Datalogger
V 2.1

Palm OS program
For storage and representation of flight data

Short Description

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Additional information: http://home.arcor.de/d_meissner/d_logger.htm

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1 Introduction

For capture of flight data it's necessary to use either a datalogger or a telemetrie system. Such devices are available at several providers.
Usually the devices are delivered including PC-programs for the transfer of the data to the PC and for graphical representing.
At the airfield Laptops are not very useful because the displays are hardly readable at sunlight conditions.

A very good alternative for such functions is the small Handheld PDAs.
They use relative small displays however they have got a touch screen in most cases.
If the devices show the most important data only and they have a zoom function then they are very useful on the airfield for this purpose.

The following described program doesn't run on normal personal computers but exclusive on the small handhelds with Palm-OS operating system.
The program cooperatives together with dataloggers in the version V2.0 and onwards exclusively. These are described at http://home.arcor.de/d_meissner/d_logger2.htm .

The Palm-program has the ability to:

- configure the datalogger,
- receive and store data from the logger,
- plot the most important data,
- perform simple analyses of the flight data and
- transfer the data to the domestic PC.

2 Program start

The program is started by clicking the Icon "D_Logg2"..

fig. 1 Program start

fig. 2 Display after the first start

If the program has been started for the first time, then in the background a database with the name "LOGDB2" will be generated.

Within this database the coefficients for the datalogger, and the flight data are stored.
The size of this database can be displayed using the normal operating system functions of the Palm OS. Also the deletion of this database can take place by using of the normal Palm OS functions.

3 Adjusting the coefficients

Since each user would like to adapt its dataogger flexibly to its special needs, it is not possible to calculate the flight data uniformly.
The one wants to use the logger at sea level and other one flies at an airfield which has some hundreds meters of height.

The adjustments of the dataloggers hardware occur via appropriate resistances.
For the adjustment of the Palm software to the used hardware coefficients (constants) are used for the individual parameters, which are stored in the Palm (in LOGDB2). These coefficients are changeable at any time.

Because the generated coefficients will not fit to your own datalogger you should first adapt this coefficients to the respective datalogger.

For modification of the coefficients click the “menue” key of the Palm (quite left down) and then select “Config – Konstanten 1“.

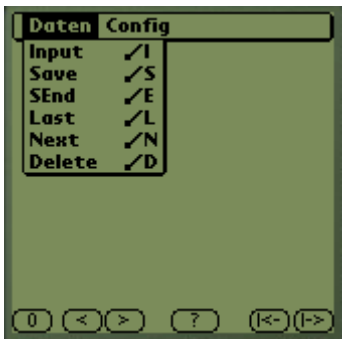


fig. 3 Menu data

fig. 4 Menu config

fig. 5 Constants-1

fig. 6 Constants-2

Since the present software-Version can represente height and speed information as well as voltage and current data in numeral form, input for the appropriate coefficients are necessary.
The input / modification of the coefficients takes place without decimalpoint via touch screen input.
Click “Save” for the data storing.
If changed data should not be stored, select “menue” and “Flugdaten” (flight data).

The coefficients have the following meaning:

Temperature: temperature at sea level (e.g.185 / 10 °C means 18.5°C)
This coefficient is used for the altitude calculation and applies to all flight data. The temperature decreases approximately per 100m by 0.6°C. If the airfield is situated e.g. in 500m altitude, 3° must be input here more than based on the airfield.

P0: Pressure when the amplifier of the pressure sensor delivers 0V.
(used for the altitude calculation). This pressure represents also the max. value of the measuring range, in the example 1026 hPa (= 1026 mBar).

Druck = P0 - P x 0943 / 10000: Pressure coefficient of the pressure sensor + amplifier.
In the example is used 0.0943 hPa per lsb.
Since the logger operates with 10 bits, in the example a pressure range of 1024 x 0.0943 = 95,43hPa is representable.
The measuring range in the example is then 930.57... 1026 hPa.
(used for the altitude calculation)

Speed = V / 0950 * 100: Pressure coefficient for the differential pressure sensor + amplifiers for the speed calculation.
in the example: 1 / 0.095 hPa per lsb.

Speed offset: Offset of the differential pressure amplifier (in lsb).
The circuit of the amplifiers generates already a voltage if the input pressur is zero. This can be compensated by the offset.
(used for the speed calculation)

Strom: (Current) coefficient for the current channel (AD3).
In the example: 10 / 57 = 0,175A per lsb.

Kapazität: Capacity of accumulator (not used in version V2.1).

Spannung: (Voltage) coefficient for the voltage channel (AD4).
In the example:10 / 620 = 0,0161V per lsb.

Frequenz (Frequency) coefficient for the frequency channel (not used in version V2.1).

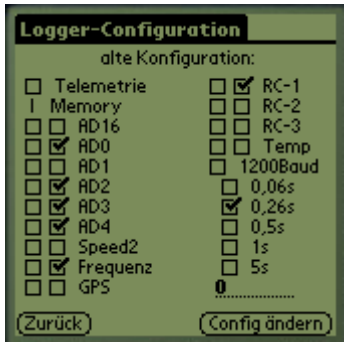
Drehzahl: r.p.m. (Number of revolutions) coefficient for period duration measuring channel (not used in version V2.1).

4 Configuration of the datalogger

Configuration means which of the inputs are switched on and which sampling rate is used for the storing or sending of data.
The configuration is permanently stored in the logger and can be changed however at any time with the Palm program or also with an equivalent PC program.

For the configuration modification of the datalogger first the serial interface of the datalogger must be connected with the serial interface of the PalmPilot.
The power supply for the loggers should be prepared, but is not switched on yet.
Then click on the “menu” button and select “Config Logger”.
Now a message should appear “Logger einschalten” (switch the Logger on).
Within the next 10 s the logger should be switched on.

The logger transmits its configuration to the Palm, which can display it.
Clicking on the appropriate function field can make configuration changing.
After the appropriate selection the key “Config” must be pressed.
The Palm now transmits the new configuration to the datalogger. This stores these and acknowledges it to the Palm for comparison.
Afterwards the datalogger can be switched off and separated from the Palm.
The datalogger will operate now for the next time with the adjusted configuration.



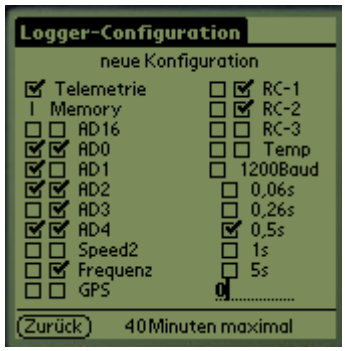


fig. 7 Swich the logger on now **fig 8** Old Config **fig. 9** New Config

In the example (fig. 8) the past configuration was of that kind that 6 inputs were switched on.
My logger has turned on the altitude sensor at AD0, the speed sensor at AD2, the current sensor at AD3, the voltage sensor at AD4 and the r.p.m sensor at frequency input.
Additionally in the example a RC channel (e.g. the elevator) will be recorded.
The logger will store the data all 0,26s.

A new configuration was selected according to the example (fig.9):
In the logger will be stored the same data as already in fig. 8 and additionally a second RC channel (e.g. rudder).
Apart from internal storing, additionally the altitude, Vario (AD1), speed and voltage will be transmitted downwards by telemetry.
The sampling rate is here 0,5s.

5 Transfer of flight data to the Palm

After the datalogger has recorded flight data, this data should be buffered somewhere.
Exactly that is the major task of the Palm program that is described here.
As well you can see whether the datalogger has worked perfectly and additionaly you can measure the most important data.
Afterwards the datalogger is ready for the next flight data. The old data in the logger can be overwritten now.

For the data transfer the serial interface of the datalogger must be connected with the interface of the Palm but the datalogger shall not yet be switched on.
Usually the datalogger can remain in the flight model.
If that is the case, the RC transmitter should be switched on now, so that when switching on the receiver the servos do not run.
Now the “menue key” is pressed and “Input” selected.
The message “ Datenlogger einschalten” (switch on the datalogger) appears.
Within the next 10 s you should switch on the logger.
The logger should now transmit the flight data to the Palm.
The user detects this by an appropriate message by the Palm (- receive data -).
After 10s the 32 KByte should have arrived in the Palm.
At the Palm now the flight data are represented graphically.
For shorter flights the data communication can be aborted earlier (switch off the power of

logger).
You can transfer the data as often as you like. The flight data aren't deleted.
They will be overwritten only with a new data logging.

fig. 10 The logger switches on now

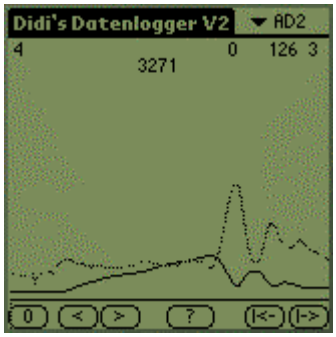


fig. 11 Diagram of the data

Similarly as in fig. 11 it should look if everything is o.k.
Do not be surprised if remainders of an old flight are displayed on the end of the diagram.
Because the old data in the datalogger aren't deleted, it's a quite normal thing.

The numbers in fig. 11 means:
4: that is the 4th data record stored in the Palm
3271: number of bytes used by this flight in the Palm
0 126: the configuration (don't care)
3: sample rate, e.g. 3 data records per second (without decimalpoint, 3.9 is therefore also 3)

Before you have a look on the data, first you should store these in the Palm.

For data storing you must press the "?" key first and select the area with the pin (make clicks on the start and the end of the interval).
For better selection you can zoom the picture whit the keys ">" and "<".

fig. 12 Selection beginning

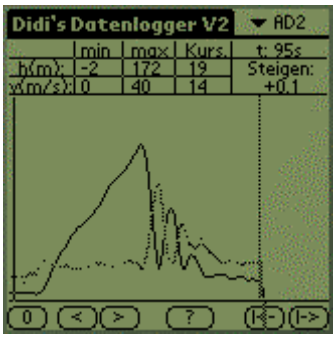


fig. 13 Selection end of the area

After the flight section has been selected the "menu key" is pressed and "Save" is selected.
The message "-Datensatz gespeichert –" (data stored) is displayed then.

6 Display of flight data

The Palm can display only 2 of the available parameters in each case.
One of the parameter is always the altitude, which should be connected at the input AD0.
The altitude is always represented as full line.
The second parameter, which shall be displayed, can be selected from a list.
Which parameter is selected is displayed on the top right.

For selection of the parameter click on the top right with the pin.
An appropriate selection list appears from which the second parameter can be selected.

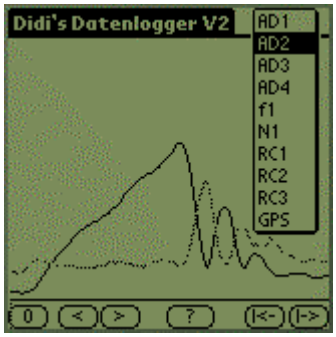


fig. 14 Selection of the second parameter

fig. 15 The current is selected here

The meaning of the keys at the lower field is:

0:	zooms the whole flight on the display
< or. >:	shifting on the right (left)
?:	query of information / marking (subsequent always 2 pin positions are queried)
I <- or ->I:	zoom

The zoom of the altitude data in the y-direction takes place automatically so that the graph fits on the display.
The zoom of the second parameter is not yet implemented in the last version.

fig. 16 Display of the GPS data

Fig. 16 shows the GPS data.
The cross in the center shows thereby the position (Lat, Long) of the same point, which is represented quite left at the altitude graph. The altitude graph shows the barometric altitude, not the data from the GPS.

7 Measuring of flight data

In the available version only the altitude -, speed -, current and voltage levels can be measured.

For a measurement the flight paragraph of interest must be marked, by ”?” key press and afterwards click with the pin at the begin and at the end of the interesting sector.

Upon first click the air pressure at the selected place is displayed in the upper area.
If you click on one point before the start, then the daily air pressure at the airfield will be displayed.

Upon second click first the display is zoomed accordingly and then appears a small table with numeric values within the upper display area.
The values are calculated according to the well-known barometric altitude and speed formulas under consideration of the stored coefficients.

In the table means:
min: minimum value in the selected section
max: max. value in the selected section
Kurs: data at the second cursor
45s: time between the first and second cursor
+2.8: climbing / sinking [m/s] (altitude at the cursor 1 minus altitude at the cursor 2 by time)

fig. 17 At the beginning of the area

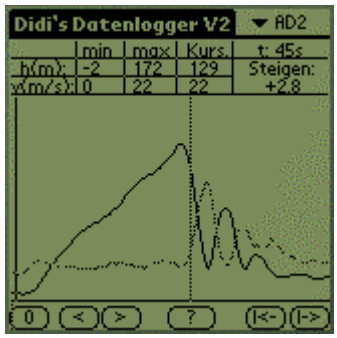


fig. 18 End of the area

The most important data can be measured by clever selection of the flight section, achieved altitude (see fig. 18), max. speed (see fig. 20), climbing performance (see fig. 19), rate of descent, duration of the flight etc..
Additionally the data at each point can be displayed, due to the always-represented values at the second cursor.

fig. 19 Climbing performance measures

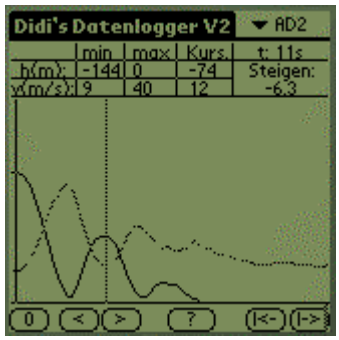


fig. 20 Max. speed

Note that for the altitude calculation the altitude at the cursor 1 is always used as zero-altitude (see fig. 19 and 20).

8 Transfer of flight data from the Palm to the PC

The flight data, which are stored in the Palm, can be transferred to a PC for further processing.
Therefore the Palm must be connected to the PC and the datalogger program on the PC must be started.
The flight, which will be transferred, can be selected with the “up” – “down” keys of the Palm or with menu “Last” or “Next” keys.

For transmitting the data of the Palm press the “menue key” and select “Send” then.
The operation of the PC program is described in a separate file, which is available under the following URL:
http://www.sprut.de/electronic/soft/logger.htm

9 Deletion of flight data

For deletion of flight data the flight must be selected with the “up” or “down” keys of the Palm (or menu “Last” - “Next”).
Afterwards pressed the menue key and then select “Delete”.

10 Known problems

1)
Before reading the loggerdata the logger configuration may not be changed.
If the configuration was changed then exactly the same configuration as used for recording must be configured before the data were transfered.

2)
The Palm software is compatible only with the datalogger version 2.0 and onwards.
If you have used earlier program versions of the Palm program then the “LOGDB2” database must be deleted manually (use operating system instructions) before you start the program.

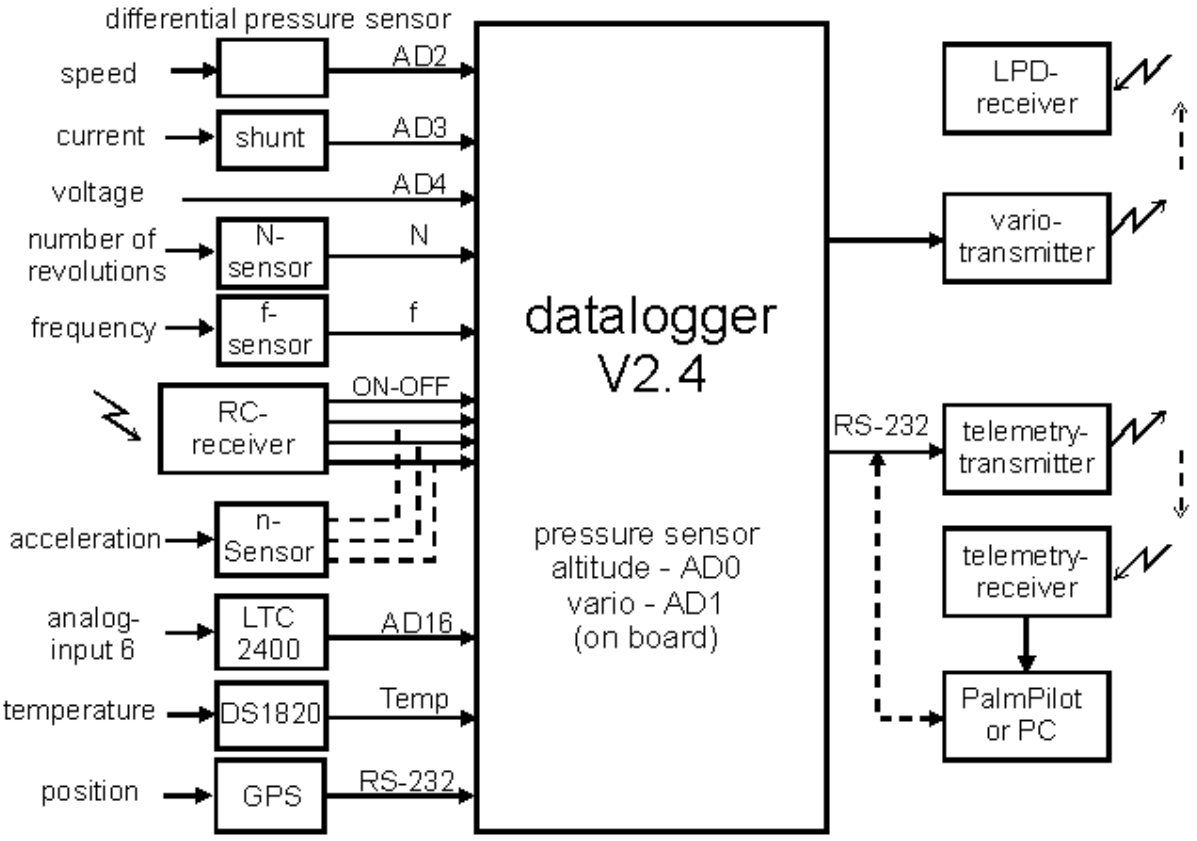


fig. 21 Datalogger V2.4 scheme