## VW 920


## VW 910

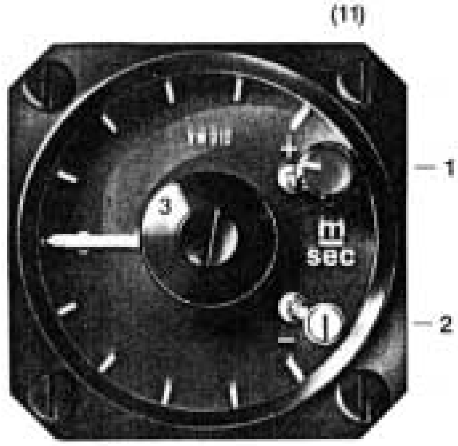


Fig. 1

# VW 910/920 Manual

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## 0. Data Gathering System

The variometer is based on recently developed pressure sensors which measure absolute & differential pressure.

They consist of two metal membranes adjacent to each other which produce travel proportional to pressure. The travel is measured using semiconductors which react to the magnetic field. The sensors produce a voltage signal which is proportional to this travel in a bridge circuit. The signal is up to 100 times greater than that of the sensors normally available and results in a correspondingly reduced risk of external interference, more stable zeroing and excellent reliability.

The membranes are adjacent to each other which compensates for any travel resulting from accelerations and prevents corruption of the signal. We have developed these sensors ourselves and they are not available in any other vario system (Patent No: P3023719.5-09).

The absolute pressure sensor transmits the altitude signal from which the variometer signal is derived using electronic differentiation. A second sensor produces the pitot pressure signal and of course this reduces in accordance with the barometric pressure height formula. To ensure that the compensation remains error free, the height signal corrects the pitot pressure signal value. This means that compensation is achieved without a TEK tube and is exact at any altitude.

An electronic filter with a time constant of 1.2 secs smooths both the variometer display and also the acoustic variometer output (twin tone audio vario).



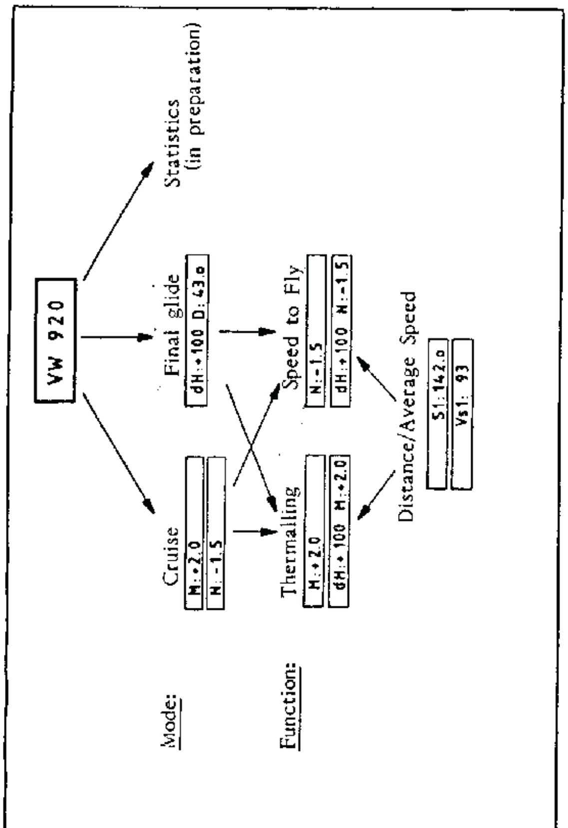



Fig. 2 Program Map

## 1. System Overview

1.1 Variometer (see Fig.1)

(1) On-Off/Volume

(2) Compensation + / -

(3) Zero Setting Unit (no acoustic signal)

2.2 Computer

(4) Latching Sensor Control Knob for McCready values 0.0 to 5.0 in 0.5 steps

(5) Latching Sensor Control Knob for wing loadings from 25 to 50 kp/m$^2$ in 2.5 kp/m$^2$ steps

(6) Latching Sensor Control Knob for Wind Components from -50 to +50 kph in 5 kph steps

(7) Polar Selector Switch:
- P1 Bug contaminated polars and second span
- P0 Measured Polars
- P2 Rain Polars

(8) Cruise - Final Glide Switch
- Mid-Position: Cruise Mode
- EA : Final Glide Mode
- S : Statistics (program extension)



(9) Input Key
- Function 1: Input & Change
  - Distance
  - Altitude
- Function 2: Change Display
  Remaining Distance <-> Total Energy Vario/ Average Climb

(10) Enter and Correct Key
- KORR: Distance Correction
- ENT : - Entry of Inputted Height/Distance
  : - Calculation of Actual Wind Components

(11) Vario Zero (Optical & Acoustic)

(12) Built-in Polars (see Appendix 9.1)

## 2. Operation

After switch-on (1) the following messages appear one after the other on the screen:

Variometer VW 910

SG switch (SG = Speed to Fly Sensor) should be set to "climb": the vario needle will deflect fully downwards and then home-in on zero after about 20-30 seconds.

If the SG switch is set to "speed to fly": deflection of the needle in the minus range, depending on the McCready value and the polars.

The audio signal reacts similarly.

VW920 Computer

On screen: VW 920 2A Type: 1 *)

Then current set values are displayed at 3 second intervals:
MC (McCready value)
FB (wingloading)
WD (WinD components)

The display will come to rest at "Speed to Fly" N (= total energy vario)

N: -1.7 at

"Climb" M (= average rate of climb over the last 20 seconds).

M: 2.4



Now adjust the volume control (1) to your preferred setting, adjust the McCready value (4) to zero, set the actual wingloading (not forgetting water ballast) (5) & set the wind components (6) to zero as well.

The lower row of switches (7-10) all start off in the mid-position. *)
The sequence of characters and numbers on the left give information on the version of the program, the number on the right gives the polar group selected and is therefore indicative of the aircraft type (see Appendix 9.1)

In " cruise" mode the functions "climb" and "speed to fly" can be selected by the pilot either by using the speed-to-fly SG switch or using the magnetic switch on the flap control (see also 7. Installation).

In the former case, i.e. Cruise-Climb, the variometer displays the instantaneous rate of climb or sink. The optical instrument covers the range +/-5.0 m/s, the acoustic instrument +/-10.0 m/s. At rates of sink in excess of -10 m/s the tone cuts out completely. This does not mean that the variometer system is faulty: it is in fact a warning of an extreme flight condition (such as may occur during wave flight). The computer displays the average rate of climb over the last 20 seconds in the left hand field of the display:

M: + 2.4



Current standards in competition flying make digital display of this sort of information necessary since an improvement of only 0.1 m/s in the average rate of climb during a 300 km flight means a saving of about 7 minutes. An analogue display cannot provide the same degree of recognisable differentiation.

In the second case, "cruise - speed to fly", speed to fly is represented visually by the variometer and acoustically by the audio variometer, and of course these two methods represent tried and tested systems.

If the variometer reading and the audio tone are:
in the minus range - fly faster,

If they are:
in the plus range - fly slower.

You are flying at the optimum speed when zero is displayed and the audio tone is intermittent. We have quite intentionally not left a window of silence around the optimum speed to fly as the pilot would have no indication as to incipient deviation from it, i.e. whether he should fly faster or slower, however narrow the window.

Needless to say, speed to fly is related to the McCready value set, and also to the wingloading. You can check these values using the control knob or you can easily turn the sensor knob slightly and for three seconds the set speed to fly is displayed in the right hand field.

N: 1.2 FB: 35.0

N: 1.2 MC: 1.5



It is important when doing this to make sure that it is latched. Otherwise the computer can not decide with certainty which of the two values it is supposed to display - and the display will flick from one to the other.

So that you as a pilot can have some idea of the vertical speed of air masses irrespective of the speed to fly, the computer offers a digital readout of *Netto Climb* and *Netto Sink*. That is rate of climb and sink of the air mass through which you are flying at the time, without the glider's rate of sink, as on the polar, being included.

N: + 3.0

A netto reading of + 3.0 m/s means that your glider will actually climb at approximately 2.0 m/s should you decide to circle in this particular air mass.

If the obviously positive rising air reading and the encouraging speed to fly indication when approaching thermalling speed induce you to throw a turn then switch the SG switch to "climb". When you do this the computer immediately gives you the average rate of climb over the last few seconds because the integrator is already taking into account the rate of climb values but excluding the previous sink. In this way you rapidly receive information on the rates of climb likely to be achieved in this thermal. (Fig. 3).

It is appropriate at this point to mention the option of a second "permanent" speed to fly display (second vario). In this case switching the vario to speed to fly only affects the audio tone.

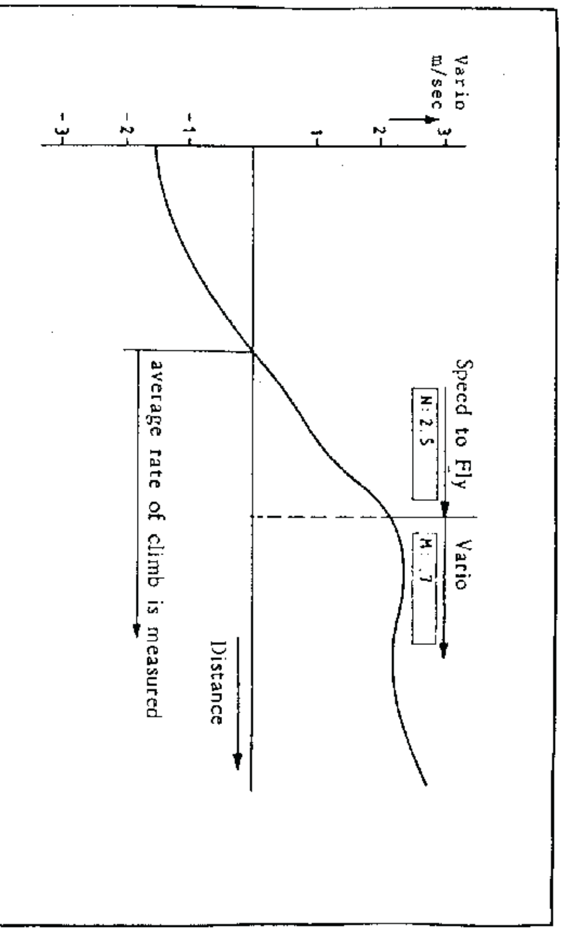



Fig. 3 Average Rate of Climb (start of data collection)

## 3. Final Glide

The computer is particularly useful when used in the "Final Glide" mode. It is designed so that you can quickly and easily check the interaction of all the factors involved: (wind component, McCready value, altitude, bug encrustation of the leading edge). In this way it is easy to optimise the final glide.

Usually the final glide is commenced when the pilot is already familiar with the specific meteorological conditions of the day inasmuch as they affect gliding. He knows the cloud base, the average rates of climb and he will at least have some idea of what the wind is doing. That enables him to make certain decisions whilst planning the final glide, probably with a higher McCready value (because that represents additional safety) (4) and with the estimated wind component (6) only the headwind or tailwind vector is of any interest. In addition he must state the distance from his home base airfield as exactly as possible, and for this purpose it pays to use an air map which has been prepared with concentric circles representing distance from base (see Appendix).

### 3.1 Setting the Values

You start this program by switching to EA (final glide - switch 8). The display immediately asks:

DISTANZ? D: 0.0

(DISTANZ = Distance) The distance is entered in kilometres using the input key (9) in the + direction (increasing). If you leave your finger on the key then the figure increases in



5 km steps. By pressing the key rapidly you can then set the exact distance to the nearest kilometre.

Operating the switch in the (-) direction is used to correct any accidental overshoot. When the correct value is displayed, switch (10) is used to ENTer the value. Do wait however until you are exactly above your reference point (e.g. railway or other well defined landmark) as the computer will start measuring the distance only at the precise moment you press ENT.

Now the second question appears on the display:

HOEHE? H: 1360

(HOEHE = Height) The altitude displayed is produced by the internal pressure sensor which gives a value for height assuming barometric pressure to be 1013 hPa. To correct this value to the QFE of your destination or the QNH value you use your mechanical altimeter by setting the correct value e.g. 1210 m as shown by your ordinary aneroid altimeter. This should be done at approximately 100 kph because otherwise the height reading output will be inaccurate as a result of the kinetic energy factor. At all events if you do fly faster than 100 kph you are on the safe side because more speed also means more energy and therefore greater height. You do this in the same way as entering the distance in kilometres, i.e. (+) increases the height reading, (-) reduces the height reading. When the switch is held the increments are 50m and only 10m when keyed briskly. When you have produced the corrected value don't forget to use the ENTer switch (10).

The computer will now respond with:

dH:+ 150 D: 42.0

On the left of the display is your deviation from the planned glide path and on the right the remaining distance.

From the previous example you now know that on the basis of the parameters which you have set (McCready, wind and height) and with the polar that you have selected (usually P0) you are 150 m above your calculated glide path.

The glide path includes a reserve of 100m for the approach and in addition a relative reserve of 5-10% of the intended height so in the case of a final glide from 1000m this would be 50-100m. This is included as distances on airmaps are not always precise and can vary by up to 5%.

**N.B.**

The glidepath deviation figure is totally compensated i.e. a change in flying speed (which of course is natural in Dolphin flying) is included in the calculation. The display remains remarkably stable so that any trend in the glide path can easily be recognised.

The order of magnitude of the glide path deviation value gives you crucial information which you can now incorporate in your practical planning:



- Has the headwind increased?
  Increase the headwind component.
- Are your leading edges heavily bugged or only slightly?
  Select P1 or P2
- From the look of the weather can you expect good thermals ahead?
  Increase the MC value
- Up to what McCready value does the glide path deviation remain positive?

These final glide options can be called up instantly and can be assessed using the varying deviation in the glide path.

Whilst you are now on your final glide the computer is constantly calculating the remaining distance and comparing it with your height. The result is displayed in the form:

dH: xxx

At this point it is worth mentioning how the remaining distance is calculated. It may be assumed that will generally take place whilst in the Speed to Fly mode. However, if you forget to switch over to this mode the computer makes assumptions on the basis of your wing loading and speed and switches over automatically. When a certain speed value is exceeded distance is measured, but not otherwise. (c.f. Table 1) At a wing loading of 35 kp/m², for example, automatic switchover occurs when 104 kph is exceeded and distance is then measured.



Table 1
Automatic Switchover -
Speeds above which distance is measured

| Wing loading in kp/m² | Switchover speed in kph |
|---|---|
| 25.0 | 88 |
| 27.5 | 92 |
| 30.0 | 96 |
| 32.5 | 100 |
| 35.0 | 104 |
| 37.5 | 108 |
| 40.0 | 112 |
| 42.5 | 116 |
| 45.0 | 120 |
| 47.5 | 124 |
| 50.0 | 128 |

Please note that if you are flying with a McCready setting of 0 at min. sink (perhaps 90 kph) you must switch over to Speed to Fly manually as otherwise too large an error could dévelop in the remaining distance displayed. You would be on the safe side however as the distance displayed could only be greater than the actual distance to cover.

With higher McReady values you will almost always be flying in a higher speed range with automatic switchover to Speed to Fly mode. Experience to date confirms that the system works well - and automatic switchover only comes into effect when you forget to switch to the Speed to Fly mode.

After flying 10 - 15 km it is worth checking the distance displayed, so that, for example, the wind factor can be corrected if necessary. Simply look for a clearly defined landmark ahead on course and when you are exactly above



it check the remaining distance on your map with that displayed. It is important that you are directly over the landmark when making the comparison as even a slight inaccuracy in the angle is significant at any appreciable height. If you discover a discrepancy between the distance displayed and the distance on the map, all you do is this:
At the precise moment you overfly the landmark switch (10) to *KORR* then using the input key (9) type in the distance and finally use *ENT*. The computer will display the actual wind component flashing on the left of the display and on the right the previously set value for it:

WIND:+28 WD:+25.0

If you wish to disregard the difference - perhaps its too slight to matter - do nothing. After about 4 or 5 seconds the computer accepts the old value again.

If on the other hand there is a marked deviation you must correct the wind component and then assess the new glide path deviation for planning the remainder of the flight.

**A tip we find useful:**
The distance correction is accurate if the *KORR* key is operated at the precise moment of overflying the landmark. The computer notes this point in time and uses it however long you take to key in the remaining distance. This is important as your forward speed will be 40 - 50 m per second on a fast final glide - considerably more than a mile a minute. This system ensures that the correction is as accurate as you make it.

A practical tip:
In the same way that you can set an altimeter to QFE or QNH before take off you can do the same with the computer altimeter. Switch to EA (final glide mode) and start the program sequence with *ENT*: do not enter the distance but set the height - not at 0 but at -40 m and set QNH at 40 m less as well, as that gives the correct value when flying at 100 kph. The computer altimeter is not an absolute altimeter but a total energy altimeter and relates to 100 kph.

Once entered, the height is stored until you switch off the computer. When thermalling at 80 - 100 kph it is easy to check its accuracy.

### 3.2 Speed to Fly / Thermalling

On a final glide you find yourself too low for your glider's performance and you desperately need a thermal to make up the missing height. In such a case the remaining distance display is of little use to and you should use either the netto variometer or the average rate of climb display. You can obtain this information by pressing the *ENT* switch (9) upwards: this produces N or M (depending on the position of the SG switch):

dH:+ 150   N:+2.3
dH:+ 150   M:+1.8

Pressing the ENTer switch downwards returns you to D:

dH:+ 150   D: 42.0



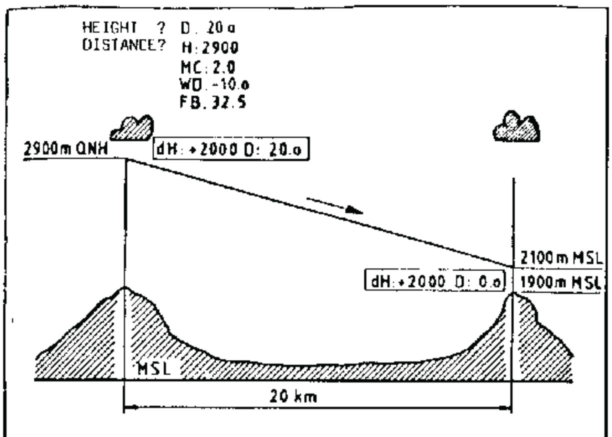



Fig. 4 Crossing a Valley

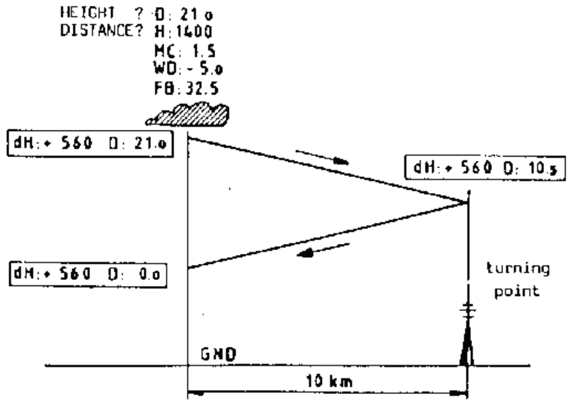



Fig. 5 Rounding a Turning Point

It is easy to remember: pressing it down (towards the ground) gives you the distance over the ground whereas the N: & M: readouts are influenced by the clouds.

If you circle, the wind component is still taken into account - as you will notice from the gradual change in the remaining distance if you thermal for a long time.

The average rate of climb gives you your McCready value which you set. You then go on thermalling until the dH display reads 0 or a positive value. Theoretically nothing can stop you getting home now! You can now settle down to enjoying the final glide. You will be surprised how accurately your display matches the actual situation. Don't forget to check the remaining distance though - in strong winds especially there may be an unexpected and considerable wind gradient.

### 3.3 Further Applications

The final glide mode can also be used in other situations:

*
In mountain flying it can be used for crossing valleys and arriving above the far ridge at a specific height. The positive glide path deviation (+ 100m) represents the arrival height. You must of course check with the contours on your map. In this case the internal altimeter must be set to QNH.

(Fig.4)
e.g. You are flying at 2900 m (QNH) and you want to cross a valley which is 20 km wide and arrive at the far ridge which the map shows to



be 1900m above sea level at 200m. In this case you must not go below a glide path deviation of dH:+2000. The figure is 2000 because 100m is already built in as the arrival height. As in Fig. 4: Crossing a Valley, this produces the display:
MC:2.0; WD:-15.0; FB:32.5.

*
For a long glide across an area with no thermal activity. In this case too the glide path (+100m) is the arrival height.

*
For flying to a turning point and possibly returning to the last thermal source.
(Fig.5)
Example: If the distance is 10 km and you are 1400 m above ground level you program a glide of 21 km (1 km for rounding the turning point!) The dH: display (+ 100 m) is then your return height. In our case (Fig. 5: Rounding a Turning Point) MC: 41.5; WD:- 5.0; FB:32.5 produces:

dH:+ 510   D: 21.0

You can judge from the change in the dH value whether your glider is capable of the mini out and return to the turning point.

*
It can also be used as a navigation aid for difficult to locate turning points: as a precaution start the distance countdown from the last known landmark. When the display reads:

dH:+ xxx   D: 0.0

it really should be possible to locate the turning point!

As you can see from the few examples given the computer has many applications. Once you have got used to it you will find you would never want to be without it again.

### 3.4 Final Glide - Example

Let us take the example of a final glide to make the situation as real-life as possible. As the operation of the equipment has already been described we shall take that as read and here concern ourselves more with the tactical applications (See Fig. 7: Final Glide).

Let us assume that we are returning from the Swabian Alb to Weiden (EDQW) and are approaching the Rhine/Main/Danube Canal south of Freystadt at 1800 m height (QFE Weiden).

We want to start our final glide at the point where the 80 km line cuts through the canal. We key in the distance 80 km using the final glide EA mode (switch 8) and wait till we are exactly crossing the canal before using the ENTer key (switch 10). Look sideways to confirm your exact position over the canal.

We don´t need to enter the height as we are so used to the routine that we did that earlier, probably before take-off. We only need to compare the height display with the mechanical aneroid altimeter. Maybe we can use the radio to check whether there has been a sharp drop in barometric pressure during the day. If there has, we can easily correct the height figure (1 hPa pressure drop corresponds to 9 m less at 1000 m and 10 m less height at 2000 m.



We have not been aware of any significant change in the wind, but to be on the safe side we add 10 kph headwind. As there is still obvious thermal activity on course ahead we retain the MC value of 1.5. The glide path deviation in our case reads as dH: -1210, i.e. we are still 1200 metres below the height needed to return home with conditions MC 1.5 and a 10 kph headwind.

Tactical considerations now lead us to 2 questions:
1. Where can we find lift to make up the height we are short.
2. Is the headwind we have estimated approximately correct?

The negative glide path deviation is helpful in the first case:

Is one cloud sufficient for us to gain the height needed? Is that possible, given today´s cloudbase? Can we perhaps avoid circling at all by gently continuing on course (MC 0.5)? No - that would still leave dH: - 730. Is there a healthy looking cloud more or less on course?

We decide to continue, using speed to fly.

We now need to check the wind. An easy to recognise landmark on our prepared map is the 60 km circle where it crosses the Neumarkt-Regensburg autobahn North East of Neumarkt. Until we get there we can do without the remaining distance D and we can switch (9) up to the netto vario (N) or the average rate of climb (M) as this helps us to gain a better



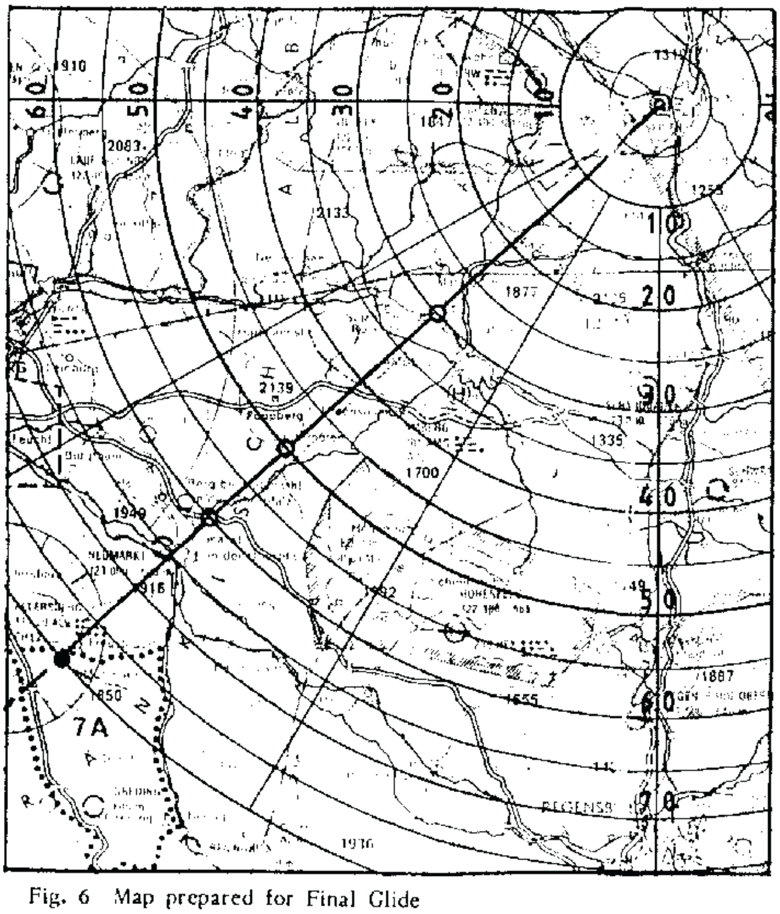



Fig. 6 Map prepared for Final Glide

impression of vertical air movement and to use lift if it is suitable. If we start circling to find lift, the distance calculation is unaffected as at this stage only the wind drift is taken into account. If when we fly straight ahead again we forget to change to Speed to Fly mode, the automatic switchover, which is triggered by speed, occurs (at a wing loading of 35 $kg/m^2$ at 104 kph - see Fig. 5) and calculates the remaining distance exactly. We can now concentrate on finding lift.

As we approach the autobahn to check the distance we switch (9) downwards. The remaining distance is displayed for comparison as we overfly the autobahn. There is obviously less or even no headwind because instead of 60 km the computer is displaying D: 62. Exactly at the point where we fly over the autobahn we press the *KORR* and correct using switch (10) to 60, we enter it by using the *ENT* switch and immediately the actual wind component is displayed on the left and the previously set one on the right:

WIND: 0 WD:-10.0

As soon as we have corrected the wind (6) the glide path deviation improves to dH:-960 m. Whilst passing over Lauterhofen at 700 m above ground we meet strong lift under a tight cloud and soon centre on more than 2.0 m/s lift. We now set the MC value to MC=2.0 and immediately the freshly calculated glide path deviation reads dH:-1140. As we continue thermalling we see that the actual glide path deviation is reducing all the time.



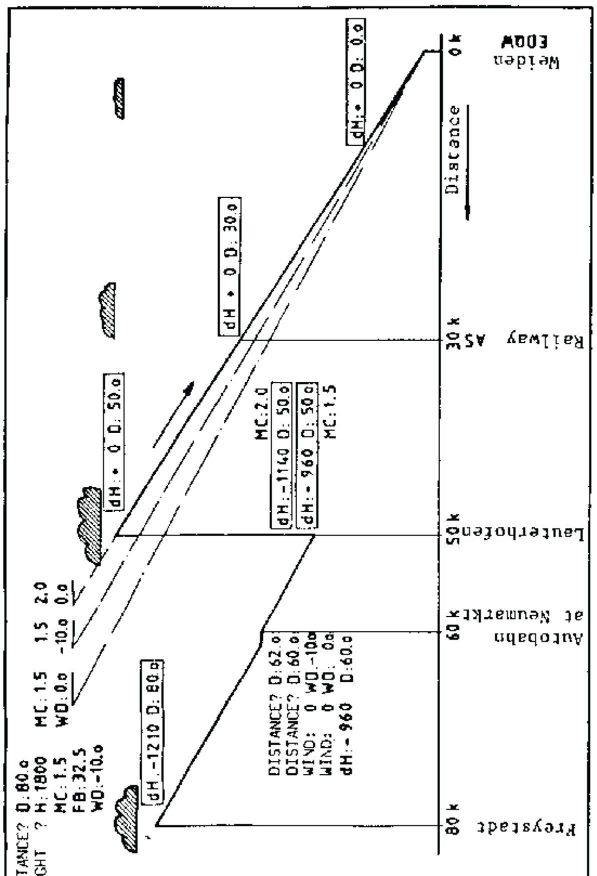


Fig. 7 Example of a Final Glide

When it finally reaches dH:0 or a positive value we can simply head off towards Weiden with sufficient reserves of height: we have 100m above our destination, 5% of the calculated height and 530m if we return the MC value to 0.

We check the wind component again when crossing the Amberg/Sulzbach railway at the 30 km mark. There are no great deviations (+/- 1km). So the final glide is in the bag.

N.B.

When comparing distances the 0.5km steps in the display are a great help and make checking more precise, especially in the case of short distances.

## 4. Measuring Distances

Our pressure sensors, which are a new patented design, provide all the data necessary for the exact calculation of a final glide, so of course it makes sense to use this precision for the rest of the flight so that distances flown and height-corrected average cruise speeds (TAS) can be displayed as digital read-out, taking account of the wind. This has now become extremely user-friendly thanks to our highly sophisticated computer program which includes the automatic switchover facility already described (page 3.1) which frees the pilot from the necessity of switching to Speed to Fly - thus reducing his workload.

When using this method however it is important to recognise that deviations from track and diversions will naturally result in distorted values. When the pilot has learned to make a quick correction for these factors (which are more likely in weak weather conditions than on good thermal days) it becomes possible to measure distances (e.g. at turning points) and to determine average speeds remarkably precisely. In many instances these facilities help the pilot with navigation, checking the wind and in making tactical decisions.

The computer can store four sections or part sections of a flight and the average speeds in each. This can be started and stopped, deleted and used for other distance and speed measurements independently of each other. For example, the four sections could be used for the total distance round a triangle and also for each leg of it.

You also have the option of programming a section of the flight in advance; if you do this the kilometre total will decrease towards 0 or you can allow the distance flown to increment. In the first case you know at once without doing any calculations how far you still have to fly; in the second case you know how far you have flown. If you have marked distances along your track on the maps in advance you can easily find where you are, estimate flying times and perhaps avoid the unnecessary risks which might ensue from pressing on too hard.

### 4.1 Instructions

a)
Flick key 10 briefly to *ENT* and on the left of the display you will see S1" 0(= flight section 1 with 0 kilometres). Alter- natively if you flick key 9 briefly up you will see: Vs1" 0 (= average speed along section 1, at present 0 kph).

If you hold key 10 on *ENT* then the other flight sections S2" 0, S3" 0 and S4" 0 will cycle through the display. As soon as you release the key, the section displayed is available for use. You can switch from the distance indicated by repeatedly pressing *ENT* briefly if you only want the Vario (M)/speed to fly (N) displayed without the measurement of the flight section already started running on in the display. The various tasks (b-e) continue without being displayed and can be called up again with *ENT* as required.



b)
Let us start with pre-programming the legs of the task. This can only be done before the leg in question is started. On a competition flight the leg lengths could be entered like this, for example:

Key (10) to *KORR*;

S-PROGR S1: 0

will be displayed.

Using the +/- key (9) type in the required distance with a negative prefix (you want to fly this distance if possible as far as zero!), then use the ENT command, and the computer will store this data until the system is activated (e.g. when crossing the start line). Now you can enter details for S2 and other legs in the same way, by calling up the desired leg (S2-S3-S4) by holding the key on *ENT* (see a).

c)
If you wish to measure distance in the form of kilometres covered being incremented in a total then no pre-programming is necessary. Distance measurement can be activated in the air, for example over the airfield, after releasing the tug, shortly after flying over the start line, over the selected start point, etc. Just make sure that you begin with S1, so that you don't lose track of distance measuring over several legs.



What is the procedure?

You start the measurement by simultaneously moving switch 10 down and switch 9 up. This is best done with the index finger of the left hand depressing switch 10 and the thumb of the same hand raising switch 9. The display will change from S1" 0 to S1: 0. The inverted commas (") disappear and the colon (:) appears. Now the computer adds or subtracts the distance flown (final glide, automatic switchover S ...). At the same moment the display changes to Vs1

N: -1.2 Vs1: 132

At the same time the computer takes as its starting value for average speed (= Vs) the instantaneous height corrected air speed signal and from now on produces the average cruise speed taking into account both time spent thermalling and drift. The starting value is always larger than the indicated airspeed as true airspeed (TAS) increases by approximately 7% for every 1000m height (e.g. at 2000m the indicated airspeed (= IAS) will read 100 kph from the Air Speed Indicator ASI) but on the computer display you will see:

N: -1.2 Vs1: 114 (= TAS)

If you want to know the distance covered switch key 9 downwards; pressing it up again returns to the S value.

You will remember:

distance (over the ground) press down,

cruise speed (through the air) press up.

When you correct the distance then of course the Vs value will also be corrected.

N.B:

If there is no pitot pressure, e.g. on the ground, then after starting the leg not a colon (:) but a dash (_) is displayed. In this case measurement of distance and average speed only occurs when the airspeed is in the excess of 60 kph.

d)
Since you will usually have to take account of the wind strength, enter either your estimate of the wind or the value provided by the met. report as the wind component using the wind sensor knob. It is worth checking the accuracy of this value after flying a distance of 20 or 30 km. Any discrepancy between the display value and the distance actually covered (always assuming that you have not diverted off-course much to find lift) shows that the wind factor is not as you had assumed but the computer will give you its actual value immediately: Switch (10) is raised to *KORR*, the distance is corrected with switch (9) and in the display on the left the new wind factor will appear as a flashing value for four seconds. The computer accepts the corrected distance value and automatically corrects all the other active legs of the course. If for example you started with S1 as the total distance of the triangle and S2 as the distance of the first leg a correction to either of these will be effective for both of them and you only have to correct the one. Naturally the recommended wind component must now be latched with the wind sensor knob (6)



e)
Holding down (9) and (10) at the same time for about two seconds stops the measurement of distance which you will see on the display as follows:

```
         N:+1.2    S1: 78.0
--->     N:+1.2    S1" 78.0
```

but it does store the value. It can be started again at any time.

```
         N:+1.2    S1" 78.0
--->     N:+1.2    S1: 78.0
```

as described in section c). If you hold the keys for longer than two seconds they will delete that leg and also the average speed.

You will see that you can use these procedures for each additional leg: All you have to do is to call up the specific leg of the flight required (S2, S3, or S4) using the ENT switch (hold it down).

f)
Important Note:

Switching to final glide mode *EA* does not affect the measurement of distance and so the average speed on legs S1 to S4 (Vs1 to Vs4) can be checked by using the ENT switch at any time: Pressing key 10 down briefly produces S in the display: eg. Vs:



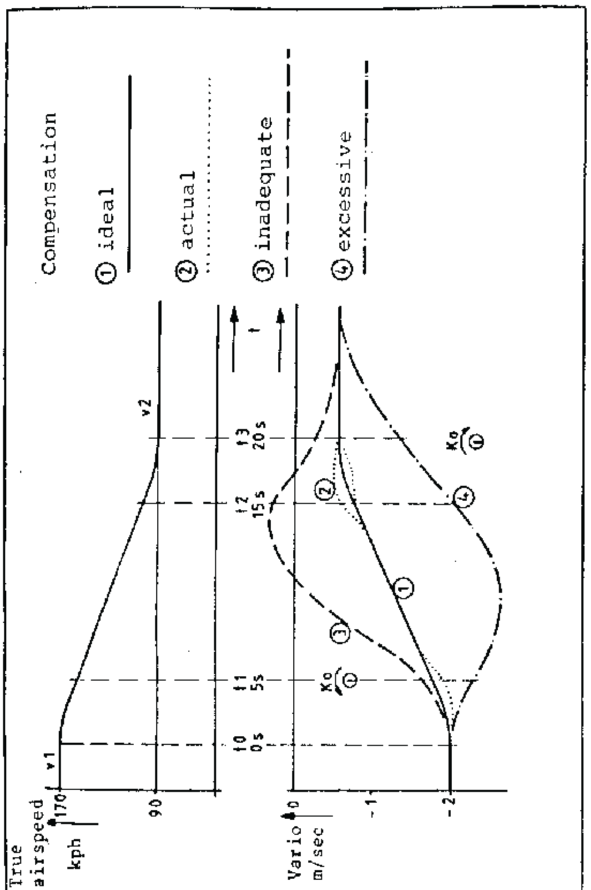



Fig. 8 Total Energy Compensation

## 5. Compensation

Compensation has not been a problem for pilots. Test bench adjustment has proved itself in practice. Even in cases where unsatisfactory results were being achieved with the pitot tube, the electrical compensation was working perfectly well.

However meticulous test bench adjustment may be, a check is needed in the aircraft itself to detect any minor static pressure and measured pressure errors. A check of this type can only be carried out during a test flight of course. There follows a description of the converting speed to height case as it has significance for actual practice.

This test requires stable weather with an absence of thermal activity if possible. The test sessions are always started at a fixed initial speed V1 (e.g. in Fig. 8 at 170 kph). The test consists of rapidly reducing the speed to a lower speed V2 (eg. 90 kph) by pulling back on the stick. To avoid acceleration effects the change in direction of flight should be smooth rather than sudden.

During the transition from V1 to V2 the variometer display is observed. Ideally (solid line (1) in Fig. 8) the display would follow the aircraft polar exactly, but there may well be small deviations in the transition phase (dotted line). In this phase the angle of attack and the lift coefficient changes. Naturally this also affects the drag coefficient. Consequently it is generally not possible to avoid a small deviation from the ideal case when conducting flight tests.

If you have reason to believe the compensation factor may be inadequate then the causes may be at the static pressure source. We have had good results with pressure taken from a tube at the rear of the fuselage which is used purely for the variometer. The pitot tubes which some manufacturers are already building into the fin as standard have proved to be very good.

You can also adjust the compensation (2) on the vario itself. Using this adjustment compensation can be set during the test flight. To do this you do need however to recognise the possible errors which may be displayed and be able to interpret them. Fig. 8 represents typical errors and these can be recognised and corrected as follows:

Variometer hits the top stop when you pull back on the stick and shows two little sink or even shows climb. Tends to operate like an uncompensated variometer (dashed line (3) in Fig. 8). The cause is too little compensation. The compensation factor is corrected by turning the compensation adjustment knob (2) anticlockwise.

The vario hits the bottom stop when the stick is pulled back and during the transition from V1 to V2 continues to show exaggerated sink values (dashed/dotted line (4) in Fig. 8). The cause of this is excessive compensation. The cure is to turn the compensation adjustment (2) in a clockwise direction.

N.B. This adjustment is sensitive: even small movements have a considerable effect on the compensation level.



## 6. Technical Data

| | VW910 | VW920 |
|---|---|---|
| **Power Supply** | | |
| Battery Voltage | 10.5-14.5 V | 10.5-14.5V |
| Current (vario at normal volume) | approx.70mA | approx.80mA |
| Polarity Safeguard | Yes | Yes |
| Equipment Fused | No | No |
| **Operating Limits** | | |
| Temperature min. | - 15 °C | - 15 °C |
| max. | + 50 °C | + 50 °C |
| Altitude(1013.3 hPa) | 9000 m | 9000 m |
| Vertical velocity | unlimited | unlimited |
| **Accuracy** | | |
| Height (to 6000m) | - | +-30m / 2% |
| Variometer | +/-3% | +/-3% |
| Speed to Fly | +/-3% | +/-3% |
| **Altitude errors** | | |
| Variometer | no | no |
| Compensation | no | no |
| Speed to Fly | no | no |
| **Display Reaction Time (from 10% to 75%)** | | |
| Variometer | 1.2 secs | - |
| Nettovario | - | 2.5 sec |
| Speed to Fly | 2.5 secs | - |
| Av. Rate of Climb | - | 15 secs |



Dimensions

| | | |
|---|---|---|
| Case | 60 x 60mm$^2$ x 162 mm | 83 x 83mm$^2$ x 156 mm |
| Panel Mounting Hole | 57mm dia. | 80mm dia. |
| Weight | 590 g | 510 g |

## 7. Installation

The glider wiring system must not be live during installation.
**Before starting work disconnect the battery.**

Both units are designed to standard dimensions so installation is very easy. Figs. 10 to 14 give you the most important dimensions that you will need for preparing your instrument panel.
There is no need for a pressure reservoir vessel because of the principle on which the pressure sensor works.

It is recommended that the computer be located top left on the instrument panel or perhaps in the middle so that it is easy to reach with your left hand. (see Appendix 9.3).

If the compass is mounted in the panel rather than above it, it must be at least 80mm away because of the magnetic field of the variometer display measuring system. If the compass is mounted on top of the pedestal i.e. on the horizontal surface above the instruments there should be no discrepancies caused by interference.

Pipe work connections are made as follows:
The pitot is connected to the *DYN* and static pressure to *STAT*. The connectors are on the rear side of the VW910 variometer. The power supply is taken from the glider´s 12V system: Red wire to the positive pole, blue wire to the negative (minus) pole. If the wires are connected incorrectly and polarity reversed the equipment will not operate. It is protected from damage caused by reverse polarity but do be careful to ensure correct polarity in any case. (Fig. 9)



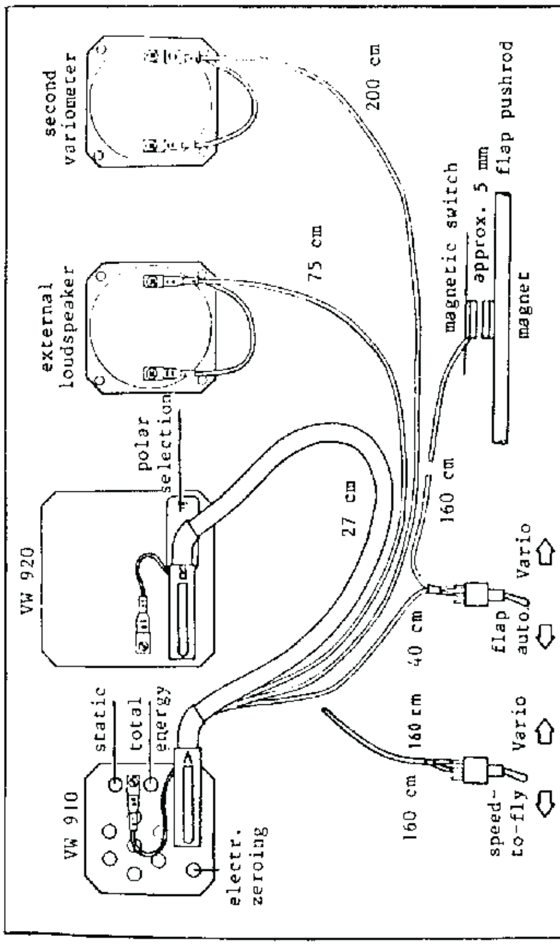


Fig. 9 VW 910 / VW920 Wiring Arrangements

Finally the VW920 computer and the VW910 variometer are connected. The 15-pole connector marked *R* is equipped with a slidelock and connectts to the computer unit. When connected, the skidelock prevents the plug from becoming disconnnected. The variometer is connected in the same way. The 15-pole connector to the variometer is marked with a *V*. The slidelock for securing the connector is mounted on the variometer case.

The lead to the SG switch should now be run. Take care to ensure that it does not run next to the radio aerial cable. The SG hand switch (toggle switch) is best installed nearer home (in the control column). In flapped gliders the SG magnetic switch should be fitted in a suitable position right next to the flap control rod. The magnet is to be fitted directly on the flap control rod and its position should be adjustable. The distance between the switch and the magnet should be approximately 5mm. Select the flap position which the manufacturers recommend as the optimum thermalling position. Then adjust the position of the magnet until the computer switches over from speed to fly (N) to vario (M) at this flap position. Now the magnet can be secured in its present position. If a second automatic switchover position is required a second magnet should be fitted.



**External Loudspeaker Option:**

The loudspeaker is supplied in a 60mm diameter case. For best effect it should be mounted in the side of the instrument pod or in the instrument panel if there is a vacant space. Avoid mounting the loudspeaker pointing upwards as it will very soon collect dirt and the sound will be distorted.The speaker is connected with a 75cm long lead which has two Faston connectors of the same width.

Duplicate Instrumentation Option:

A second vario for two seaters is available in 60mm or 80mm diameter versions. Electrical connection is via a 200 cm lead which terminates in Faston connectors of differing sizes to avoid incorrect polarity.

Finally the electrical connections and the pipework are checked, the battery is connected and the equipment is switched on using switch (1) as described in Section 2, Operation.

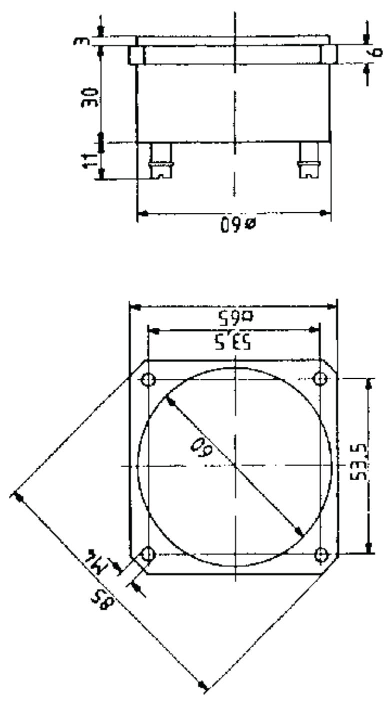



Fig. 12 External Loudspeaker

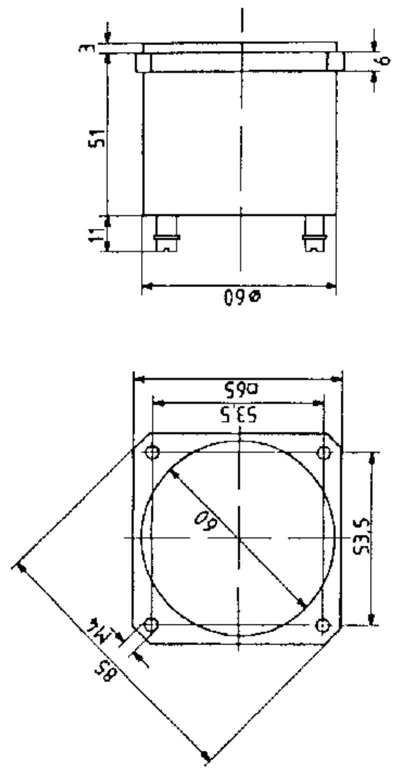



Fig. 13 Dial - 60 mm dia.

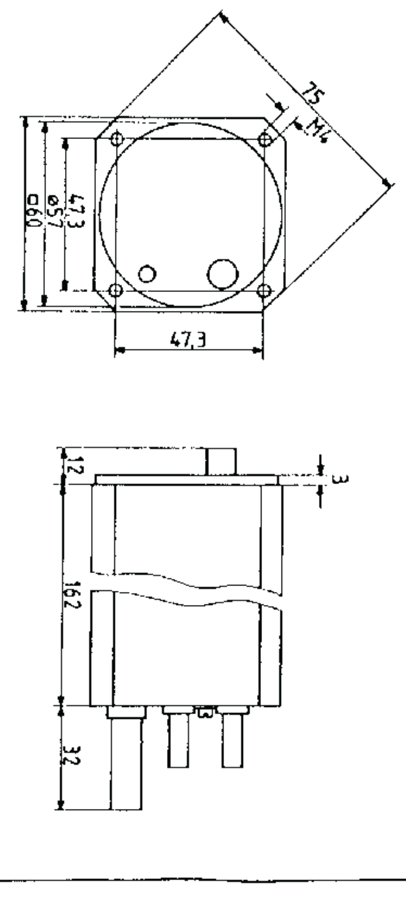



Fig. 11 VW 910 Variometer

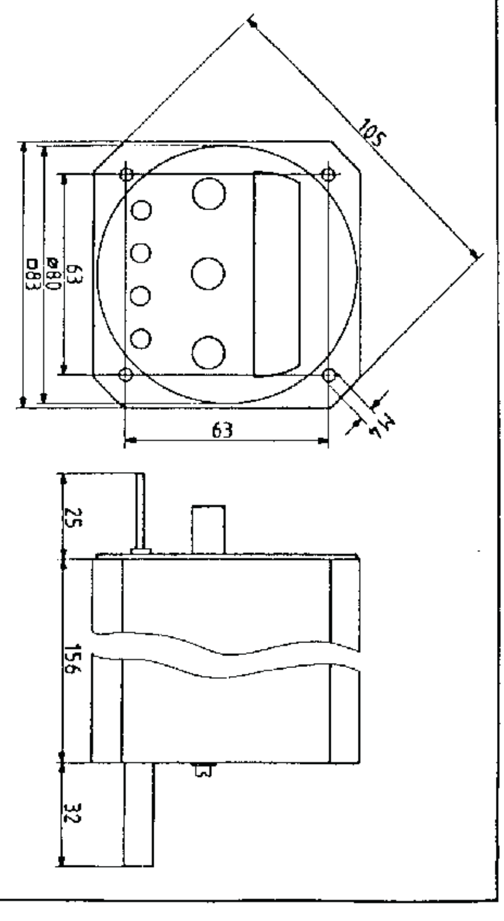



Fig. 10 VW 920 Computer

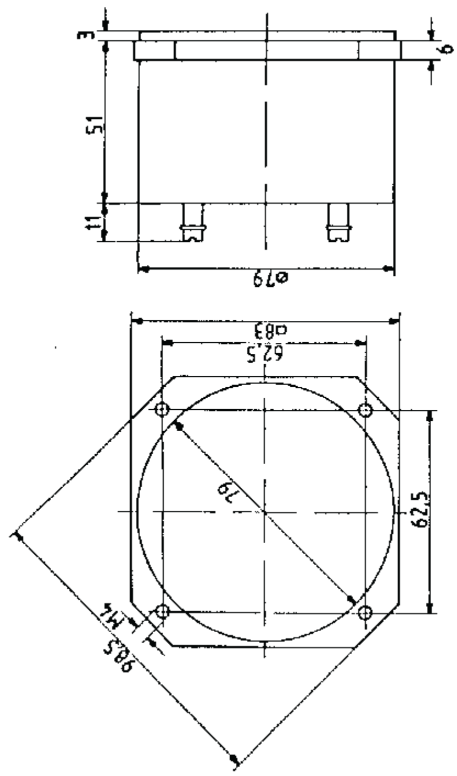



Fig. 14 Dial - 80 mm dia.

## 8. Statistics

The statistics facility is under development.

All our computers can be upgraded to include the statistics package.



# 9. Appendix

## 9.1 Polar Selection

Your VW920 has the polars for a wide variety of gliders in its memory. As the polars of various gliders often differ only by a few centimetres they have been divided into groups within similar performance bands. The group selected is displayed at switch on:

VW920-2A TYPE: 6

This table shows a suggested allocation of different gliders to polar type groups. It is designed to help you to identify the correct polar type for your glider.

| Polar No. | Glider | |
|---|---|---|
| 1 | ASW 20 | LS 3 |
| | DG 200 | LS 3 |
| | DG 202 | DG 400 (15 m) |
| | Libelle H 301 | Mini-Nimbus |
| | Mosquito | SB 11 |
| | PIK 20D | Speed Astir |
| | PIK 20E | Glasfluegel 304 |
| 2 | ASW 20C | ASW 20B |
| | Ventus | LS 6 |
| | DG 600 | |
| 3 | ASW 20L | ASW 20CL |
| | Ventus 16.6m | DG 200-17 |
| | DG 400 | LS 3-17 |
| | Glasfl. 402-17 | |



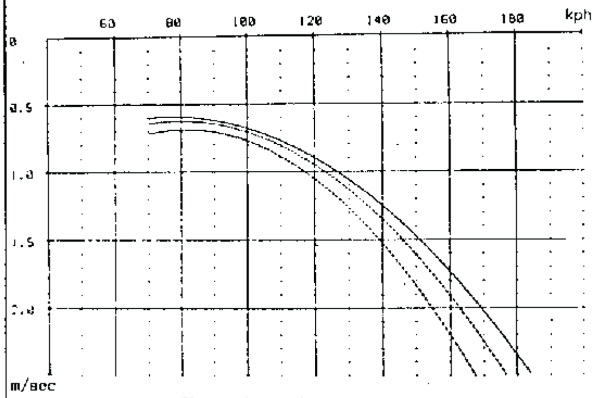
| | | |
|---|---|---|
| 4 | Nimbus 3 | ASW 22 |
| 5 | Nimbus 2 | Nimbus 2b |
| | Nimbus 2c | ASW 17 |
| | Glasfluegel 604 | Kestrel 22m |
| | Jantar 2 | Jantar 2b |
| | ASW 12 | Jantar 19m |
| | Kestrel 19m | SB 9 |
| 6 | DG 300 | LS 4 |
| | Discus | Falcon |
| | LS 3 Std. | Pegase |
| 7 | DG 100 | ASW 19 |
| | Cirrus 75 | Std. Cirrus |
| | LS 1f | Hornet |
| | Std. Jantar | G 102 Std.III |
| | D 38 | |
| 8 | ASW 15 | LS 1c |
| | Ls 1d | Astir CS |
| | Cobra 15m | Elfe SD 4 |
| | D 39b | Std. Libelle |
| | Phoebus B | FVA 20 |
| | PIK 20F | |
| 9 | ASW 19 Club | Mistral |
| | DG 100 Club | DG 101 Club |

## GROUP 1

### PERFORMANCE POLARS

①

| | | | | | |
|---|---|---|---|---|---|
| SAILPLANE | : | ASW 20 | | | |
| GLIDE RATIO E | : | 41.5 | 40 | 36.8 | |
| AT | : | 98.4 | 98.2 | 98 | kph |
| MIN. SINK | : | -.59 | -.62 | -.68 | m/sec |
| WING LOADING | : | 32.5 kp/m2 | | | |




——— Clean wing polar

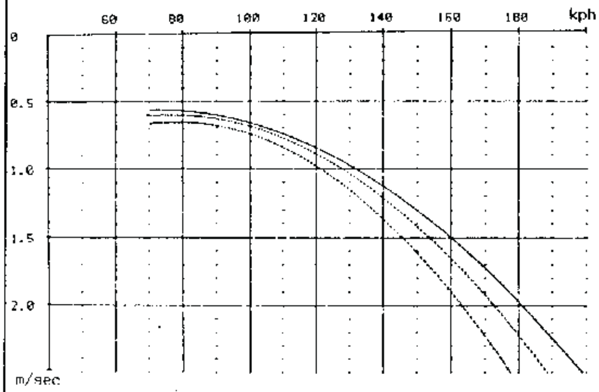
........ Bugged leading edge polars

## GROUP 2

### PERFORMANCE POLARS

②

| | | | | | |
|---|---|---|---|---|---|
| SAILPLANE | : | ASW 20C | | | |
| GLIDE RATIO E | : | 43 | 41.5 | 38.5 | |
| AT | : | 99 | 99.5 | 98.6 | kph |
| MIN. SINK | : | -.55 | -.59 | -.64 | m/sec |
| WING LOADING | : | 32.5 kp/m2 | | | |




——— Clean wing polar

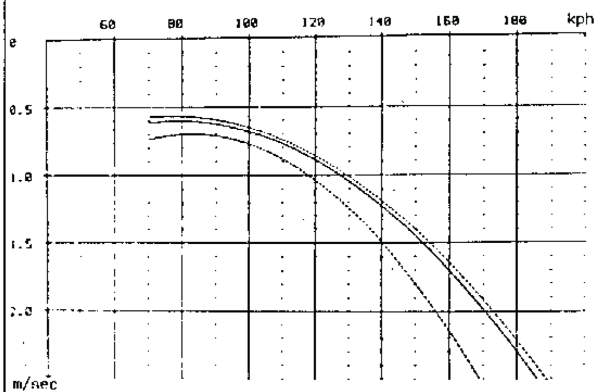
........ Bugged leading edge polars

## GROUP 3

### PERFORMANCE POLARS

③

| | | | | | |
|---|---|---|---|---|---|
| SAILPLANE | : | ASW 20L | | | |
| GLIDE RATIO E | : | 41.5 | 43.6 | 36.8 | |
| AT | : | 98.4 | 96.8 | 98 | kph |
| MIN. SINK | : | -.59 | -.55 | -.68 | m/sec |
| WING LOADING | : | 32.5 kp/m2 | | | |




——— Clean wing polar

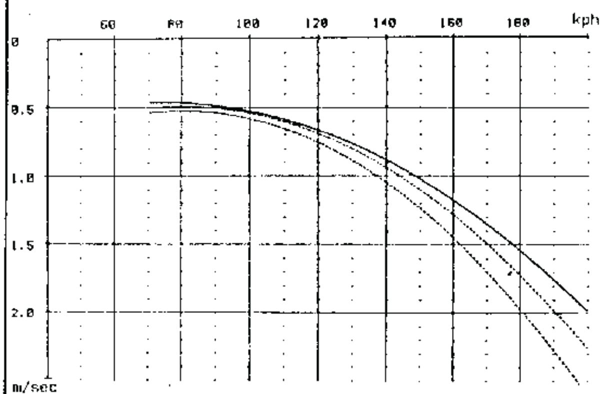
........ Bugged leading edge polars

## GROUP 4

### PERFORMANCE POLARS

④

| | | | | | |
|---|---|---|---|---|---|
| SAILPLANE | : | Nimbus 3 | | | |
| GLIDE RATIO E | : | 54 | 52.5 | 49 | |
| AT | : | 96.7 | 92.5 | 96 | kph |
| MIN. SINK | : | -.43 | -.46 | -.49 | m/sec |
| WING LOADING | : | 32.5 kp/m2 | | | |



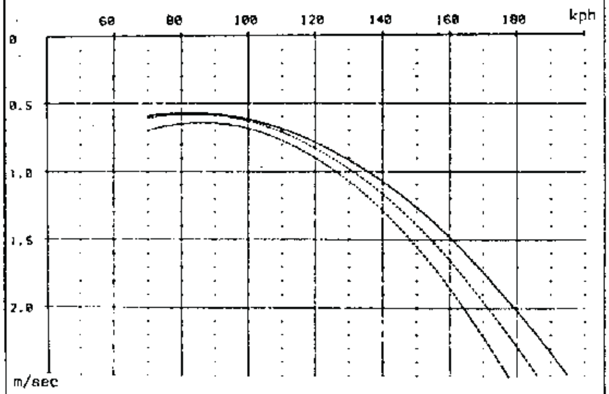

——— Clean wing polar

........ Bugged leading edge polars

## GROUP 5

### PERFORMANCE POLARS

| | | | | | |
|---|---|---|---|---|---|
| SAILPLANE | : | Nimbus 2 | | | (5) |
| GLIDE RATIO E | : | 46.1 | 45 | 41.6 | |
| AT | : | 103 | 101 | 102 | kph |
| MIN. SINK | : | -.56 | -.57 | -.63 | m/sec |
| WING LOADING | : | 32.5 kp/m2 | | | |



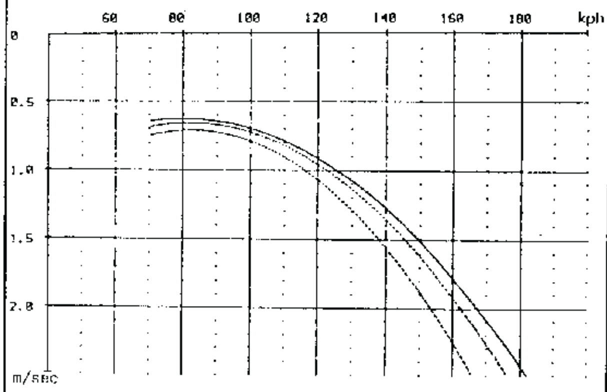

Clean wing polar
Bugged leading edge polars

- VW 920 - DR. WESTERBOER-HOFMANNSEL, WEIDEN 1h

## GROUP 6

### PERFORMANCE POLARS

| | | | | | |
|---|---|---|---|---|---|
| SAILPLANE | : | DG 300 | | | (6) |
| GLIDE RATIO E | : | 40.5 | 39 | 36 | |
| AT | : | 100 | 100 | 98.4 | kph |
| MIN. SINK | : | -.62 | -.65 | -.7 | m/sec |
| WING LOADING | : | 32.5 kp/m2 | | | |



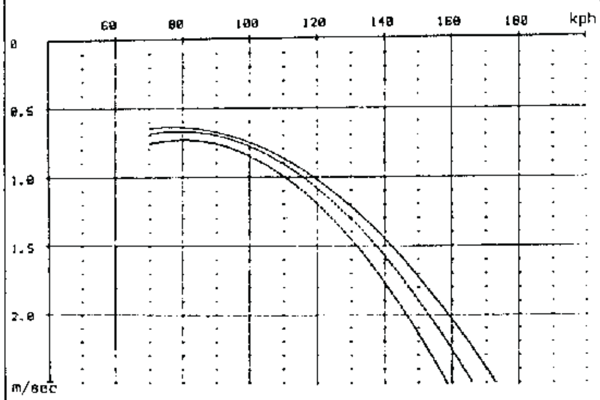

Clean wing polar
Bugged leading edge polars

- VW 920 - DR. WESTERBOER-HOFMANNSEL, WEIDEN 1h

## GROUP 7

### PERFORMANCE POLARS

| | | | | | |
|---|---|---|---|---|---|
| SAILPLANE | : | DG 100 | | | (7) |
| GLIDE RATIO E | : | 37.8 | 36.5 | 33.7 | |
| AT | : | 96.5 | 96.2 | 96 | kph |
| MIN. SINK | : | -.64 | -.67 | -.73 | m/sec |
| WING LOADING | : | 32.5 kp/m2 | | | |



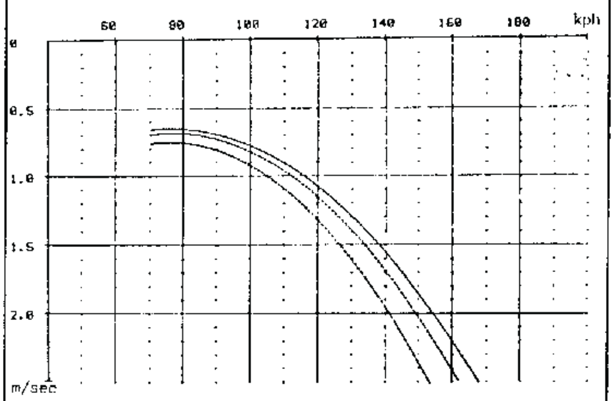

Clean wing polar
Bugged leading edge polars

- VW 920 - DR. WESTERBOER-HOFMANNSEL, WEIDEN 1h

## GROUP 8

### PERFORMANCE POLARS

| | | | | | |
|---|---|---|---|---|---|
| SAILPLANE | : | ASW 15 | | | (8) |
| GLIDE RATIO E | : | 36.8 | 35 | 31.5 | |
| AT | : | 89 | 88.3 | 86.7 | kph |
| MIN. SINK | : | -.61 | -.64 | -.7 | m/sec |
| WING LOADING | : | 32.5 kp/m2 | | | |



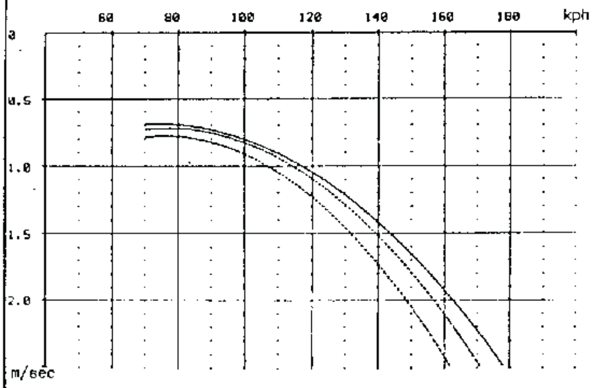

Clean wing polar
Bugged leading edge polars

- VW 920 - DR. WESTERBOER-HOFMANNSEL, WEIDEN 1h

**G R O U P   9**

**P E R F O R M A N C E   P O L A R S**

| | | | | | |
|---|---|---|---|---|---|
| SAILPLANE | : | DG 100 | | | (9) |
| GLIDE RATIO E | : | 35 | 34 | 31 | |
| AT | : | 92 | 91.7 | 89.6 | kph |
| MIN. SINK | : | -.64 | -.67 | -.72 | m/sec |
| WING LOADING | : | 32.5 kp/m2 | | | |




——— Clean wing polar

——— Bugged leading edge polars

- VW 920 - DR. WESTERBOER-HOFMANSEL, HEIDEN 1h

If you change to a different glider it is a simple job to select the new polar. All you do is this:

- Switch off the vario and computer
- Using a small Philips screwdriver unscrew and remove the small cover marked "POL.-TYP _" on the rear of the VW 920 computer.
- Select the polar type required using the 8-pole DIP switch.

The table on the next page shows the settings for the various polar groups.



| Polar Group Number | DIP Switch Setting<br>1 2 3 4 5 6 7 8 |
|---|---|
| 1 | . u u u u u u u<br>d . . . . . . . |
| 2 | u . u u u u u u<br>. d . . . . . . |
| 3 | . . u u u u u u<br>d d . . . . . . |
| 4 | u u . u u u u u<br>. . d . . . . . |
| 5 | . u . u u u u u<br>d . d . . . . . |
| 6 | u . . u u u u u<br>. d d . . . . . |
| 7 | . . . u u u u u<br>d d d . . . . . |
| 8 | u u u . u u u u<br>. . . d . . . . |
| 9 | . u u . u u u u<br>d . . d . . . . |

If you choose the group 6 polar for example you will need to set the DIP switch:-

- DIP Switch 1 up
- DIP Switch 2 down
- DIP Switch 3 down
- DIP Switch 4 to 8 all up

(Up and Down are with reference to the computer case).

On the previous page therefore "u" means the switch is up, "d" means the switch setting is down.

We have illustrated the stored polars to help you to match polars which have been measured or are manufacturer´s polars.
The polar group number is shown in each case in the circle, top right.

The sailplane named simply represents its polar group. All these polars are standardised for a windloading of 32.5 kg/m2.

The continuous line represents the polar when the glider is in optimum condition (PO). The dotted lines represent a contaminated leading edge (P1) and rain (P2). These latter figures have not been measured nor are they manufacturer´s figures. They are simply based on a wealth of competition experience.

There is one exception: Polar group 3 was intended for aircraft with variable span. In this case one of the dotted polars is better than the continuous one. It can be called up with the P1 setting of the polar switch and is equivalent to "17m Polar".



## 9.2 Map Preparation

You will have received a map overlay with concentric circles representing distance from the destination. It is designed to be stuck on a laminated 1:500000 map. It is very easy to estimate the final glide distance accurately if you use a map prepared in this way.

Recommended procedure for applying the overlay:

- Have a sponge and water with a dash of washing up liquid in it ready;
- Remove backing paper from overlay
- Wet the area in question with the wet sponge
- Place the overlay on the required position
- Line up the centre of the concentric rings with the destination
- Allow to dry for 24 hours

Wetting the map with water has the advantage that the overlay does not stick down prematurely - it is easier to position.

N.B:
Don´t wet the map unless it is laminated. Apply the overlay dry to a non-laminated map.

## 9.3 Examples of Instrument Panel Layout

Examples of good competition instrumentation:

Fig. 15: DG 300
Fig. 16: ASW 20C
Fig. 16: LS 4

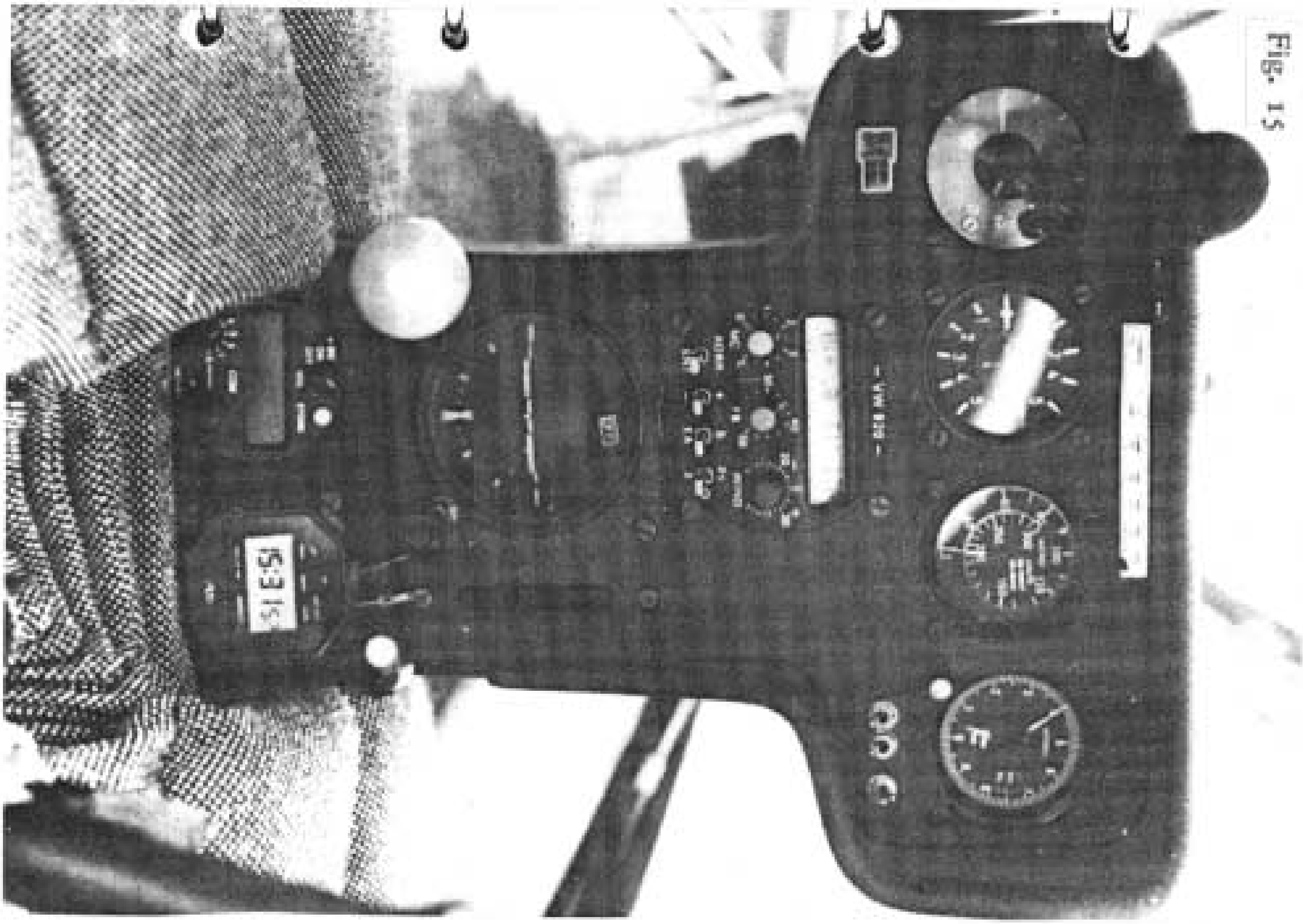


Fig. 15

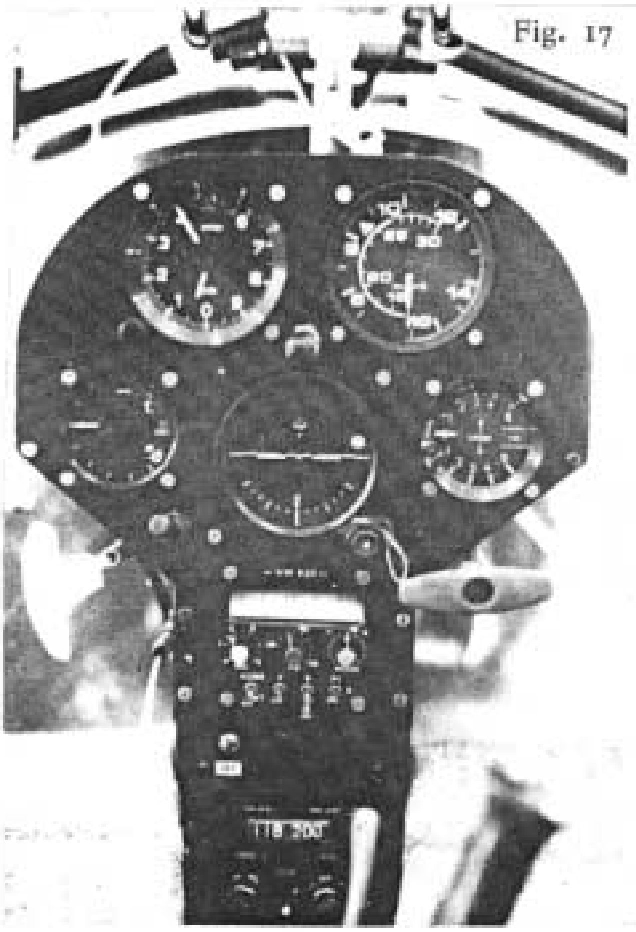


Fig. 17

Fig. 16

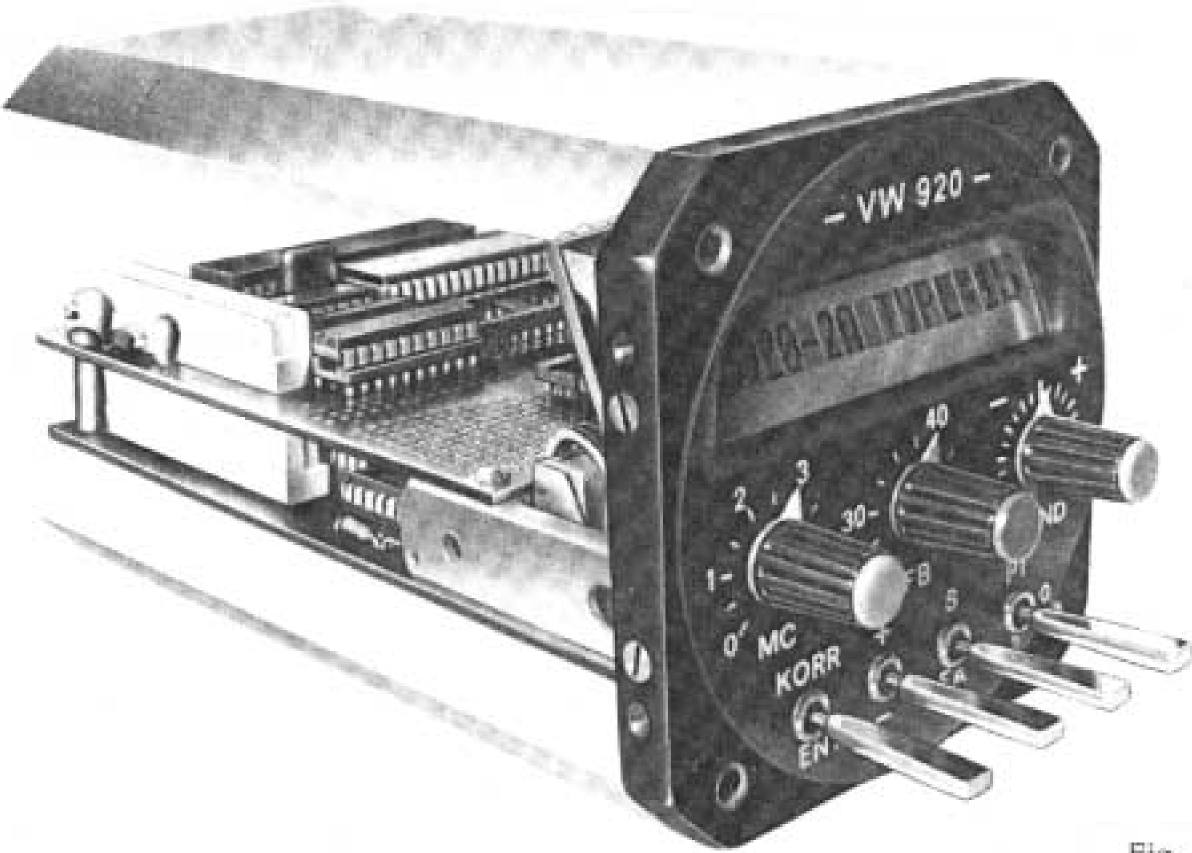



Fig. 18

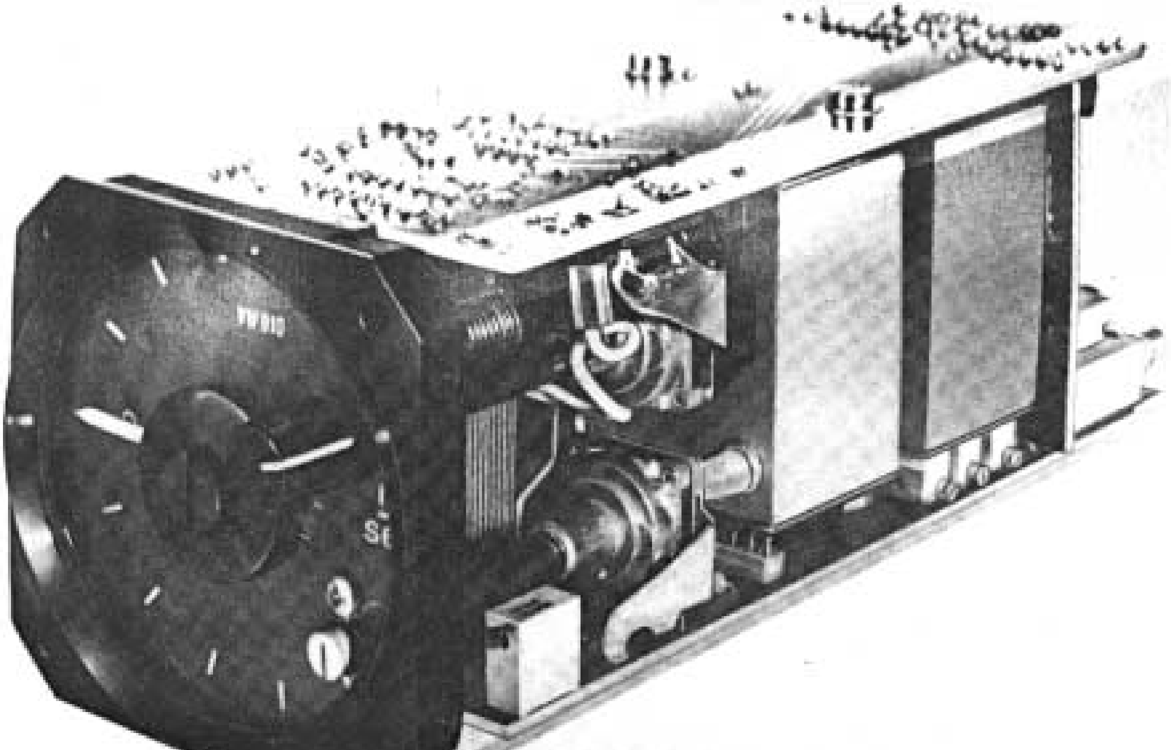


Fig. 19