owner's guide

VP 4

PESCHGES VARIOMETER

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Rev 1.121

OWNER´S GUIDE

VP 4

TABLE OF CONTENTS

1.0 The controls and their functions

S1: ON/OFF switch

after switch-on, the indicator goes to full negative deflection and goes back to zero after approx one minute warm-up time.

Simultaneously, the computer shows

```
+-----------+
! E   xxx E !
+-----------+
```

on the display.

E : english version
xxx : software indication number (e.g.: 100)
E : electronic compensation

Then, the display switches to the type of glider,

```
+------+
! LS 4 !
+------+
```

which remains visible for approx 3 seconds.

S2: **audio volume**

load : volume increase
volume decrease

S4: **digital input key**

keyed up : -1
keyed down : +1

S5: **"enter" key**

key for zero setting of the enter functions

S3: **rotary selector switch for different functions:**

- altitude and integrator in "climb"- mode
- altitude and distance in "cruise"- mode

- entry of the wind component
- selection of the vario damping level
- selection of the vario indication range
- automatic switch-over speed
- selection of the glider polar curve and TEC level setting
- entry of polar penalty factor
- entry of wing loading
- Mc. Cready setting

2.0 The variometer and speed-to-fly indicator

The variometer part of the VP 4 includes 5 functions:

- total energy compensated variometer (TEC-variometer)
- the integrator (averager)
- the net-relative vario
- the speed-to-fly indicator
- the audio generator

These functions can only work properly, if the total energy compensation has been correctly adjusted. For this reason, a test flight in smooth air must be performed after the equipment has been installed in the glider. This allows to check the electronic total energy compensation, when available. If necessary the TEC can be also adjusted in flight to match the static vents of the glider.

2.1 The total energy compensated variometer

As the pressure data acquisition is performed by electronic pressure transducess, the variometer does not show any altitude induced indication error.

The "range" position of the selector "S 3" allows to choose between ranges of indications:

2,5 m/s
5 m/s
10 m/s

This is confirmed by a indication in the display:

```
+-------+
! RAN 5 !
+-------+
```

Similary, the "damping" position of the S 3 allows to choose between 3 damping levels:

0 : small damping (1.0 sec)
1 : medium damping (2.0 sec)
2 : large damping (4.0 sec)

Both selections affect all variometer functions equally.

2.2 The integrator

When the variometer is working in "climb"- mode, the average rate of climb of the last 32 seconds is displayed, if the function "integrator/altitude" has been selected with S 3.
The display shows the necessary altitude on the left and the averager on the right:

```
+-----------+
! 1000  2.0 !
+-----------+
```

We must precise that it is a real integration and not just a pseudo integration obtained by an extreme damping of the variometer as it is the case for many other systems.
When a second indicator instrument is installed, the average rate of climb displayed on it.

2.3 The net-relative variometer (option)

In "cruise"- mode, the first indicator permanently displays the rate of climb which would be achieved, should the pilot start thermalling right at this moment. This calculation takes the proper rate of descent of the glider when ciecling in account.

The net-relative variometer indication is affected by following parameters:

- polar of the glider
- polar penalty factor (MPOL)
- wing loading ( )
- variometer range (RAN)
- damping (S 5)

2.4 The speed-to-fly indicator

As most of the functions of the VP 4, the speed-to-fly indication is essentially microprocessor controlled.The calculation is based on the coefficients of the quadratic equation, thus allowing a high precision.
Constant monitoring of the atmospheric pressure lenders the speed-to-fly indicator free of error at any altitude.When comparing the indication with other systems, it should be considered that most other systems are not free of altitude error, even mechanical variometers with Mc. Cready ring.

The speed-to-fly indicator is a command instrument and shows the pilot, if he has to decrease or increase his speed:

indicator positive : pull the stick to decrease speed
indicator negative : push the accelerate
indicator on zero : speed is correct

When only one indicator is installed, then the speed-to-fly is displayed on it. When a second indicator is installed, then the first indicator will shows the net-relative vario and the second one the speed-to-fly.

Following parameters affect the speed-to-fly indicator:

- polar of the glider
- polar penalty factor (MPOL)
- wing loading ( )
- variometer range (RAN)
- damping (DAM)
- Mc. Cready setting (MC)

2.5 The audio generator

The audio generator of the VP 4 works like in most electrical variometers. The tone frequency increases with the rate of climb. Additionally, the tone will be disrupted at an increasing frequency when in the positive range.

The volume can be adjusted through S 2.

In "cruise"- mode, the tone will be interrupted when the speed flown is correct. The meeting zone extends over +/- 0,7 m/s. Furthermore, the muting zone is automatically widened when speed is increased.
The volume is also proportionnal to the airspeed. If increases with the airspeed so that the audio signal remains always clearly audible, even at high speed.

2.6 Adjustment of the total energy compensation

During to the fact that the VP 4 ? is equiped with an electronic compensation circuitry, it is to possible to adapt the compensation level to the static pressure inlets of the glider.
For this purpose, a flight in absolutely smooth air is required. The choice of the static inlets is decisive for the quality of the compensation.
The compensation has been adjusted at the factory assumig that Pitot and static pressure are correct.

The adjustment to the glider´s pressure vents should be done as follow:

2.6.1 Switch the equipment in "climb"- mode.

2.6.2 Accelerate the glider to approx 100 mph.

2.6.3 Hold this speed for approx 20 sec.

2.6.4 Pull back gently and constantly to normal flying airspeed, avoiding brutal accelerations.

2.6.5 The variometer indication should move along the polar curve of the glider.

If it deflects too much into the positive,then it is **UNDERCOMPENSATED**

Function selector S 3 in position "com/POL"

Keep S 5 depressed. The level of compensation will appear on the display:

```
+----------+
! CS  100.0 !
+----------+
```

Then increse the compensation with S 4.

If the variometer deflects into the negative when pulling up, then it is **OVERCOMPENSATED.**

Decrease the level of compensation as above accordingly.

2.6.6 Repeat points 2.6.1 to 2.6.5 until the compensation level is correctly adjusted.

3.0 The flight computer

3.1 The mileage counter

Thanks to the use of semiconductor pressure transducers, it is possible to realise a mileage counter of high precision, free of altitude error.
In "cruise"- mode, actual remaining distance and necessary altitude are pemanently shown on the display.
The mileage counter is fed with the true airspeed, the wind velocity entered and the wind measurement time.

D (tot) = D (Tas) + V (wind) + T (wind)

D : disance
Tas : true airspeed
V (wind): wind velocity
T(wind) : wind measurement time

The distance range extends from -999,9 to +999,9 km.

The distance is always counted down.

The distance to the flown can be entered with S 4. Simultaneously, the reset of the time T (wind) is automatically triggered and a new wind calculation is started.
Before a new distance is entered, the counter should be set to zero through keying of S 5 once.
Then the distance can be entered via S 4. Keying S 4 once adds or substracts 1 km to the display. If S 4 is kept depressed, the distance display will run. As soon as a zero is set as the last digit, the computer switches to 10^{+}ers entry. Releasing S 4 will switch back to entry of the unities.
The mileage counter is automatically started when a speed of move than 80 km/h is applied for more than 15 seconds (take off). It will be automatically stopped when an airspeed of less than 60 km/h is applied during more than 15 seconds (landing).

3.2 Climb/cruise switch-over

The correct function of the mileage counter relies on an exact climb/cruise switch-over, as in "climb"- mode, the counter is fed with the glider true airspeed corrected by the wind component.

Their are three different ways of switching over from "climb" to "cruise" modes and vice versa in the VP 4.

1. Manual switch-over

The manual switch-over is commanded by an external three position switch and always has priority.

upper position : "climb"- mode
lower position : "cruise"- mode
middle position: automatic switch - over according to 2. and 3. hereunder

2. Speed triggered switch-over

In the "speed automatic" position of the selector S 3, a switch-over speed can be entered with S 4. Climb/cruise switch-over will then occure with a 5 seconds delay after this preset speed has been oversloated and vice-versa.

If a zero speed is entered, the speed triggered switch-over is disabled and the flaps switch-over described hereunder is activated.

3. Flaps position triggered switch-over

Is obtained by installing a remote mounted microswitch activated by the flaps controls.

3.3 The wind correction

With S 3 on the "wind" position, the wind component can be entered in 5 km/h steps.

(−) means headwind
(+) means tailwind

Thewind velacity selection range reaches from −120 km/h (head)to +120 km/h (tail).

With the VP 4, determination of actual wind component is very easy.It will be best explained on following example:
The first leg of a triangle is 100 km long. Thi distance is entered into the mileage counter as described in para. 3.1. Entering the distance automatically resets the wind measurement time facts to zero. Now cross the startline an take good care that during the flight, climb/cruise switch-over is done accurately. The climb mode should be only used when thermalling, othewise, the distance counted will be wrong.
After 40 km (still 60 km from turnpoint), the pilot as pinpointed a check point which will be used for the wind determination. If the entered wind component is correct, themileage counter will display 60 km when the checkpoint is overflown. If this is not the case, a readjustment is necessary and will be done as follows:

Select the "wind" position of "S 3 ".

display:

```
+-----------+
! WIND   0.0 !
+-----------+
```

Depress "S 4" once.

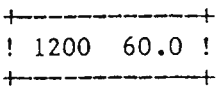
to display:

```
+-----------+
! DIST  58.7 !
+-----------+
```

Then enter the correct distance (here 60) with "S 4", which will perform the correction of the wind component.
The new wind component can then be checked and eventually refined with a second checkpoint.
Correcting the distance with S 4 during the flight will always reset the wind measurement time factor to zero.

3.4 The required altitude

The altitude required to cover the distance given by the mileage counter is permanently computed and indicated on the left side of the LC-display.



This computation takes the cinetic energy of the glider in account.

The required altitude is computed from the polar equation stored and depends of following entered datas:

- glider polar
- polar penalty factor (BPOL)
- Mc. Cready setting (MC)
- wing loading (FBL)
- wind component (WIND)

3.3.4.5 Selection of Units

Upper display shows:

Un

When left digit in lower display

is	altitude in	vertical speed in
0	meters	m/sec.
1	feet	m/sec.
2	meters	kts.
3	feet	kts.

When right digit in lower display

is	distance in	horizontal speed in
0	Km	km/h
1	Stm	MPH
2	NM	kts

4.0 Basic data inputs

The rotary selector "S 3" allows the entry of following datas:

- switch-over speed climb/cruise
- polar curve of the glider
- compensation level (only when electronic compensation is installed)
- polar penalty factor
- wing loading
- Mc. Cready setting
- wind component

4.1 Switch-over speed climb/cruise

The display shows:

```
+----------+
! AUTO  95 !
+----------+
```

The figure right of the display is the switch-over speed. It can be altered with S 4. When the external switch-over switch is in its middle position, this speed will control the climb/cruise switch-over with a 5 seconds delay.This automatism can be overriden when the switch is set into up or down position.

Keying S 5 will switch the automatism off and transfer the "climb/cruise" switch-over to the flaps switch.

The display will then show:

```
+--------+
!  FLAPS !
+--------+
```

4.2 Glider polar selection

The display shows abreviations of the name of the glider type in question for instance:

```
+---------+
! MISTRAL !
+---------+
```

Through successive keying of S 4, the polar curves of following gliders can be entered.

Clubklasse (Mistral, etc.)
Std. Cirrus
LS 1 F
Hornet C,
LS 4
LS 3, ASW 20, Mosquito, DG 200, DG 400
ASW 20 L, DG 200-17
Ventus
Ventus 16,6m
Nimbus 2
Nimbus 3 - 24,5m
Nimbus 3 - 22m
ASK 21
Twin Astir
Janus C
H - 301
Salto 13,6m
Salto 15m
DG 300
ASW 22
Calif - A 21
G 109 B
ASW 20 B
ASW 20 C
Discus
LS 6
Kestrel 17
Jantar IIB
Pik 20 S
ASH 25
DG 500-22
Phöbus C
ASK 13
Club Libelle
H 304
H 604
Mini Nimbus
ASW 17
Janus CM
Pik 20 E
DG 100
Astir CS
DG 400-17
Ka 6 E
Cirrus 18
LS 1 C
LS 3 A
LS 3-17

BS 1
ASW 20 CL
ASW 19
ASW 19 WL
DG 600
DG 600-17
ASW 12
H 201 B-15
H 201 B-17

4.3. Total energy compensation level (only for E-version)

The total energy compensation level can be adjusted in the "comp/POL" position of the selector "S 3". S 5 must be kept depressed during all the operation.

The display shows:

```
+-------------+
!  CS  100.0  !
+-------------+
```

CS : for compensation

Now, the level can be adjusted with S 4 between 80.0% and 105.6 % in 0.1 % steps.

80 % means : 20 % undercompensated
105.6 % means : 5.6 % overcompensated

The glider polar selected reappears in the display after S 5 has been set free.

4.4 Polar penalty

A percentage of penalty related to the glider polar curve can be entered in the "bugs" position of the selector S 3. This is to account for performance losses occuring in flight through dirtying of the aerofoil by bugs or rainwater.
As it is assumed that take off will always occure with a clean glider, the polar penalty is always reset to zero when the equipment is switched-off.

The display shows:

```
+-----------+
! BPOL  -10 !
+-----------+
```

-10 : means 10 % penalty factor

4.5 Wing loading

The wing loading can be varried between 30 and 50 kp/m in the "wing load" position of the selector "S 3".

```
+-----------+
! FBL  38 KP !
+-----------+
```

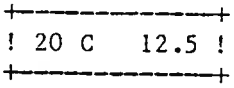
4.6 Mc. Cready setting

The Mc. Cready setting can be selected between 0.0 and 4.0 m/sec in the "Mc. Cready" position of the selector S 3.

```
+----------+
! MC  20  !
+----------+
```

5.0 Battery voltage and outside air temperature

Selecting the "Temp/battey" position with S 3 will display the outside air temperature on the left of the display and the battery voltage on the right:



After the equipment has been installed, the temperature must be calitrated by comparison with another thermoter located in the vicinity of the temperature probe.
This can be done with S 4 while S 5 is kept depressed.

6.0 Short operating instructions

Before take-off

- check of the basic datas: - switch over speed
  - polar curve
  - compensation level
- switch over to "cruise" mode and enter the distance of the first leg with S 4
- enter the predicted wind component with S 4
- enter the predicted average rate of climb (Mc. Cready setting)
- enter the correct wing loading
- select the range of indication for the vario
- check the vario damping

In flight

- perform the wind component correction when reaching each checkpoint
- enter new distance when a turnpoint is reached

7.0 Simulator operation

Why a simulator?
The relations between the programs themselves are so complex in this software version, that we have to advise the pilot to get familiar with the operation of the equipment on ground. The VP 3 is able to simulate a flight and reacts the same way as in flight to the datas entered by the pilot.

How to trigger the simulator operation.

- Switch the equipment OFF
- Depress S 5 and S 4 simultaneously (S 4 in up position). Keep both switches depressed and switch the equipment on again with S 1. Release all the switches only after the display has showed the type of glider.

It is absolutely necessary to make sure that the equipment has been switched off again before the next take-off.

How the simulator operation works.

When the simulator operation is switched on, the computer simulates the take-off of the glider and clears all the memories. Simultaneonsly, the clocktime of PRG 4 is stored in PRG 7 and considered as startline. During a normal flight, the indicated airspeed (IAS) of the glider is measured in the vario with a precision pressure transducer and transformed into true air-speed (TAS) by the computer. In simulator operation, no pitot pressure is requird as th computer simulater a preprogrammes true air speed of 150 km/h. (IAS =TAB).

There is no difference between real flight and simulation in the operation (only the speed cannot be variated). The climb/cruise switch-over can be operated as ever over the flaps, the automatism of the manual switch. As we are on ground, the vario registers no variation of altitude.

8.0 Installation instructions

The VP 4 consists of:

- the computer/main control unit (58mm diameter)
- 1 ou 2 round indicators (60mm diameter)
- one basic wiring harness with loudspeaker and 3-position switch.

The basic wiring harness is the same for all versions of the VP 3 and includes following connectins:

- battery, marked "B+" and "B-"
- connection cable for mechanical Integator/speed to fly instrument (white and black cables)
- loudspeaker cable with connector loudspeaker
- cable with 3-position switch for manual climb/cruise switch over
- cable for connection of a flap switch (marked with "Flaps")
- cable with temperature probe (red end).

The computer can be installed in any regular 58mm instrument hole. The housing of the computer is grounded (-). When other electronic devices are installed in the instrument panel, proper grounding of these instruments must be checked and ensured.
The mechanical indicators have a diameter of 60mm. They should not be installed in the direct vicinity of the compass. The minimum distance being 20 cm.
The unit is designed for a power supply variating between 10.5 V and 15 Volt DC. An internal diode prevents damage of the unit in case (+) and (-) have been wrongly connected. However this protection only works when the proper fuse has been installed in the power supply wiring. The power is routed to the computer via the (B+) and (B-) lines. A 0,4 A slow blow fuse must be inserted into the (B+) line. In this case, if the unit is wrongly connected the fuse will blow and no further damage will occure.

The lack of fuse can lead to very extensive internal destruction of unit for which no warranty can be claimed.

It is strongly recommended to use a large section cable (2,5mm or more) for the power supply in the glider. All minus connection of the electrical instruments should be grounded to a common point in the vicinity of the instrument panel (for instance screw or bolt in the metallic instrument panel). The (+) line should also be a large section cable (minimum 2,5mm 2).

The mechanical instrument should be connected as follows:

Varioinstrument	brown on minus black on plus

When a second instrument is used (integrator/speed to fly), it should be connected as follows:

	white on minus black on plus

The loudspeaker can be installed at any place in the cockpit-however is should be far away from the compass.

A further cable leads to a 3-position switch which commands the climb/cruise switch over as follows.

Middle position: automatic switch over enther over speed or over flap switch
upper position : climb
lower position : cruise

The flap switch will switch the unit to climb mode when closed and to cruise mode when open.

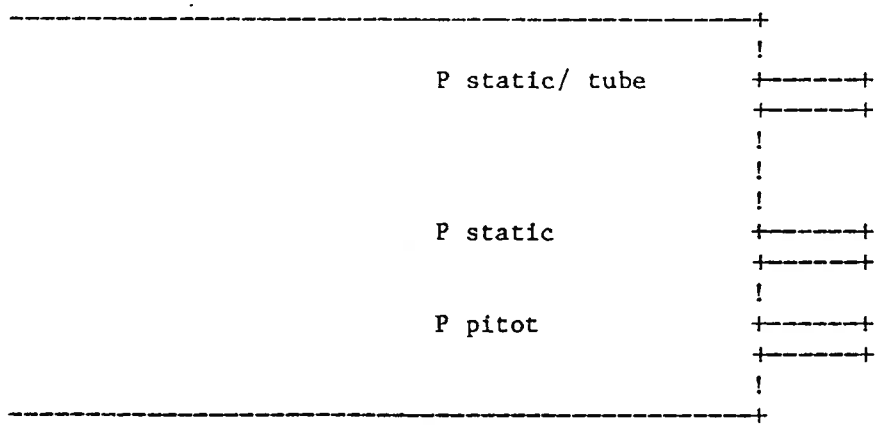
The temperature probe is covered with a red isolation and should be protected against strong mechanical effects. It can be installed in the airduct or in a zone submitted to the outside air.

None of the connecting wire should be installed parallel to the antenna cable of the radio equipment at this could lead to interferences when the radio is transmitting.

A 15 pin connector are visible at the rear of the unit. It recieves the connector of the basic wiring harness.
The connector are fitted with a locking device preventing an accidental interruption of the connection. Proper insert of the connectors locking device should be ensured as follows:

Push the locking device into open position on the loose connector. Insert the connector into the socket and push the locking device into the closed position until the metal tongues are well undes the bolts on each side of the connector. Check the connection lacking by trying to pull the connector out with moderate effort.

The rearside of the main contol unit is fitted with three pressure tubes connections.



The middle connection is always for static pressure. It should be separated from the static connection of any other instrument.

The upper connection recieves either the TEC probe when the VP 3 is to work with probe compensation or the static pressure when working with electronic compensation.

The lower pressure connection recieves the pitot pressure, the same one as th one linked to the airspeed indicator.

Experience shows that the use of a common probe (Prandel probe) for static and pitot pressures has given the best results as for as the compensation is concerned. It allows an error free measuring of the speed of the glider and is therefore strongly recommended.

Some typical pressure connections for different types of gliders:

type	static pressure	pitot pressure	compensation ratio
LS 3	front and rear*	front	93.6 %
LS 4	front and rear*	front	95.0 %
LS 6	front and rear	front	98.2 %
VENTUS	front and rear	front	97.0 %
NIMBUS 2	rear	front	
NIMBUS 3	front and rear	front	
DISCUS	front and rear	front	
Std. CIRUS	front	front	

* a special pressure connector is needed.

9.0 Warranty conditions

The Peschges Variometer company grants a two years warranty on the complete equipment, starting from the day of sale and five years warranty on the pressure transducers.

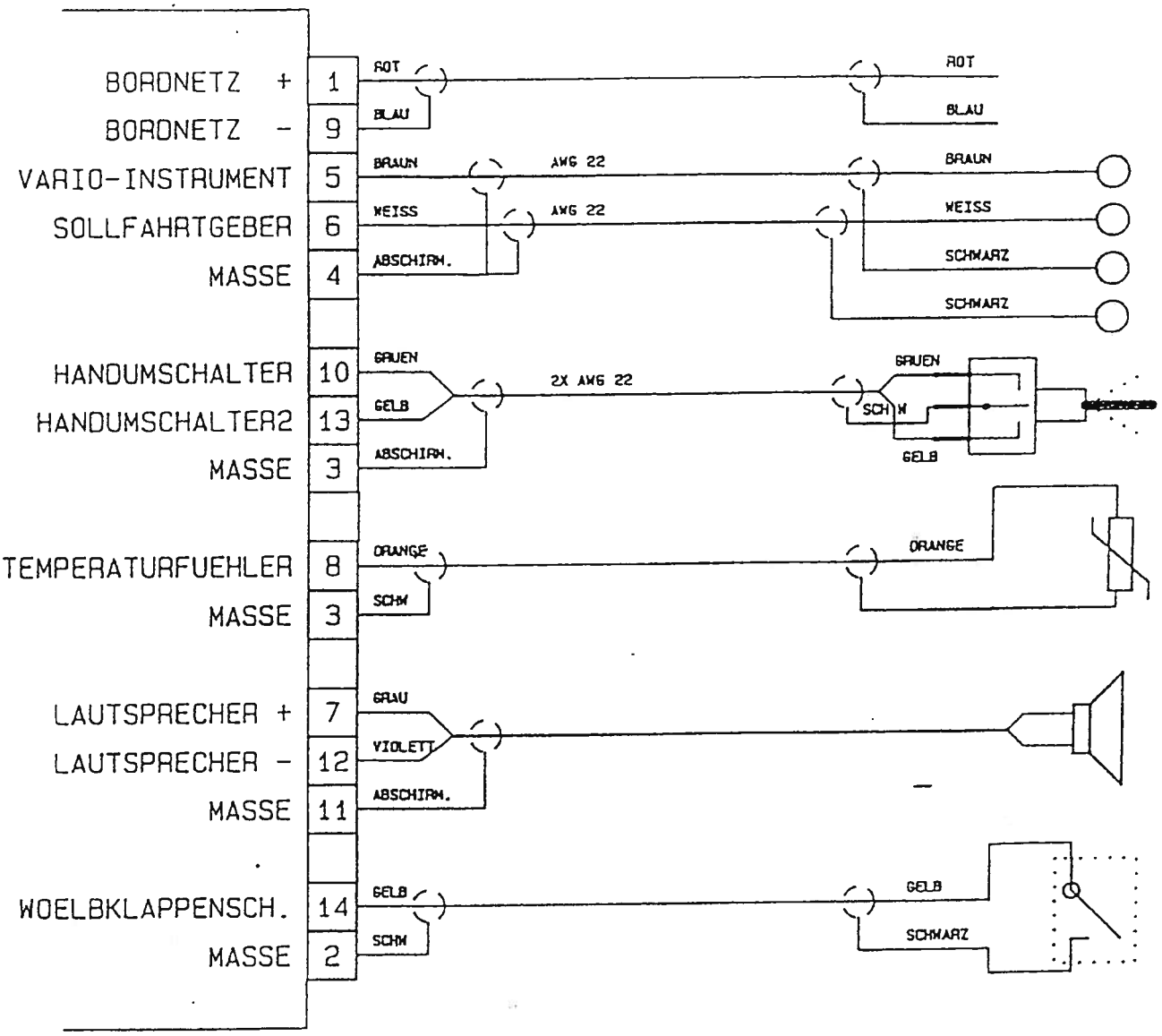
The warranty performance is expressly bound to following conditions:

- customer registration card duely filled and sent back to the factory
- equipment seal undamaged
- equipment has been handled with reasonnable care (switches, displays..)
- equipment is sent back to the factory in its original special schock-proof packing. No liability for transport damage!
- prepaid freight to the factory
- the equipment has been operated within the allowed voltage range
- the equipment has been protected by the prescribed external fuse
- the equipment has been operated within the allowed pressure range of the pressure hansducers:
  static pressure : 0-1 bar underpressure
  Pitot pressure : 0-50 mbar overpressur.

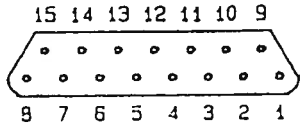
The warranty expressely excludes:

- broken switches
- damages cables
- mechanically damaged parts
- transport damages
- damages due to overvoltage or reversed polarity if no fuse was installed
- damages due to unallowed operation
- damages due to the crash or damages of the glider

****
*
* - WARNING-
*
* The warranty is void if the equipment seal is damaged.
*
****



STECKERANSICHT: LOETSEITE



PROJEKT: VP3 (4) -ANSCHLUSSKABEL	REV.: 3
BEARBEITER:	DATUM: 22.4.87

PESCHGES VARIOMETER GMBH

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