric   Instrument - Alpha   Graphic - Alpha

```
13:15:33  [low]  INS
Comp  :    155° SE
Speed :     2.4 m/s
Dir   :    134°Scal
Temp :    21.5°
RH    :     43 %  ⇧
Press :  961.1mb
```

```
12/11/04   2:51  INS
0    m/s    20  Sca
                 2.4
Dir.°      Scal
                 130
S  W  N  E  S
                 165
```

```
12/11/04   2:51  INS
-20  0  ℃    40
                 21.4
0        %    100
                 42.6
850    mb   1050 ⇧
                 961
```

```
12/11/04   2:51  INS
0    m/s    20  AVG
                 2.4
                MAX
                 2.6
                MIN
                 2.3
```
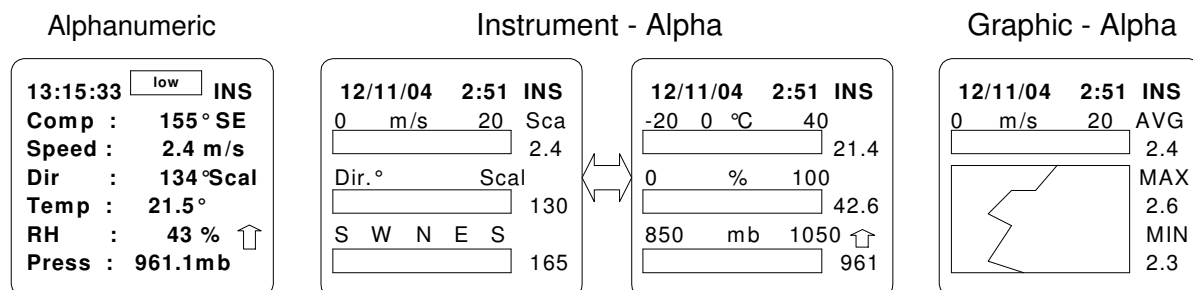
Comp.	Horizontal orientation of the instrument (compass)
Speed	Wind speed (m/s, knots, km/h or mph)
Dir	Wind direction in degrees.
Temp	Air temperature (ºC or º F).
RH	Relative humidity (%).
Press	Atmospheric pressure (mb).

Abbreviation **INS** in the upper right corner of the display marks, that instrument shows instant data; they are refreshed every second.

In the "RUN MODE", we can switch from displaying instant data to the average, minimum or maximum values, by pressing keys **AVG**, **MIN** or **MAX** respectively. All these keys, when pressed again, return instrument to display instant values.

Formats of displays in AVG, MIN or MAX mode are identical to formats of instant data; type of the displayed data is marked only by an abbreviation in the upper right corner of the display:

INS: ... instant values
AVG: ... average values
MIN: ... minimums
MAX: ... maximums

Average data of the last interval

Press key **AVG** (Average). LCD shows (depending on the selected display type):

Alphanumeric	Instrument - Alpha	Graphic - Alpha

```
 Alphanumeric                    Instrument - Alpha                 Graphic - Alpha

13:15:33 [low] INS      12/11/04  2:51 INS    12/11/04  2:51 INS    12/11/04  2:51 INS
Comp :   155°SE         0   m/s    20  Sca    -20  0  ℃    40        0   m/s    20  AVG
Speed :  2.4 m/s        ┌──────────┐  2.4     ┌──────────┐  21.4    ┌──────────┐  2.4
Dir   :  134°Scal       Dir.°      Scal  ⟷    0      %   100                    MAX
Temp :   21.5°          ┌──────────┐  130     ┌──────────┐  42.6                2.6
RH   :   43 %  ⇧        S  W  N  E  S         850   mb  1050 ⇧                   MIN
Press :  961.1mb        ┌──────────┐  165     ┌──────────┐  961                 2.3
```

Shown are average values from the last averaging interval. Until end of the first averaging interval, all values are zero. Data are refreshed at the end of each averaging interval (e.g., if averaging interval is set to 30 min, each half an hour).

To return to display instant values, press **AVG** again. By pressing keys **MIN** or **MAX**, it is possible to display minimums or maximums directly.

Minimums of the last interval

Press key **MIN** (Minimums). LCD shows (depending on the selected display type):

Alphanumeric	Instrument - Alpha	Graphic – Alpha
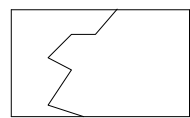
```
┌─────────────────────┐   ┌─────────────────────┐ ┌─────────────────────┐   ┌─────────────────────┐
│ 12/11/04      MIN   │   │ 12/11/04  2:51 MIN  │ │ 12/11/04  2:51 MIN  │   │ 12/11/04  2:51 MIN  │
│ Comp :    155°SE    │   │ 0   m/s    20  Sca  │ │ -20  0  ℃    40     │   │ 0    m/s   20  AVG  │
│ Speed :   2.4 m/s   │   │ ┌─────────────┐ 2.4 │ │ ┌─────────────┐21.4 │   │ ┌─────────────┐ 2.4 │
│ Dir   :   134°Scal  │   │ Dir.°     Scal      │ │ 0       %    100    │   │ ┌─────────────┐ MAX │
│ Temp :    21.5°     │   │ ┌─────────────┐ 130 │ │ ┌─────────────┐42.6 │   │              2.6    │
│ RH    :   43 %  ⇧   │   │ S  W  N  E  S       │ │ 850    mb  1050 ⇧   │   │              MIN    │
│ Press :   961.1mb   │   │ ┌─────────────┐ 165 │ │ ┌─────────────┐ 961 │   │              2.3    │
└─────────────────────┘   └─────────────────────┘ └─────────────────────┘   └─────────────────────┘
```

Shown are minimum values from the last averaging interval. Until end of the first averaging interval, all values are zero. Data are refreshed at the end of each averaging interval (e.g., if averaging interval is set to 30 min, each half an hour).

To return to display instant values, press **MIN** again. By pressing keys **AVG** or **MAX**, it is possible to display average values or maximums directly.

Maximums of the last interval

Press key **MAX** (Maximums). LCD shows (depending on the selected display type):

Alphanumeric	Instrument - Alpha	Graphic - Alpha.
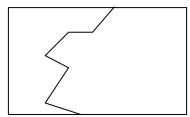
```
┌─────────────────────┐   ┌─────────────────────┐ ┌─────────────────────┐   ┌─────────────────────┐
│ 12/11/04      MAX   │   │ 12/11/04  2:51 MAX  │ │ 12/11/04  2:51 MAX  │   │ 12/11/04  2:51 MAX  │
│ Comp :    155°SE    │   │ 0   m/s    20  Sca  │ │ -20  0  ℃    40     │   │ 0    m/s   20  AVG  │
│ Speed :   2.4 m/s   │   │ ┌─────────────┐ 2.4 │ │ ┌─────────────┐21.4 │   │ ┌─────────────┐ 2.4 │
│ Dir   :   134°Scal  │   │ Dir.°     Scal      │ │ 0       %    100    │   │ ┌─────────────┐ MAX │
│ Temp :    21.5°     │   │ ┌─────────────┐ 130 │ │ ┌─────────────┐42.6 │   │              2.6    │
│ RH    :   43 %  ⇧   │   │ S  W  N  E  S       │ │ 850    mb  1050 ⇧   │   │              MIN    │
│ Press :   961.1mb   │   │ ┌─────────────┐ 165 │ │ ┌─────────────┐ 961 │   │              2.3    │
└─────────────────────┘   └─────────────────────┘ └─────────────────────┘   └─────────────────────┘
```

Shown are maximum values from the last averaging interval. Until end of the first averaging interval, all values are zero. Data are refreshed at the end of each averaging interval (e.g., if averaging interval is set to 30 min, each half an hour).

To return to display instant values, press **MAX** again. By pressing keys **AVG** or **MIN**, it is possible to display average values or minimums directly.

Storing data to EEPROM memory

Regardless of the type of the displayed current data, data are stored in the EEPROM memory at the end of each averaging interval. Historic data from this memory can be reviewed later on the RVM 96C, or sent to the external computer. Data are not stored, if RVM 96C is not in the measuring mode (during setting of the internal parameters or reviewing stored data). To prevent unnecessary loss of data, instrument automatically returns to the measuring mode, when operator does not press any key for more than 30 seconds (excluding "OFF" key).

DATA PROCESSING

Processing of temperature, relative humidity and atmospheric pressure data

Air temperature and relative humidity are measured by the combined SHT75 sensor that has internal 14 bit A/D converter and uses temperature data also for the temperature compensation of RH measurements.

Atmospheric pressure is measured by the temperature-compensated INTERSEMA MS5534A sensor with 15 bit internal A/D converter.

Wind speed is measured by optoelectronic stroboscope with frequency output from 0 – 1000 pulses / sec. for the wind speeds 0 – 50 m/s.

Wind direction vane has 6 bit Gray-code optoelectronic encoder (resolution 5.63°).

Horizontal orientation of RVM 96C is measured by VECTOR 2X electronic compass, with the resolution 1° and accuracy 2° RMS.

For each measurement of temperature, relative humidity and atmospheric pressure, an average value of N samples, sampled with the approximate frequency of 10 Hz, is calculated through the measurement interval (e.g. 1 second). Instant value (as shown on the display) for each of these parameters is:

$$X = \frac{1}{N} \sum_{i=1}^{i=N} A_{(i)}$$

Where N represents number of samples in the measurement interval, $A_{(i)}$ particular sample and X measurement value. X is thus an average value over the measurement interval; oscillations of particular samples are smoothed.

Wind speed is measured by counting pulses through measurement interval, which also represents an input smoothing.

Wind direction and horizontal orientation (compass) are measured simultaneously each second.

At the end of each averaging interval, mean values of temperature, relative humidity and atmospheric pressure are calculated:

$$\overline{X} = \frac{1}{M} \sum_{j=1}^{j=M} X_{(j)}$$

Where M represents number of measurement values in the averaging interval, $X_{(j)}$ particular measurement value and $\overline{X}$ average value in the averaging interval.

Minimums and maximums are defined as minimal and maximal measurements in the averaging interval:

$$X_{min} = \Big|_{j=1}^{j=M} \min(X_{(j)}) \quad \text{and} \quad X_{max} = \Big|_{j=1}^{j=M} \max(X_{(j)})$$

Processing of wind data

Wind is described with its speed and direction. Wind data can be processed by RVM 96C in scalar or vector mode.

a.) Scalar wind processing:

Average scalar wind speed is calculated as arithmetic average value of measured wind speeds in averaging interval:

$$\overline{v} = \frac{1}{M} \sum_{j=1}^{j=M} v_{(j)}$$

Where M represents number of measurement values in the averaging interval, $v_{(j)}$ particular measured wind speed and $\overline{v}$ average scalar wind speed in the averaging interval.

For wind direction, we define "prevailing wind direction" as a direction of wind that occurred most of times during the averaging interval. Since 6-bit Gray code enables 64 different wind directions, RVM 96C forms a histogram by counting occurrences for each direction in the averaging interval. Wind direction, where the histogram has its maximum, is a prevailing wind direction.
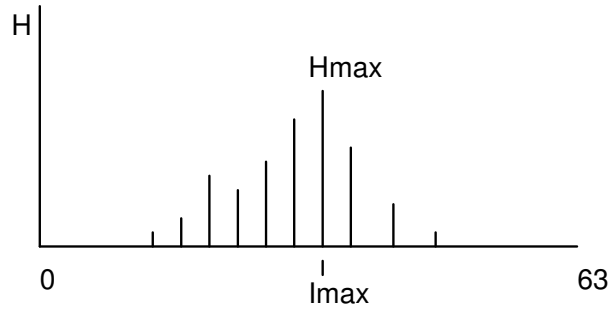
b.) Vector wind processing:

In it`s nature, wind is vector, defined by magnitude (speed) and direction. RVM 96C performs also vector wind data processing. In this case, each measured wind vector is decomposed to it`s x and y component, v_x and v_y:

$$v_{x(j)} = v_{(j)} * \sin(\varphi_{(j)})$$

$$v_{y(j)} = v_{(j)} * \cos(\varphi_{(j)})$$

At the end of averaging interval, average x and y components of wind speed are calculated as:

$$\bar{v}_x = \frac{1}{M} \sum_{j=1}^{j=M} v_{x(j)} \text{ and } \bar{v}_y = \frac{1}{M} \sum_{j=1}^{j=M} v_{y(j)}$$

From there, RVM 96C calculates absolute value of the resultant vector wind speed:

$$|\vec{v}| = \sqrt{\bar{v}_x^2 + \bar{v}_y^2}$$

and the corresponding angle:

$$\varphi = \arctan\left(\frac{\bar{v}_x}{\bar{v}_y}\right)$$

Direction of wind vector $\varphi(\vec{v})$ is finally determined with the following relations:

$\bar{v}_x > 0$	$\bar{v}_y > 0$	$\varphi(\vec{v}) = \varphi$
$\bar{v}_x > 0$	$\bar{v}_y \leq 0$	$\varphi(\vec{v}) = 180-\varphi$
$\bar{v}_x \leq 0$	$\bar{v}_y \leq 0$	$\varphi(\vec{v}) = 180+\varphi$
$\bar{v}_x \leq 0$	$\bar{v}_y > 0$	$\varphi(\vec{v}) = 360-\varphi$

c.) Minimum and maximum wind:

Minimum and maximum wind values are defined as wind samples, where minimal and maximal wind speeds were measured during the averaging interval, with the appropriate wind directions:

$$v_{min} = \Big|_{j=1}^{j=M} \min\big(v_{(j)}\big) \qquad \text{and} \qquad v_{max} = \Big|_{j=1}^{j=M} \max\big(v_{(j)}\big)$$

$$\varphi_{min} = \varphi\big(v_{min}\big) \qquad \text{and} \qquad \varphi_{max} = \varphi\big(v_{max}\big)$$

MENU SYSTEM OF RVM 96C

Operator can input constants and set operating parameters of RVM 96C by using the menu tree of the instrument. Keys on the keyboard have the following meanings:

SET   ... confirm the selection / input
UP   ... Go to the upper menu or increase numeric value
DOWN   ... Go to the lower menu or decrease the numeric value
BACK   ... return from the function / break the operation

By pressing SET/MENU, we enter the RVM 96C basic (root) menu

Use UP and DOWN keys to select the desired submenu or action, use SET to confirm the selection, use BACK to return to the previous selection. UP in DOWN keys can be used also to set the numeric values. They have auto-repeat feature; by keeping them pressed for more than 3 seconds auto repeat accelerates for the first, and by keeping them pressed for more than 7 seconds, for the second time.

For security reasons, "MATH PARAMETERS" menu requires to enter the password number (set to **23**).

Overview of the menu-structure

Menu 9-1. (Alfanumeric)   RUN MODE   ... display data on alphanumeric screen
             (Instrument-alfa) NEXT PARAM   ... display data on instr.-alphan. screen
             (Graphic-Alfa)   SHOW PARAM   ... display data on graphic-alphan. screen
Menu 9-2: OPERATING PARAMETERS   ... set parameters for operation
Menu 9-3: SERIAL PARAMETER   ... set communication parameters
Menu 9-4: MATH PARAMETERS   ... set parameters for data processing
Menu 9-5: SET TIME DATE   ... set time and date
Menu 9-6: CLEAR ALL DATA   ... clear EEPROM memory
Menu 9-7: DISPLAY TYPE   ... select display mode
Menu 9-8: VIEW BUFFER   ... view historic data from memory
Menu 9-9: COMPASS CALIBRAT.   ... calibrate electronic compass

Description of the menus

Menu 9-2: Operating parameters

> **Enables configuration of RVM 96C operation and presentation of data**

```
┌─────────────────────┐
│ Run mode            │
│ Operating param     │
│ Serial param        │
│ Math parameters     │
│ Set Time            │
│ Clear all data      │
│ Display type        │
│ View buffer         │
│ Compass Calibrat    │
│      MAIN           │
└─────────────────────┘
         ⇕
┌─────────────────────┐        ┌─────────────────────┐
│ Average interval    │ ◄◄ ►►  │       1 min         │
│ Wind Disp. proc     │        │       2 min         │
│ Wind unit           │        │       5 min         │
│ Temperature unit    │        │      10 min         │
│ Direction calc.     │        │      30 min         │
│ Automatc OFF        │        │      60 min         │
│     OPERATING       │        │     AVERAGE         │
└─────────────────────┘        └─────────────────────┘
```

Select the data processing (averaging) interval

```
┌─────────────────────┐
│      Scalar         │
│      Vector         │
│       WIND          │
└─────────────────────┘
```

Select which average wind data (scalar or vector) are displayed on LCD. Regardless of this selection, both vector and scalar wind data are always stored in the database.

```
┌─────────────────────┐
│     Unit m/s        │
│     Unit Kn         │
│     Unit Km/h       │
│     Unit Mph        │
│     WIND Unit       │
└─────────────────────┘
```

Select the wind speed units; both for the display and for the RS 232 serial data transmission.

```
┌─────────────────────┐
│    °C Celsius       │
│    °F Fahrenheit    │
│     TEMP. Unit      │
└─────────────────────┘
```

Select the temperature units.

```
┌─────────────────────┐
│  Consider compass   │
│  Ignore Compass     │
│     DIR Calc        │
└─────────────────────┘
```

- Compute wind direction according to compass data
- Ignore compass data (instrument should be oriented manually)

```
┌─────────────────────┐
│   Automatc NO       │
│   Automatc YES      │
│    Power cont.      │
└─────────────────────┘
```

- no automatic switch-off
- automatic switch-off of RVM 96C if wind speed is 0 more than 10 minutes

Menu 9-3: Serial parameters

Set serial data communication mode

```
Run mode
Operating param
Serial param
Math parameters
Set Time
Clear all data
Display type
View buffer
Compass Calibrat
        MAIN
```

```
        300 bps
       1200 bps
       2400 bps
       4800 bps
       9600 bps
      19200 bps
      38400 bps
     115200 bps
        SPEED
```

```
   Speed

   Serial mode

     SERIAL
```

```
   Automatic
   On ext.command
     SERIAL OUT
```
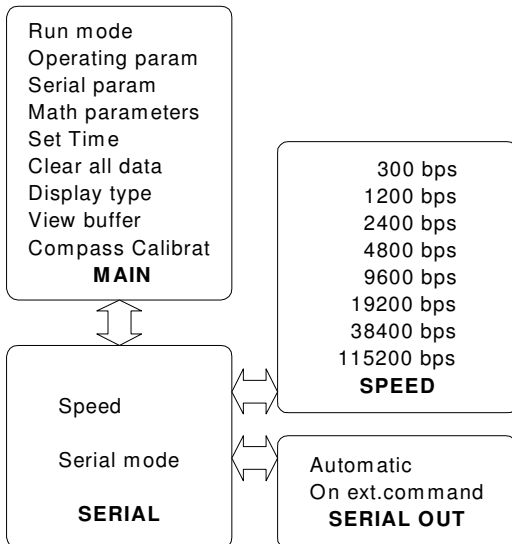
Set the serial transmission speed. Default value is **9600 bps**.

Automatic – send average data automatically at the end of each data processing interval

On ext. Command – pole average data

Menu 9-4: Math parameters

Set system and computational parameters

Run mode
Operating param
Serial param
Math parameters
Set Time
Clear all data
Display type
View buffer
Compass Calibrat
MAIN

Setting
PASSWORD
23
<SET> OK

PASSWORD to enter 9-4 menu. Using **UP** or **DOWN** keys, set password to **23**, then press **SET**.

Setting
TEMP. CALL [ ]
0.0
<SET> OK

Set the temperature bias. Example: **– 0.4** lowers temperature readings by 0.4 C in the entire range.

Setting
RH. CALL [%]
0.0
<SET> OK

Set the relative humidity bias. Example: **– 1.2** lowers RH readings by 1.2 % in the entire range.

Setting
DIRECTION CALL [ ]
0
<SET> OK

Correct wind direction in range from 0 to 359 dg. Primer: Example: **22** increases direction angle by 22 dg. Default value is 0!

Setting
PRESS CALL [mb]
0.0
<SET> OK

Set the atmospheric pressure bias. Example: **– 0,3** lowers pressure readings by 0,3 mbar in the entire range.

Battery voltage
Ub= 4.1 V
Press Set

Adjust measurement of battery voltage (normally in the range from **3.1** to **4.2V**).

Setting
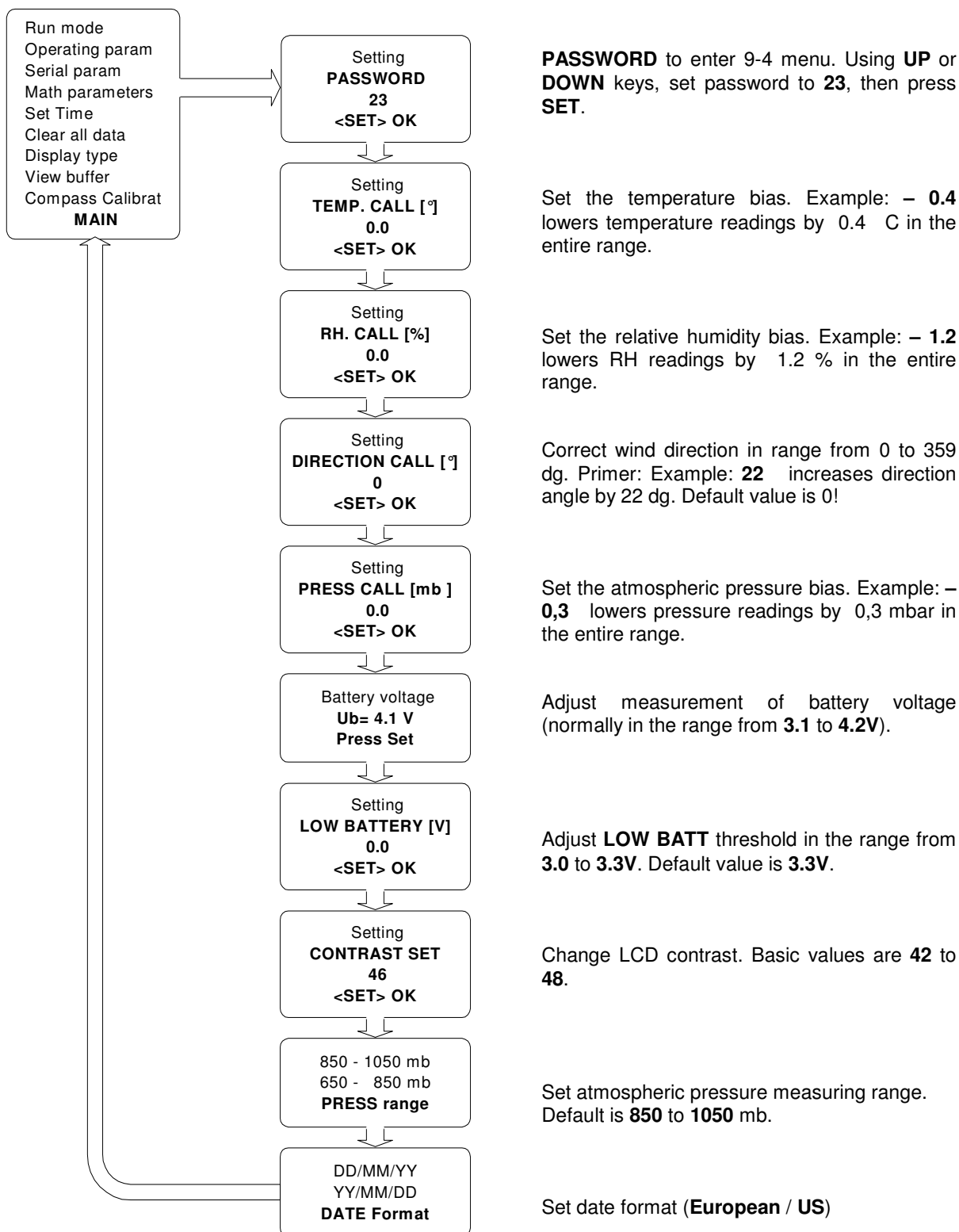**LOW BATTERY [V]**
0.0
<SET> OK

Adjust **LOW BATT** threshold in the range from **3.0** to **3.3V**. Default value is **3.3V**.

Setting
CONTRAST SET
46
<SET> OK

Change LCD contrast. Basic values are **42** to **48**.

850 - 1050 mb
650 - 850 mb
PRESS range

Set atmospheric pressure measuring range. Default is **850** to **1050** mb.

DD/MM/YY
YY/MM/DD
DATE Format

Set date format (**European** / **US**)

Menu 9-5: Set Time

Adjust date and time

```
Run mode
Operating param
Serial param
Math parameters
Set Time
Clear all data
Display type
View buffer
Compass Calibrat
      MAIN
```

```
        Setting
    DATE - TIME
Date: 5-01-05
Time: 12:01:44

      Select
```
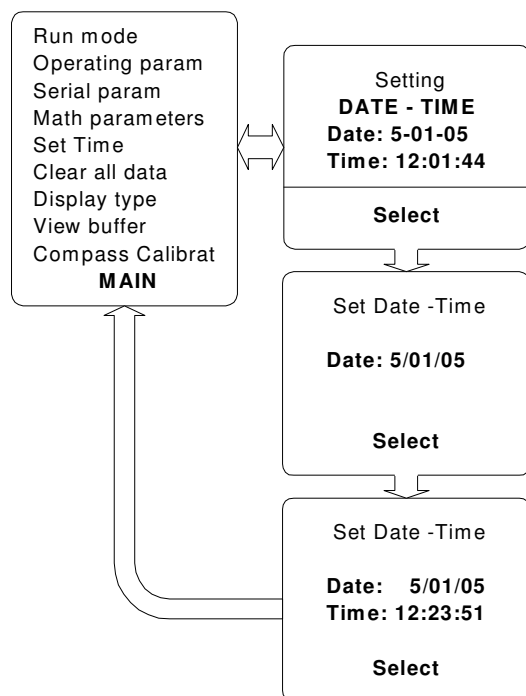
Actual DATE / TIME is shown. **BACK** exits from menu without altering the current data. To adjust TIME / DATA, press **SET**

```
   Set Date -Time

Date: 5/01/05

      Select
```

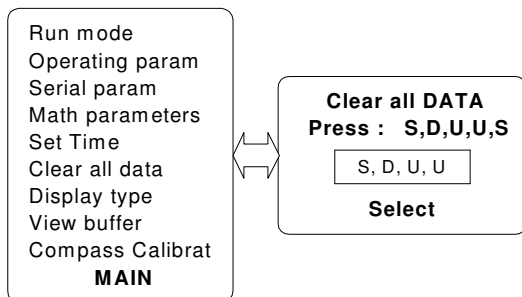Set DATE (by pressing **UP** or **DOWN**). For each correct value, press **SET**.

Set TIME in a same way.

```
   Set Date -Time

Date:   5/01/05
Time: 12:23:51

      Select
```

Display shows the adjusted DATE / TIME. When real time corresponds to the set value, press **SET** (thus starting a clock)

Menu 9-6: Clear all Data

Clear all data from the memory

```
Run mode
Operating param
Serial param
Math parameters
Set Time
Clear all data
Display type
View buffer
Compass Calibrat
      MAIN
```

```
  Clear all DATA
Press :  S,D,U,U,S
  ┌──────────────┐
  │ S, D, U, U   │
  └──────────────┘
      Select
```

Function erases all data that are stored in the internal EEPROM memory. For the security reasons, it is activated only with the following sequence of keys: **SET, DOWN, UP, UP, SET**. After this, EEPROM is completely erased (all stored data are lost!) and message "**Buffer cleared !** " appears on the screen.

RVM 96C has a circular database; when memory is full, the oldest data are automatically replaced with the newest. Clearing of the internal memory to make space for the data is thus not necessary.

Database can store from **2000 to 2048** intervals. Depending on the selected data processing interval, this means the storage for :
approx. 84 days at 1 h data processing interval
approx. 42 days at 30 min data processing interval
approx. 14 days at 10 min data processing interval
approx. 33 hours at 1 min data processing interval

Menu 9-7: Display type

> **Menu enables selection of different forms of displaying data.**

```
12/11/04   2:51   AVG
Comp  :      155° SE
Speed :      2.4 m/s
Dir   :      134°Scal
Temp  :      21.5°
RH    :      43 %      ⇧
Press :      961.1mb
```
Alphanumeric display

Instrument - alphanumeric display

```
Run mode
Operating param
Serial param
Math parameters
Set Time
Clear all data
Display type
View buffer
Compass Calibrat
        MAIN
```

```
Alfanumeric
Instrument-Alfa
Graphic-Alfa
   DISPLAY
```

```
12/11/04   2:51   AVG
0     m/s    20   Sca
                  2.4
Dir.°        Scal
                  130
S   W   N   E   S
                  165
```

```
12/11/04   2:51   AVG
-20  0  ℃    40
            1.4
0     %    100
            2.6
850    mb   1050   ⇧
            961
```

```
12/11/04   2:51   AVG
0     m/s    20   AVG
                  2.4
                  MAX
                  2.6
                  MIN
                  2.3
```
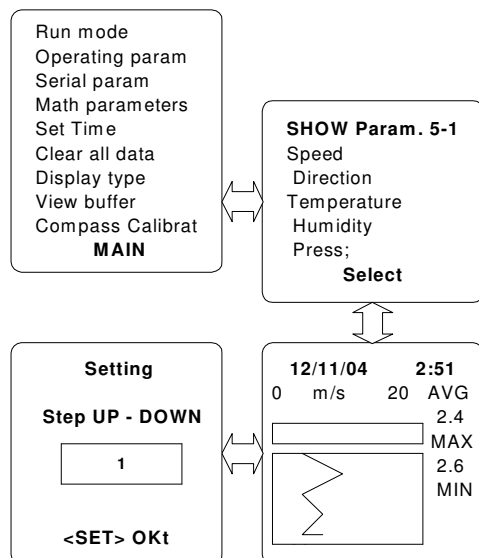Graphic – alphanumeric display

Alphanumeric display shows all measured data in a numeric form simultaneously on the same screen. Together with the atmospheric pressure data, tendency of pressure is shown by an arrow (at all display types - ↑ means increasing pressure, ↓ means decreasing pressure). To select alphanumeric type of display, go to the **Display type** menu, select **Alphanumeric**, press **SET** and than press **BACK.**

Instrument-alphanumeric display shows measured data both graphically on a horizontal scale (like an analog instrument) and also in the numeric form. To select this type of display, go to the **Display type** menu, select **Instrument-Alpha**, press **SET** and than press **BACK.** There are two screens of this type. First shows temperature, humidity and atmospheric pressure on the same screen, while the other shows wind and compass data. Toggling between both (**Wind param**. and **Next param**.) is done by pressing **SET** twice

Graphic-alphanumeric display shows one parameter at the time. In the upper part of the screen there is a horizontal analog scale and a numeric value. Lower part of the screen shows graph of the measured values of the selected parameter. To select this type of display, go to the **Display type** menu, select **Graphic-Alpha**, press **SET** and than press **BACK.** To select the parameter, press **SET** (**Show param**.), pres **SET** again, select the parameter (**UP** / **DOWN**) and confirm by **SET**.

Menu 9-8: Wiew buffer

Review data from the internal database

```
Run mode
Operating param
Serial param
Math parameters
Set Time
Clear all data
Display type
View buffer
Compass Calibrat
    MAIN
```

```
SHOW Param. 5-1
Speed
 Direction
 Temperature
 Humidity
 Press;
        Select
```

```
    Setting

Step UP - DOWN

       1

   <SET> OKt
```

```
12/11/04    2:51
0   m/s    20  AVG
                2.4
                MAX
                2.6
                MIN
```
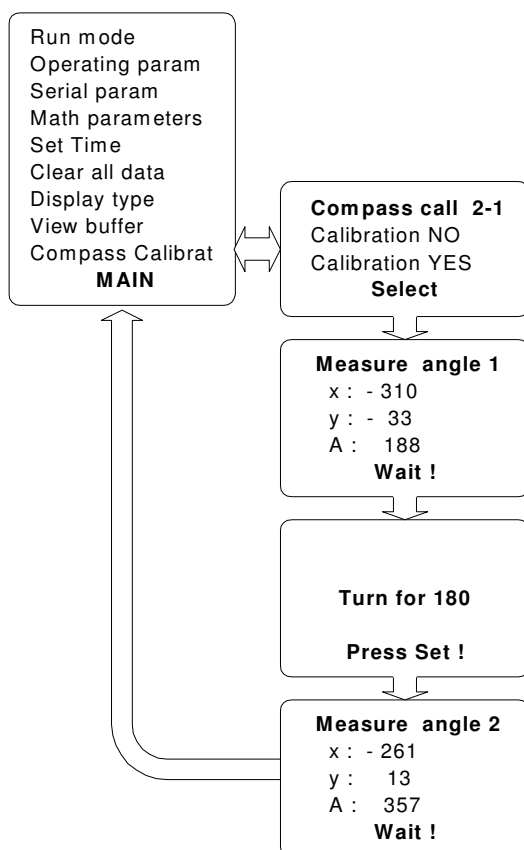
Statistical data are transferred to the internal database at the end of each data processing interval (date, time, average values, minimums, maximums, wind scalar and vector data). Maximum 2048 data intervals could be stored in the database on the FIFO principle.

Select parameter and press **SET**. Last 36 intervals are shown with marker at the last computed interval. By pressing **UP** / **DOWN** marker (and data presentation) slide through the time. To change the step of the marker, pres **SET,** change step by **UP** / **DOWN** (in number of data-processing intervals, 1 to 36), confirm by **SET**. By pressing **BACK** we can choose different parameter or by pressing **BACK** again, exit from the **View buffer** menu.

Menu 9-9: Compass Calibrat

Calibrate the internal compass

```
Run mode
Operating param
Serial param
Math parameters
Set Time
Clear all data
Display type
View buffer
Compass Calibrat
    MAIN
```

```
Compass call  2-1
Calibration NO
Calibration YES
    Select
```

```
Measure  angle 1
 x : - 310
 y : - 33
 A :   188
       Wait !
```

```
   Turn for 180

   Press Set !
```

```
Measure  angle 2
 x : - 261
 y :   13
 A :   357
       Wait !
```

When using RVM 96C in the vicinity of a considerable mass of feromagnetics, built-in electronic compass should be calibrated.

1. Select **Compass Calibrat** menu. Orient instrument in an arbitrary direction, put it in a vertical position, select **Calibration YES** and press **SET**. Screen shows **x** and **y** coordinates and the computed angle **A**. Leave instrument in the same position, until **Turn for 180** appears on the display. Turn instrument for 180º and press **SET** again. Screen again shows **x** and **y** coordinates and the computed angle **A.** Wait for RVM 96C to return to the basic menu; then calibration of the compass is completed.

2. Selecting **Calibration NO** and pressing **SET** returns instrument to the basic menu without calibration of the compass (the same is achieved by pressing **BACK**)

On returning to the surroundings without feromagnetics in vicinity, be sure to re-calibrate compass again!!!

19

DATA TRANSFER

RVM 96C has RS 232 serial interface. Use RS 232 cable to connect instrument to the COM port of the external computer. **Tx, Rx,** and **GND** pins are used; transfer distance can be 15 m max.

Serial communication

RVM 96C enters serial communication mode by receiving **<CR>** (carriage return) on the serial line. External computer should use an appropriate terminal program (e.g. HyperTerminal, Tera Term, etc.) with the following settings:

COM	**X**	COM port to which RS 232 cable is connected (X = 1, 2, ...)
Baud rate	**XXXX**	Transmition speed, to which RVM 96C is set (by default 9600), could be XXX=1200, 2400, 4800, 9600, 19200, 38400 and 115200 bps.
Data:	**8**	
Parity:	**none**	
Stop:	**1**	
Flow control: none		

After receiving <CR>, **'Local_$'** is printed, meaning the **'Local terminal operation**'. The following commands can be typed to RVM 96C:

----- **USER COMMAND**   -----

ECHO	Set echo =>ON =>OFF
TIME	Return time-date
STIME H:M:S D/M/Y	Set time-date
PINS	Return instant data
PAVG	Return last average data
PAGE n	Return last n records
PALL	Return all records from the database
P10 n	Return last n records for temperature
P35 n	Return last n records for relative humidity
P47 n	Return last n records for atmospheric pressure
P100 n	Return last n records for wind
LOGON	Start logging
LOGOFF	Stop logging
ERASE	Erase all records !!!

Each command should be terminated by <CR> (=<ENTER>) !!!

Description of commands

ECHO <ON, OFF>
ECHO ON makes all typed commands visible on the terminal screen
ECHO OFF makes commands invisible on the terminal screen

Default RVM 96C setting is ECHO OFF.

Example: ECHO ON <CR>

TIME
Returns current time and date

Example: TIME <CR>

RVM 96C answers:
12:37:46 31/08/04

STIME <H:M:S D/M/Y>
Set time and date

Exampler: STIME 12:37:46 31/8/4 <CR>

PINS
Transfer instant data (data in **bold** are returned by RVM 96C)

Example: PINS <CR>

Date	Time	Speed	Unit	Direction	Pressure (mb.)	Temp.	Unit	RH (%)	Chksum
5:01:05	**6:04:12**	**0.0**	**m/s**	**158**	**962.2**	**22.8**	**C**	**34.4**	**255**

PAVG
Transfer average data from the last interval (data in **bold** are returned by RVM 96C).

Example: PAVG <CR>

Date	Time	scal	Speed vect	min	max	Unit	Direction scal	vect	Pressure mb avg	min	max	Temp. avg	min	max	Unit	RH % avg	min	max	Chks
3:01:05	**2:36**	**1.4**	**1.0**	**0.0**	**9.8**	**m/s**	**56**	**97**	**962.7**	**962.5**	**962.9**	**22.2**	**22.1**	**22.3**	**C**	**35.7**	**34.2**	**37.2**	**099**

PAGE <nnnnn>
Transfer average data from the last <nnnn> intervals (data in **bold** are returned by RVM 96C).

Example: PAGE 3 <CR>

Date	Time	scal	Speed vect	min	max	Unit	Direction scal	vect	Pressure mb avg	min	max	Temp. avg	min	max	Unit	RH % avg	min	max	Chks
3:01:05	**2:36**	**1.4**	**1.0**	**0.0**	**9.8**	**m/s**	**56**	**97**	**962.7**	**962.5**	**962.9**	**22.2**	**22.1**	**22.3**	**C**	**35.7**	**34.2**	**37.2**	**099**
3:01:05	**2:35**	**0.0**	**0.0**	**0.0**	**0.0**	**m/s**	**163**	**0**	**963.1**	**962.9**	**963.3**	**22.2**	**22.2**	**22.3**	**C**	**33.7**	**33.6**	**33.9**	**057**
3:01:05	**2:34**	**0.0**	**0.0**	**0.0**	**0.0**	**m/s**	**163**	**0**	**963.0**	**962.8**	**963.2**	**22.2**	**22.2**	**22.2**	**C**	**33.7**	**33.7**	**33.8**	**052**

PALL
Transfer all data from the database (from latest to the oldest). Data in **bold** are returned by RVM 96C.

Example: PALL <CR>

		Speed					Direction		Pressure mb			Temp.				RH %			
Date	*Time*	*scal*	*vect*	*min*	*max*	*Unit*	*scal*	*vect*	*avg*	*min*	*max*	*avg*	*min*	*max*	*Unit*	*avg*	*min*	*max*	*Chks*
3:01:05	**2:36**	**1.4**	**1.0**	**0.0**	**9.8**	**m/s**	**56**	**97**	**962.7**	**962.5**	**962.9**	**22.2**	**22.1**	**22.3**	**C**	**35.7**	**34.2**	**37.2**	**099**
3:01:05	**2:35**	**0.0**	**0.0**	**0.0**	**0.0**	**m/s**	**163**	**0**	**963.1**	**962.9**	**963.3**	**22.2**	**22.2**	**22.3**	**C**	**33.7**	**33.6**	**33.9**	**057**
3:01:05	**2:34**	**0.0**	**0.0**	**0.0**	**0.0**	**m/s**	**163**	**0**	**963.0**	**962.8**	**963.2**	**22.2**	**22.2**	**22.2**	**C**	**33.7**	**33.7**	**33.8**	**052**

......
......
Till the end of the database or until <**ESC**> is pressed.

Transfer can be temporary suspended and later resumed by pressing <**SPACE**>.

P10 <nnnnn>
Transfer last <nnnnn> intervals, temperature data only. Data in **bold** are returned by RVM 96C.

Example: P10 <nnnn> <CR>

Parameter					*Unit*	*Chks*
	Date	*Time*	*avg*	*min*	*max*	
P10	**1:01:05**	**6:30**	**22.9**	**22.9**	**22.9**	**C**	**114**
P10	**1:01:05**	**6:29**	**22.9**	**22.9**	**22.9**	**C**	**122**
P10	**1:01:05**	**6:28**	**22.9**	**22.9**	**22.9**	**C**	**121**

P35 <nnnnn>
Transfer last <nnnnn> intervals, RH data only. Data in **bold** are returned by RVM 96C.

Example: P35 <nnnn> <CR>

Parameter					*Chks*
	Date	*Time*	*avg*	*min*	*max*	
P35	**1:01:05**	**6:38**	**34.0**	**33.9**	**34.1**	**044**
P35	**1:01:05**	**6:37**	**33.8**	**33.7**	**34.1**	**048**
P35	**1:01:05**	**6:36**	**34.0**	**33.9**	**34.1**	**042**

P47 <nnnnn>
Transfer last <nnnnn> intervals, atm. pressure data only. Data in **bold** are returned by RVM 96C.

Example: P47 <nnnn> <CR>

Parameter					*Chks*
	Date	*Time*	*avg*	*min*	*max*	
P**47**	**1:01:05**	**6:40**	**961.3**	**960.7**	**961.7**	**122**
P47	**1:01:05**	**6:39**	**961.3**	**961.0**	**961.6**	**123**
P47	**1:01:05**	**6:38**	**961.4**	**961.1**	**961.8**	**126**

P100 <nnnnn>
Transfer last <nnnnn> intervals, wind data only. Data in **bold** are returned by RVM 96C.

Example: P100 <nnnn> <CR>

Parameter		**Hitrost**	**Avg**			**Enota**		**smer**	**Chc**
	Datum	**Ura**	**Scal**	**Vect**	**min**	**max**	**Scal**	**Vect**	
P100	**1:01:05**	**6:41**	**0.0**	**0.0**	**0.0**	**0.0 m/s**	**157**	**0**	**175**
P100	**1:01:05**	**6:40**	**0.0**	**0.0**	**0.0**	**0.0 m/s**	**157**	**0**	**174**
P100	**1:01:05**	**6:39**	**0.0**	**0.0**	**0.0**	**0.0 m/s**	**157**	**0**	**182**

AUTOMATIC printout (set from the **Serial param. -> Serout mode** menu)
With this setting, RVM 96C sends data automatically at the end of each data processing interval, without polling

Format of data is equal as with **PAVG** command:

			Speed				**Direction**		**Pressure mb**			**Temp.**				**RH %**			
Date	*Time*	*scal*	*vect*	*min*	*max*	*Unit*	*scal*	*vect*	*avg*	*min*	*max*	*avg*	*min*	*max*	*Unit*	*avg*	*min*	*max*	*Chks*
3:01:05	**2:36**	**1.4**	**1.0**	**0.0**	**9.8**	**m/s**	**56**	**97**	**962.7**	**962.5**	**962.9**	**22.2**	**22.1**	**22.3**	**C**	**35.7**	**34.2**	**37.2**	**099**

LOGON
Store data in the internal database.

Exampler: LOGON <CR>

LOGOFF
Stop storing data to the internal database. Storing of data is resumed with the <**LOGON**> command, or by turning RVM 96C OFF / ON.

Example: LOGOFF <CR>

DISPLAY ILLUMINATION

Backlit LCD is illuminated for few seconds whenever a key on the keyboard is pressed. Display illumination can be turned on permanently by pressing **LON** key. Successive press on the **LON** turns the permanent display illumination off.

POWER SUPPLY

RVM 96C has built-in Li-ion accumulator battery. Supplied is also the appropriate battery charger (230V AC / 6-12V, 500mA), that can be used as an external power supply.

RVM 96C can also be powered from the external DC source 6 – 12 V DC, connected to the battery connector (5.5 mm / 2 mm).
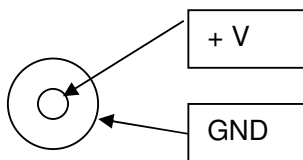
Powering from the internal battery

In the handle, RVM 96C has **3.6 V** / **1000 mAh Li-ion** accumulator battery. Capacity of the internal battery enables instrument to continuously operate without display illumination for 30 hours.

When battery voltage drops to **3.3 V** (adjustable in **Math parameters** menu), **LOW** warning starts to blink on the display. Connect instrument to battery charger!

When battery voltage falls to **3.0 V,** RVM 96C shows the following screen:
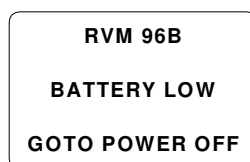
and shuts itself off after **1** second, to prevent over discharge of battery and loss of date / time information. It is not possible to turn instrument on again, unles the battery is charged.

Charging the battery

Connect charger to the instrument and plug it in the mains socket. When battery indicator shows full battery and stops showing charging, Li-ion accumulator is fully charged.

MOUNTING RVM 96C TO THE PHOTOGRAPHIC TRIPOD

RVM 96C can be easily mounted to any photographic tripod; for this purpose, instrument has on the bottom of its handle a standard nut.

CAUTION

When leaving the instrument outside, care should be taken, that it is not exposed to the excess moisture or rain (or that it is externaly protected against the precipitation).

TECHNICAL DATA

Dimensions	300 mm * 220 mm * 80 mm
Mass	0.6 kg
Operating temperature range	-30 to +50 dg. C
Protection	Al closed case
Display	LCD, graphic 98x65, illuminated
Connectors	3.5 stereo RS232, 2,1x5.5 battery
Keyboard	Sealed, flat
Power supply	Built-in 3.6 V LI-ion battery
Autonomy	30 h
Power consumption	19 mA
Separate battery charger	voltage and current limiter
Data transmission	RS232, serial, adjustable speed, 8 bits, 1 STOP bit, no parity
Distance for serial data transmission	RS232: 15 m max

Sensors:

Atmospheric Pressure

Producer of sensor	Intersema Sensoric SA
Type	MS5534
Operating principle	piezzoresistance
Measuring range	300 – 1100 mbar
Accuracy	+/- 1 mbar
Resolution	0.1 mbar

Wind Speed and Direction

Wind speed sensor	Robinson`s cross, optoelectrobic stroboscope
Wind direction sensor	Wind vane, 6-bit optoelectronic Gray code encoder
Wind speed measuring range	0 to 50 m/s
Speed constant	20 imp./m
Wind speed accuracy	+/- 0.5 m/s
Wind direction accuracy	+/- 5.6 deg.

Relative humidity

Sensor	combined temperature / RH sensor
Producer of sensor	Sensirion
Type	SHT75
Operating principle	Capacitive polymere
Measuring range	10 – 100 % RH
Accuracy	+/- 3 % RH
Resolution	1 % RH

Temperature

Sensor	combined temperature / RH sensor
Producer of sensor	Sensirion
Type	SHT75
Measuring range	-30 – +50 C
Accuracy	+/- 1 C
Resolution	0.1 C

Battery Charger

Input voltage	220 to 240 V, 50 to 60 Hz AC
Output voltage	6-13.8 V DC, nonstabilized