Geotronics

WORKSHOP INFO

October 1993
GEOTRONICS AB
Technical Support Dept.
Danderyd, SWEDEN
WI/9310A

Instrument type: Geodimeter Instruments

Subject: Lubrication of instruments and sub units

Description: To maintain specified instrument performance service workshops must not use other than by GEOTRONICS AB approved type (Part No) of grease at each position/function.

Below is a summary of greases and their general purpose. In the maintenance manual for each Geodimeter system you will find details of lubricants/lubrication when applicable.

Part No	Name	General purpose	
571 905 940	Isoflex OPN4 (TOPAS)	Foot screws (Tribrach)	
571 905 942	MS4	Screws/Threads	
571 905 943	Rocol ASP	Motion screws Vert/Hor	
571 905 944	Isoflex NBU 15	Servo drives (cog wheel)	
571 905 946	High vacuum grease	Water/dust protection - Bottom part - Pivot axes - Gear housing	
571 905 948	Uni silicon TKH 1011	(System 500) Sealing for focusing mechanism telescope	
571 905 949	Isoflex PDL 300A	(H.V) Locking surface, slide bearings	
571 905 950	Fluolub 175	Rubber seal telescope (System 400)	
571 905 952	Unimoly C220	Basic surface treatment (Servo drives)	
571 905 953	DFIM	Threads/Occular	
571 905 955	Catenera KSB 12	Bearing	
571 905 956	Isoflex Topas L30	Motion Control (Non metal)	Servo
571 905 957	Isoflex Topas AK50	Motion Control (Metal)	Servo

8. ASSEMBLING CHECKS

8.1 Assemble the Geodimeter except the casing. Check that all cables are placed correctly. Check that no pins on IC:s are folded. Check that the springs for H.A. and V.A. driving are placed correctly.

8.2 Check the back up battery voltage. Min. 3.6V DC. (New status is 3.65V).

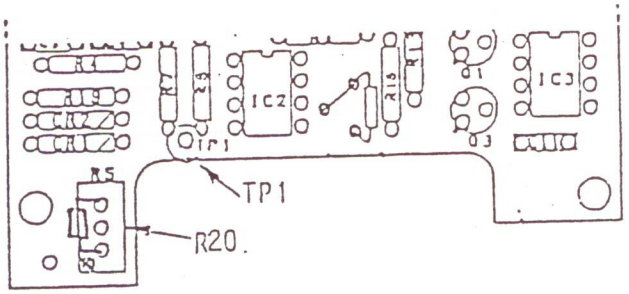
8.3 Check the current consumption: 0.5A.

9. SENSOR AND PLUMB COMPENSATOR SIGNALS

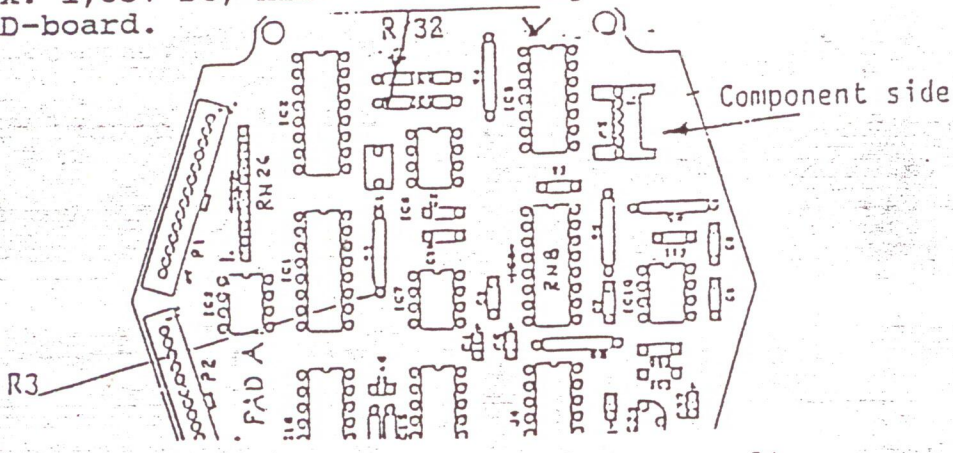
Compensator: 571 143 016 and 571 144 720

9.1 Check that R20 on OSC-board is 10k

9.2 Check the 12khz signal on the OSC-board, TP1.
With an oscilloscope: Pure sine wave, with no clipping.



9.3 Check the sensor voltages, max. and min. values.
Read directly on the GDM-display by entering
F22=0, F161=128, F137=31.
Max: 1,85V DC, Min: 1.6V DC. Adjust with R3 on the PAD-board.



9.4 Check the plumb compensator reference voltage.
Read directly on the Gdm-display. Max: 1,85V,
Min: 1,3V.
Adjust with R32 on the PAD-board.

9.5 Check by tilting instrument 10C that label 122: X-direction, 123: Y-direction, is increasing 10500 - 12000 pulses (1,05 - 1,2V).
Adjust with R17 on the PAD-board.

9.6 Run the COMP-program (GSS).
Follow the program.

10. INNER PATH SIGNAL LEVEL

10.1 Check the inner path signal level one more time, see point 5. (Loading of the angle unit can affect this level).

11.1 TRACKLIGHT VOLTAGE

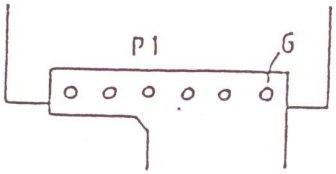
11.1 Connect IC1:14 on COM-board to ground. Meas on P20:6. Adjust voltage to 6,15 (± 0,05V) HIGH level with R14 on COM-board. Normal level is now 4,3 - 4,5V.

12. CROSS HAIR ILLUMINATION

12.1 Cover the telescope front lense. Adjust on the COM-board, R22 to the left to a suitable illumination of the cross hairs. Just visible, not too bright!
(Newer instruments have a fixed resistor).

13. CHECK OF UNICOM MODULATION

13.1 Measure, with an oscilloscope, the transmitter signal on the TRM-board.
P1 pin 6:



13.2 Knock on the UNICOM-microphone and see that the square wave is frequency modulated.

14. ALIGNMENT

14.1 Make an alignment of the distance unit to the telescope. Use an interconnection cable between the panel (COM-board) and the distance unit to be able to reach the adjustment screws.

15. COMPLETE ASSEMBLING

15.1 Assemble the Geodimeter completely with casing and all screws.

15.2 Check the alignment of the distance unit to the telescope.

15.3 Make an ESD-check: ⏚ - measure from the screw on the distanc unit casing to the bottom part.

16. INTERFERENCE SIGNAL

16.1 Make cyclic error measurements as follows:

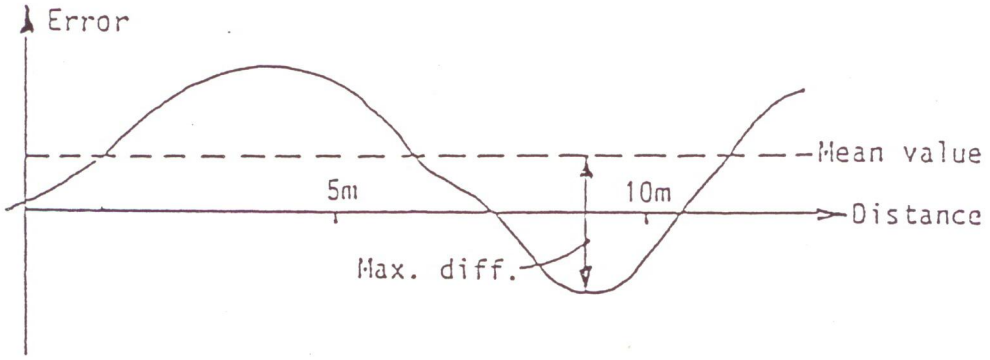
16.2 Mount the Geodimeter on a base line where you can change the prism position in calibrated steps.

16.3 Decrease the signal to 3.7V AGC by the range tester no 671.113.614.

16.4 Make $\bar{D}$ measurements at 2m steps in a 10m interval.

16.5 The maximum error difference betweeen the value from one point and the mean value of all points must not exceed 10mm.

16.6 If out of tolerance improve groundings.



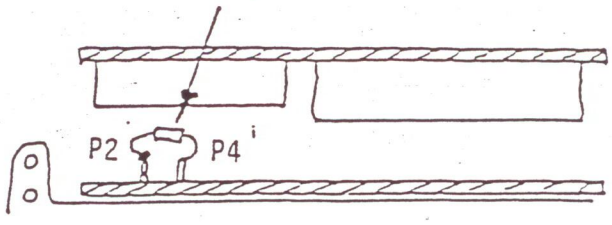
17. SIGNAL DEPENDENCE

17.1 Choose one of the distances in 9 where the cyclic error is about zero.

17.2 Make on strong signal and one weak signal measurement in $\bar{D}$.

17.3 The difference between them must not exceed 4mm.

17.4 If out of tolerance (remove the casing) and change the resistor on the left side of the lower DIM-board.



If compensation is needed the resistor use to be 100-150k. Min. value: 15 kohm.

18. POINTING ERROR

18.1 Mount the Geodimeter for baseline measurements. Make pointing error measurements in four directions. Distance 30-50m.

18.2 Tolerances:
2.5 c from center: ±3mm
7.5 c from center: ±30mm

19. TRACKLIGHT ALIGNMENT

19.1 Turn the Geodimeter in face two and aim towards a large flat reflector. Loosen the two screws holding the tracklight. Align the tracklight to the telescope crosshair. Tighten the screws.

20. KNOBS

20.1 Fasten the H.A.-and V.A.-drive locking knobs in correct position i.e. the driving shall just become stuck in the end clockwise position of the drive locking knobs.

21. COLLIMATING ERRORS

21.1 Make a full test measurement including tilt axis error.

21.2 Adjust the horizontal collimation error with the horizontal cross hair screws.

21.3 Calibrate the vertical angle offset, Label 103.
The correct V.A. offset = Vertical collimation error plus the current V.A. offset.

21.4 Make a final full testmeasurement.

22. GDM-CONSTANT

22.1 Measure calibrated baselines. Put in the correct GDM-constant, Label 209.

23. FINAL CHECKS

23.1 Make a listing.

23.2 Check all switch functions.

23.3 Check spread in distance.

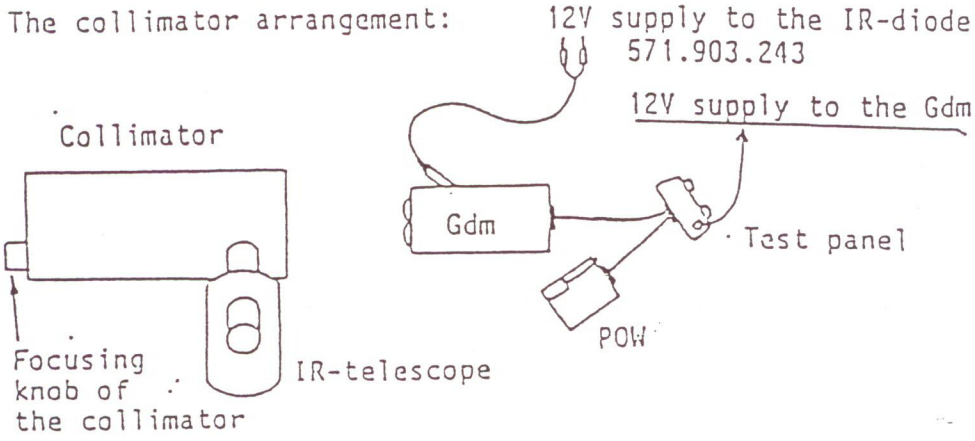
23.4 Make angle measurements to check the accuracy.

24. SECURING

24.1 SECURE LABELS > 99!

OPTICAL ADJUSTMENTS.

The collimator arrangement:



First check the 5V according to 1.

Op.1 Focus the TRANSMITTER fibre (no radial adjustments can be made) as follows:

Op.1.1 Remove the POW-board and fit the Baseunit to EDM.
Connect the panel and the POW-board by the extension cable.
Let the POW lay beside, but watch for shortcircuit to metal parts on the table.
Fold up the upper DIM-board so you can reach the transmitter and the receiver fibres.

Op.1.2 Remove the filter in front of the transmitter fibre (left) (lift up the metal clip on which the filter is mounted).

Op.1.3 Mount the Geodimeter in front of a collimator set to ∞

Op.1.4 Adjust the collimator so that you can see the transmitter light.

Op.1.5 Shortcircuit the transmitter diode on the TRM-board by a 5 ohm resistor to get the light weaker.

Op.1.6 Loosen the screw that holds the fibre (from top) and focus. Then fasten the fibre again.

Op.1.7 Check that the fibre end is clean. Otherwise blow clean air from a spray tin on it.

Op.2. Focus the RECEIVER fibre and adjust it radially as follows:

Op.2.1 Switch off the Geodimeter.

Illuminate the receiver fibre and its holder by IR-light from a diode (tool part no 571.903.243) being put into the hole on the right side of the chassis.

Op.2.2 Loosen the screw that holds the fibre (from left).

Focus the receiver fibre (the black area with about the same size as the transmitter light).

Lock the fibre again.

Op.2.3 Switch on the Geodimeter.

Collimate as follows:
Adjust the receiver fibre radially by the two screws until the receiver fibre and the transmitter light is seen in the same position.
BE VERY ACCURATE! The adjustment is critical.
Knock on the receiver fibre holder and see that the position do not change.
Switch off the Geodimeter.

Op.2.4 Check that the receiver fibre is clean. Otherwise blow clean air from a spray tin on it.

Op. 3 Put back the transmitter filter and lock it with Pliobond.

TECHNICAL INFO

FEBRUARY 1990
GEOTRONICS AB
Technical Support Dept.
DANDERYD, Sweden
571/90002

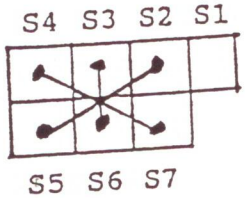
INSTRUMENT TYPE: GDM 400-system

SUBJECT: Promconfiguration on board PRO2-C

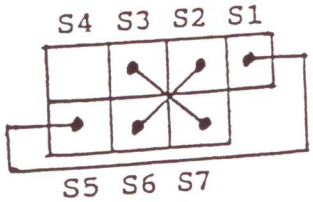
DESCRIPTION: Jumpers (S1-S7) for decoding of the memories are connected for actual circuits fitted.

The program 571 123 542 - 14 (presently used) is contained in either 4 x 32k or 2 x 64k to be followed by programs in need of 4 x 64k at a later stage.

PRO-boards fitted with 32k PROMS (27C256) are strapped



PRO-boards fitted with 64k PROMS (27C512) are strapped



GEOTRONICS

TECHNICAL MEMO

September, 1991
GEOTRONICS AB
Technical Support Dept.
DANDERYD, Sweden
571/5703

Subject: PRS-board Circuitdiagram 571 143 791
TM 571/5692 November 1990

Decription: Positioning of Jumper (R2) for JC3 when fitting 256k prom.

CHANGE EARLIER DOCUMENTS (TM+DIAGRAM IN MAINTENANCE MANUAL).

Jumpers are connected to suit type of Prom-circuit used for the actual PRS-Program (571 123 582)

R2 - R5 IC3 = PROM 1
R6 - R9 IC4 = PROM 2

	32	64	128	256k
R2	–	0	0	0
R3	0	–	–	–
R4	–	–	–	0
R5	0	0	0	–
R6	–	0	0	0
R7	0	–	–	–
R8	–	–	–	0
R9	0	0	0	–

27C256 = 32k
27C512 = 64k
27C010 = 128k
27C020 = 256k

= 27C1001

Unsolder the 0-resistor (jumper) carefully and refit in appropriate position.

8. ASSEMBLING CHECKS

8.1 Assemble the Geodimeter except the casing. Check that all cables are placed correctly. Check that no pins on IC:s are folded. Check that the springs for H.A. and V.A. driving are placed correctly.

8.2 Check the back up battery voltage. Min. 3.6V DC. (New status is 3.65V).

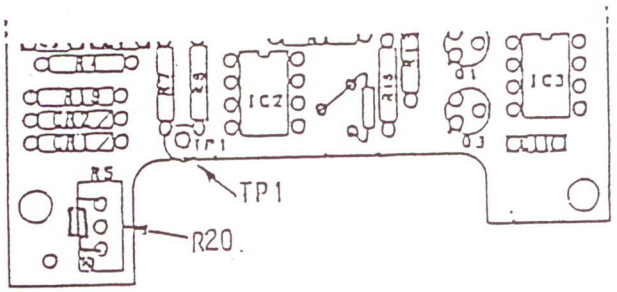
8.3 Check the current consumption: 0.5A.

9. SENSOR AND PLUMB COMPENSATOR SIGNALS

Compensator: ~~571 143 016 and 571 144 720~~ R 71 144 790

9.1 Check that R20 on OSC-board is 10k

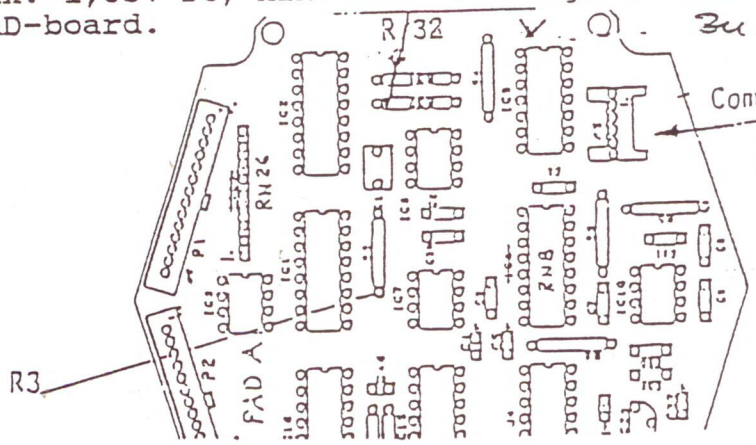
9.2 Check the 12khz signal on the OSC-board, TP1.
With an oscilloscope: Pure sine wave, with no clipping.



GDM → unlock
↓
A/D Werte werden angezeigt!

9.3 Check the sensor voltages, max. and min. values.
Read directly on the GDM-display by entering
F22=0, F161=128, F137=31.
Max: 1,85V DC, Min: 1.6V DC. Adjust with R3 on the PAD-board.

Spannung zu klein, R3 ~~klein~~ machen



Hz = F 115
F 116
V = F 117
F 118
F 120

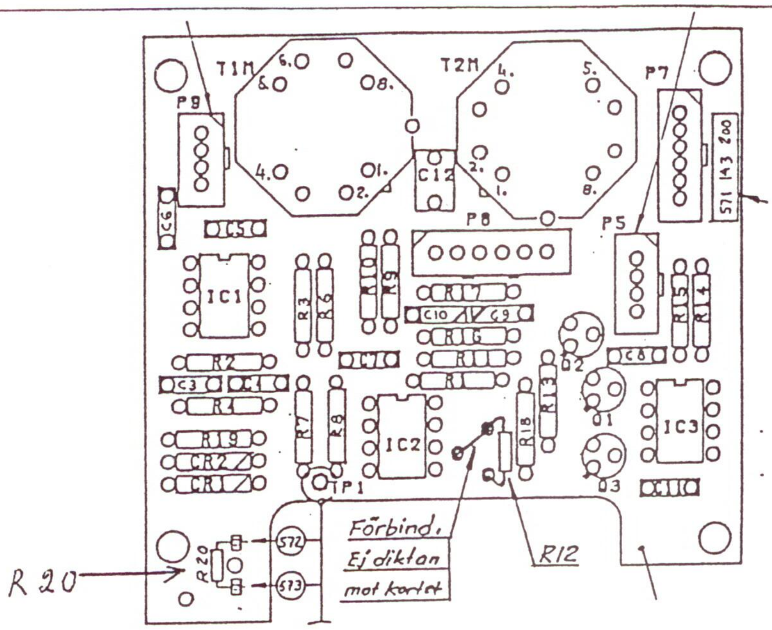
9.4 Check the plumb compensator reference voltage.
Read directly on the Gdm-display. Max: 1,85V,
Min: 1,3V.
Adjust with R32 on the PAD-board.

Wenn zu groß: R32 kleiner machen

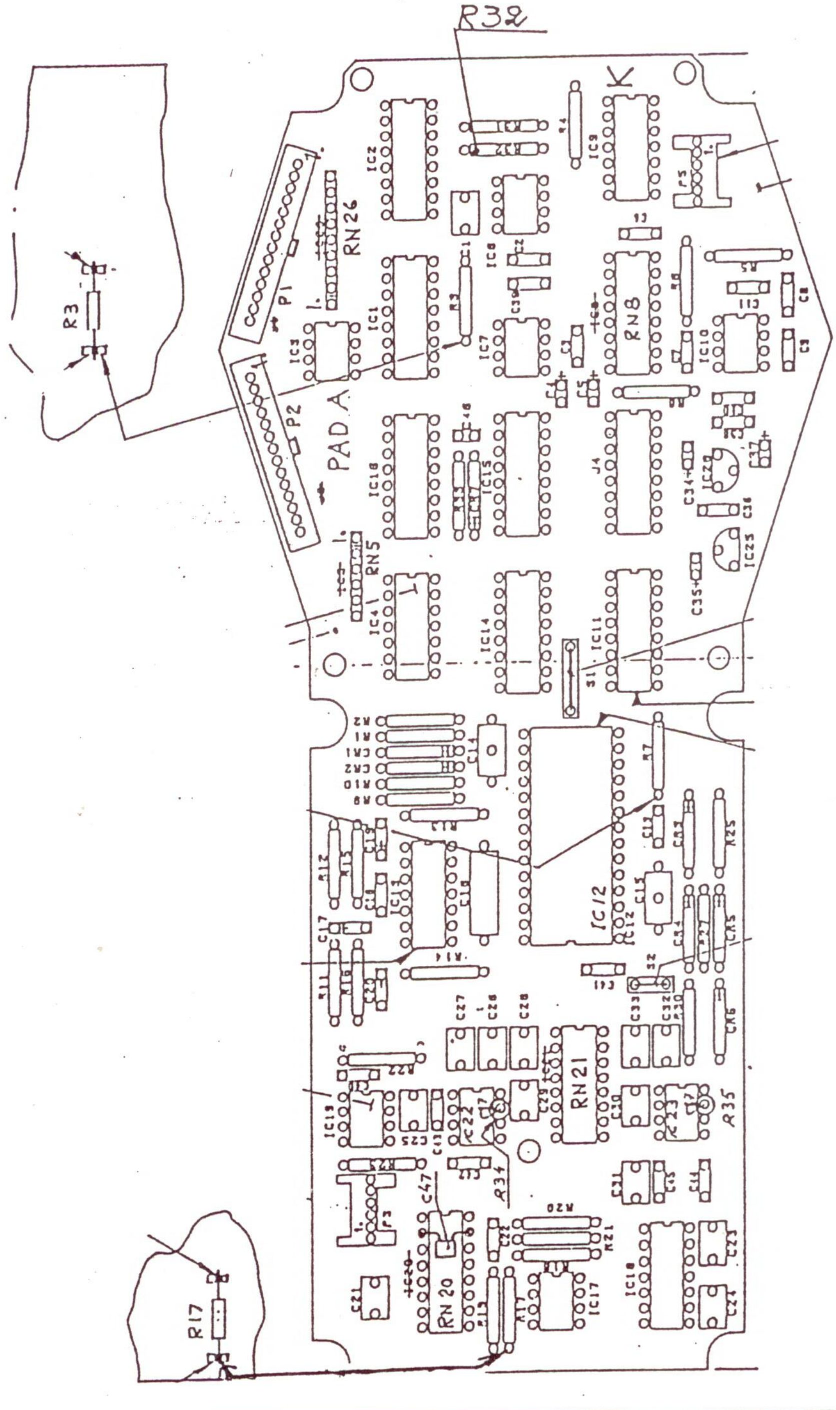
9.5 Check by tilting instrument 10C that label 122: X-direction, 123: Y-direction, is increasing 10500 - 12000 pulses (1,05 - 1,2V).
Adjust with R17 on the PAD-board.

Wenn zu groß: R17 größer machen

9.6 Run the COMP-program (GSS).
Follow the program.



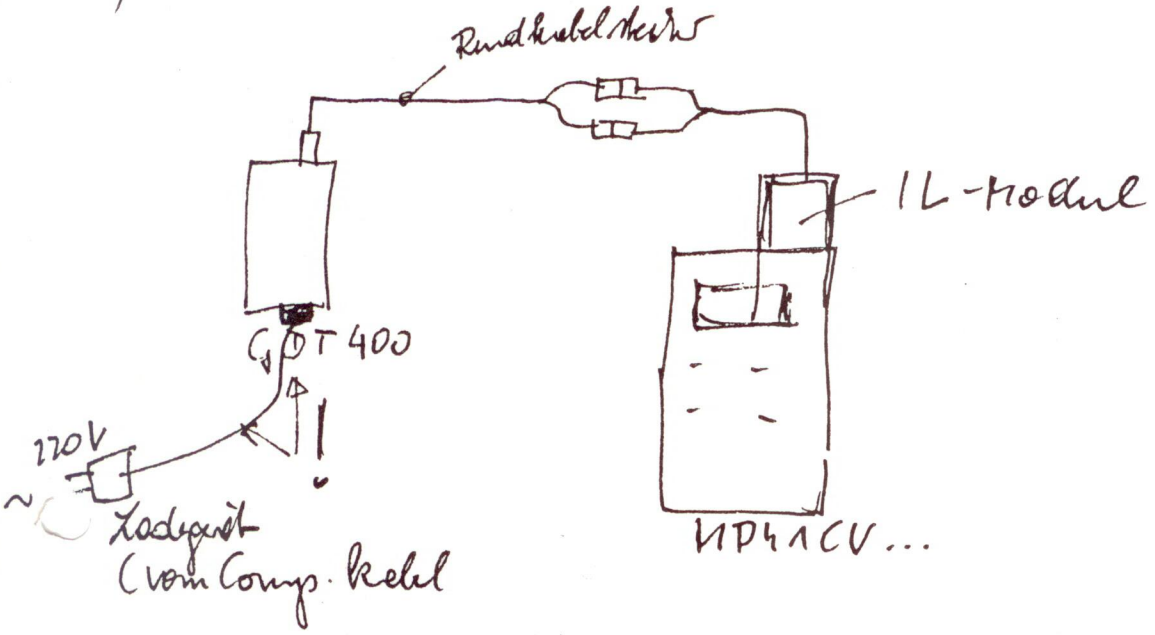
T1M
T2M
P9
P7
P8
P5
IC1
IC2
IC3
C12
TP1
Förbind.
Ej diktan
mot kortet
R12
R 20



R32
PAD A
RN26
RN5
RN8
R3
IC12
RN21
RN20
R35
R34
C47
R17

GDT 400 ↔ HP41CV — IL-Modul

1.) alles zusammenstecken:



2.) GDT 400 + HP41CV einstecken,
am Display HP41: 0.000 (wenn nicht, "memory lost" machen)

VS.: Abdeckmodul am HP41CV-Stack

3.) initialisieren:

a) α K shift X eingeben in HP41CV →
Display: „K*"

b) α XEQ α OUTA α eintippen →
Display zeigt: 0.000 → fertig, OK.

4.) Test: mit P50, P51 am GDT 420, ... ausprobieren,
ob alles OK mit ⁄.

Geodimeter

26.5.

Sk

Stadardprotokoll und Format

im Geodat 400

P51

P56

Protokol 0

1: 4800
2: 2
3: 7
4: 1
5: ~~10~~ → 99
6: 0
7: 1
8: 17
9: 19
10: 0
11: 0
12: 0
13: 0
14: 1.10
15: 0
16: 1.26

Format 0

2: 80
3: 13
4: *

Befehl, um daß Protokoll o über die Schnittstelle aufzurufen:

OD=o CRLF → Befehl wird vom PC aus gesendet!

Geodimeter

Anschrift:
Geodimeter GmbH
Zimmersmühlenweg 40
6370 Oberursel/Ts.

Tel. 0 61 71/6 30 20 (Sa.-Nr.)
Telefax 0 61 71/44 55
Telex 4 10 831

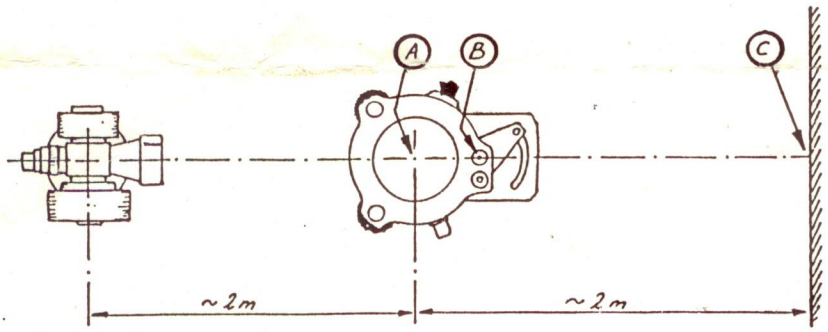
Bankverbindungen:
Deutsch-Skandinavische Bank AG, Frankfurt am Main (BLZ 512 202 00) Kto. 030 558 003
Dresdner Bank AG, Oberursel (BLZ 500 800 00) Kto. 6 101 254 00
Postgiroamt Frankfurt am Main (BLZ 500 100 60) Kto. 347374-608

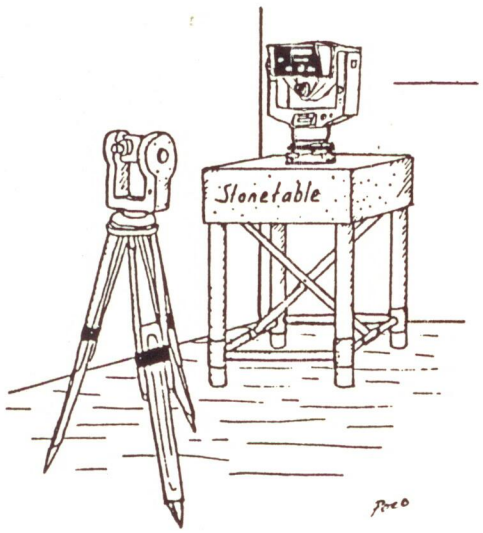
Handelsregister:
Amtsgericht Bad Homburg v.d.H. HRB 2713
Satzungsmäßiger Sitz: Oberursel/Ts.
Geschäftsführer: Lars Persson
Vorsitzender des Verwaltungsrates: Rudolf Wildorf

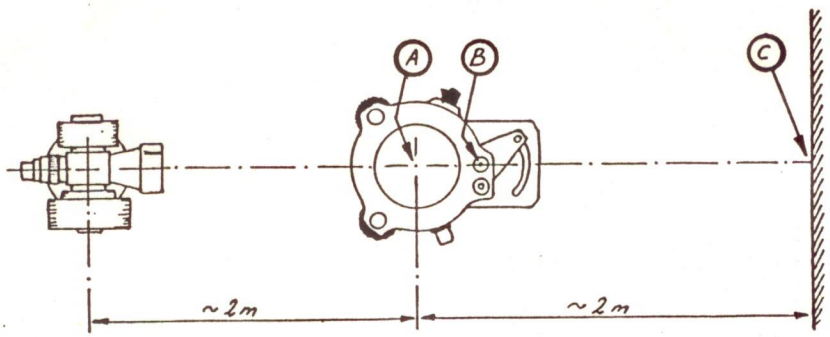
GEOTRONICS AB
Technical Support Dept.
DANDERYD, Sweden

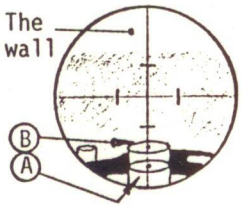
INSTALLATION & CALIBRATION OF SPECIAL TRIBRACH PART No: 908 142 202

1. Glue the special tribrach to the stonetable.
2. Place a totalstation on the special tribrach, level it and adjust the vertical angle to ≈300gon.
3. Aim to the wall on which the mark Ⓒ is supposed to be made.
4. Make a mark, that could be seen through the telescope, on the wall.
5. Draw a horizontal line through the mark.
6. Remove the totalstation.
7. Insert the center-disc Ⓐ in the tribrach.

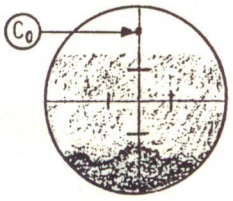






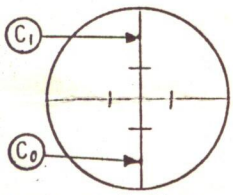


8. Place the theodolite so that both the tribrach and the wall could be seen simoultaneously in the telescope without any vertical adjustment.
Level the theodolite.
Adjust the theodolites position on the tripod so that Ⓐ and Ⓑ coincide.
Make sure that the theodolite still is levelled.

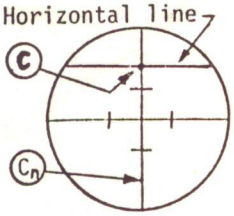


9. Focus at the wall and make a mark C_0 on it. (See fig I)
The mark should be made with a very fine pencil/needle.

Ⓐ, Ⓑ and C_0 should now be in line.



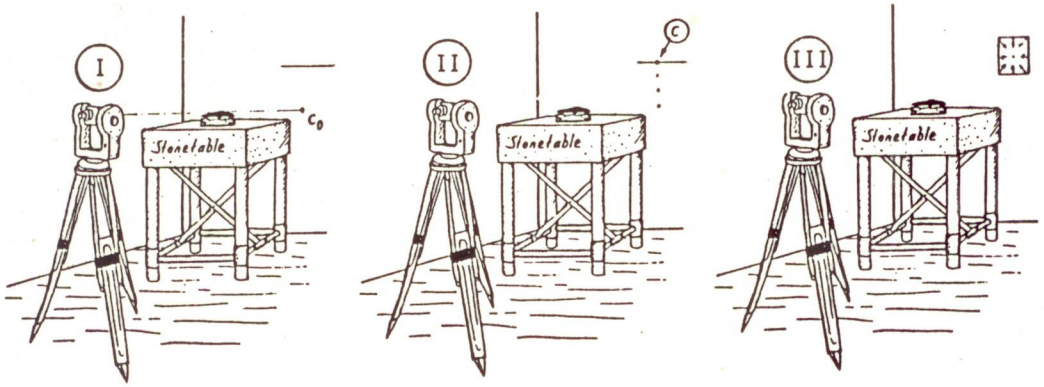
10. Adjust the theodolite so that the mark C_0 is placed at the bottom of the vertical line in the haircross.
Make a new mark C_1 at the upper part of the vertical line.



11. Continue with this procedure until you can see the horizontal line (see point 5) in the telescope, then make a mark Ⓒ at at the point where the horizontal line crosses the vertical line in the haircross. (See fig II)

12. Make a screen with a centre hole, stick it to the wall positioned with Ⓒ visible. (See fig III).

13. Calibrate your special tribrach by measurement of the elevation difference CW-CCW position of level and put value in HP-85 calibrationprogram. (≈0,1000 gon)



GEODIMETER SYSTEM 500 SYSTEM.

Electrical adjusting software.

4.1.1 General Description.

With the help of the software "TROL" the distance unit for system 500 is electrically adjusted. A set of adjusting steps is gone trough one by one:

1. Visual inspection.
2. Supply voltage connection of the instrument.
3. Adjustment light output.
4. Light output, measurement.
5. Measuring signal, in search mode.
6. Adjusting inner-path level.
7. Adjusting F1/F2 ratio.
8. Check distance difference at low and high signal.
9. Measuring the working point of the greywedge.
10. Measuring the elapsed time for one measuring cycle.
11. Audio signal control.
12. Haircross illumination and tracklight control.

4.1.2 Tools.

To use "TROL" following tools are needed:

PC-computer
LabCard PCL-714
Interface part no:571 600 089
Adjustment fixture part no:571 600 021
Accurate volt meter (DMM)

The program contains:

Instructions how the adjustments shall be performed.
Input of measured values:Sig.level (DC), Lin.signal (AC)
and the photo-detector signal.
Control of external greywedge.
Input and output of measured signals, control signals
and communication with the distance unit via LabCard

4.1.3 Voltage measuring.

Voltage measurement are made via labcard 14 bit analog inputs.

Analog input channels:

Probe DC
Probe mean value (DC)
Probe AC
Sig.level
Photo-detector

Probe measuring specification:

Probe X1:

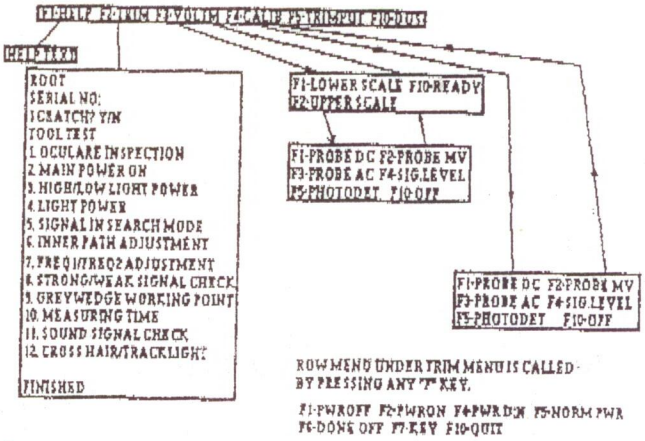
Measuring range:	-1.5V - +1.5V
Resolution:	0.1mV
Accuracy:	+/- 0.3mV DC, +/- 1.1 mV AC;
max divergence in range:	0 - 1V

Probe X10

Same as above multiplied by 10 with maintained resolution 0.1mV

Accurate calibration of volt meter and probe is needed to get relevant measuring values.

4.2.1 How to use the program,



Root menu.

F1-Help
Help text/manual.

F2-Trim
Electrical adjusting
the distance unit.

F3-Volt meter
Possibilities to use the LabCard voltmeter outside the adjusting program. One or two channels can be used. Via the first menu at the root directory the right analog channel is chosen:F1-lower, F2-upper, F10-ready.
In the second menu the channel:F1-probe DC, F2-Probe MV,F3-Probe AC, F4-signal level, F5-Photo detector is chosen. Then max reading is set 0-2V=X1 probe 2V-15V=X10 probe, when the key F10-Ready is pressed the measurements starts.

F4-Calibr
Calibration of the LabCard voltmeter.
When the calibration has been performed the obtained calibration constants will be used at every voltmeter measurement in the program. Every channel has it's own scale factor and offset (note: X10 probe setting has it's own constant). The calibration constant is saved in a file called SCF.DEF.
In the menu F4 calibrate:
- F1-Probe DC
- F2-Probe MV (DC)
- F3-Probe AC (note there is no X10 in probe AC calibration, AC = 1.5khz)
- F4-Signal.level
- F5-Photo-detector is chosen.

To perform calibration:
Start TROL program
Press F4 calibration
Follow TROL program instructions.

- F1 Probe X1: DC	short circuit probe -connect max1.5V DC
- F2 Probe X1: MV (DC)	short circuit probe - connect max 1.5V DC
- F3 Probe X1: AC=1.5khz	connect 5mV AC - connect 100mV AC
- F4 Signal level: DC	short circuit pin 7 and pin14(GND) on J3, connect 1-7V DC to pin 7 and pin 14(GND) on J3.
- F5 Photo detect: DC	short circuit pin 23 and pin14(GND) on J3, connect 1 - 7V DC to pin 23 and pin14(GND) on J3

Any power source that will provide this type of voltages can be used for calibration purposes, DC 1-15 V (DC POWER SUPPLY), AC 1mv - 1V1.5khz(SIGNAL GENERATOR or equivalent) Also a accurate voltmeter (DMM) has to be used

F5-TrimProt
Text and adjustment results are stored and updated in two files, while adjustments are made.
The text file: TRxxxxxx.TXT and the test result file: TRxxxxxx.DAT.
xxxxxx = serial no:.
The test results are possible to print out.

When F2-Trim is chosen the display will show a table menu, where the different adjustment steps are shown.

Root
Serial no:
Scratch ? Y/N
Tool test

1. Ocular inspection
2. Main power on
3. High/Low light power
4. Light power
5. Signal in search mode.
6. Inner path adjustment.
7. Freq1/Freq2 adjustment
8. Strong/Weak signal check
9. Greywedge working point
10. Measuring time
11. Sound signal check
12. Crosshair/Tracklight

Finished

4.2.2 Extra command.

There is also an extra commando row, that can be called up
by pressing any of the F keys.
These commands can be performed aside from the trim-menu.

F1-PwrOff
Power from the adjustment box to the distance unit is disconnected
F2-PwrOn
Power from the adjustment box to the distance unit is connected
F3-Reset
Reset is sent to the distance unit
F4-Pwr d:n
The distance unit is set in "power down" mode
F5-NormPwr
The distance unit is set in "normal" power mode
F6-Done off
Removes the "Done" mark at the row that's marked in the menu
F7-Key
Unlocks the order of the adjustment steps, so that any adjustment
can be made independent of each other.
F10-Quit

The trim menu is numbered from 1 to 12. When one adjustment is done,
the prompt automatically jumps to the next position.
The only possibility to change that order is to call the extra
commands by pressing a F key and press the F7 key. Then any of 12
positions can be chosen. This is indicated by the key symbol,
in the upper right corner of the screen, that will disappear.
There are three ways to go back from the trim menu to the root menu:
1. Choose root in the menu
2. Press the esc key
3. Go through the whole menu and choose Finished in the menu.

Both 1 and 2 will work the same way. The adjustment state
will be saved in the "STATE.PAR" file.
The computer can now be shut off. When started again and entering
the adjustment menu in the TROL program, it will be at the same
state as where it was left.

Note: When using the third alternative to leave the trim menu, the
"STATE.PAR" file will be cleared.

4.2.3 The adjusting steps:

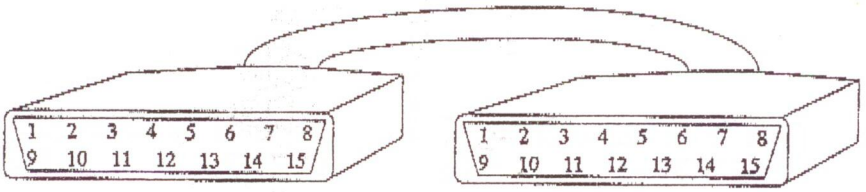
Root:	Back to the root menu.
Serial no:	Press enter and write serial no.
Scratch Y/N:	Start from the beginning and clear the STATE.PAR file.
Tool-test:	(Not used).
1. Ocular inspection:	Notes can be written and saved.
2. Main power on:	Power to the distance unit, reset and opening of the external greywedge.
3. High/Low light power:	Option to change the output light power, presently not used .
4. Light power:	Check of the light power, if out of tolerance check the optical adjustment.
5. Signal in search mode:	Measurement of signal level in search mode. Tolerance 7V +/- 1V DC.
6. Inner path adjustment:	The instrument is set in the test mode and cal, via the computer. Turn the screw clockwise and adjust to 100mV AC +/- 30 on the first flank. Three test measurements are made and the result should be within 100mV AC +/-30mV.
7. Freq1/Freq2 adjustment:	The greywedge is turned to the signal/noise limit 5mV AC F1 if necessary adjust on R14 on the DIP board to obtain 5mV AC at signal/noise limit. The value is read and saved. The instrument is set in test mode and F2. The value is read and saved, the value should be F1 + 1mV AC +/-0.5mV. The instrument is set in F1. The Lin.signal is measured again.

8. Strong/weak signal:	Ten measurements with open external greywedge and ten measurements with external greywedge at the sig.level value at point 7 +/- 0.1mV are made. Strong and weak signal mean values and spread are calculated.
9. Greywedge working point:	Measure the Sig.level and Lin.signal, in D-bar mode. Sig.level = 6,2 +/- 0.3V. Lin.signal = 120 +/- 30mV. If Sig.level out of tolerance adjust R41 on the DIP board.
10.Measuring time:	The instrument measures two times, a mean value of the measuring time is then calculated. Tolerance 3.3 +/- 1 sec. No adjustments can be made.
11.Sound signal check:	Signal and absence of signal when at the signal noise level.
12.Crosshair/tracklight:	The crosshair illumination will blink.

Finished (State.par file will be set to 0)
Result saved in directory:TROLDAT.

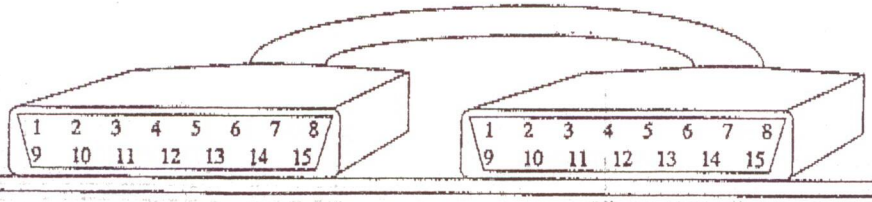
ELBOX CABEL J5 (DSUB15p) - DIGITAL PORT 2 (DSUB15p)

J5 (15p DSUB)	DIGITAL PORT 2(Low on LabCard 15p DSUB)
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
14	14
15	15



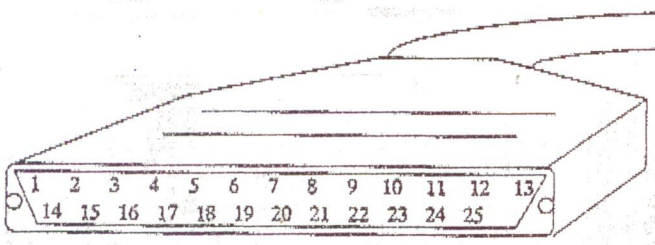
ELBOX CABEL J6 (DSUB15p) - DIGITAL PORT 1 (DSUB15p)

J6 (15p DSUB)	DIGITAL PORT 1(High on LabCard 15p DSUB)
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
14	14
15	15

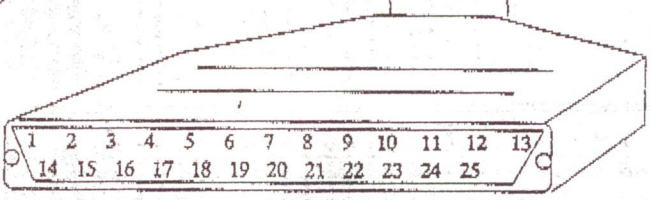


ELBOX CABEL J3 (DSUB25p) - TRIM FIXTURE BOX (DSUB25p)

J3 (25p DSUB)	TRIM FIXTURE BOX(25p DSUB)
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
14	14
15	15
16	16
17	17
18	18
19	19
20	20
21	21
22	22
23	23
24	24
25	25



J3 DSUB25p

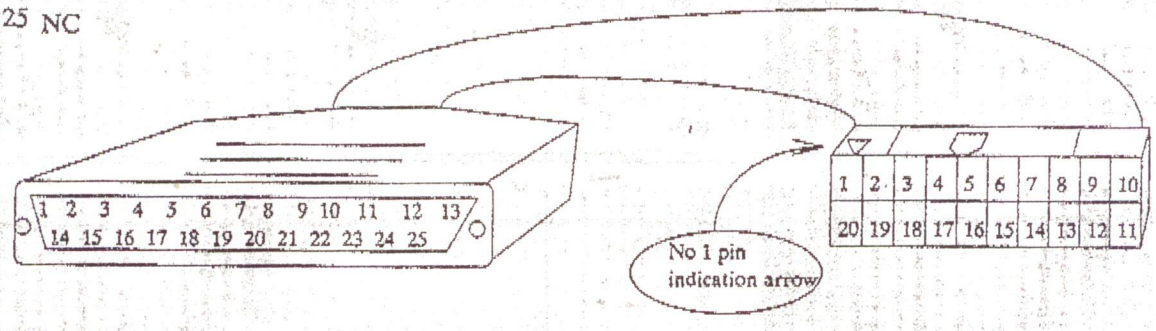


J8 TRIM FIXTURE BOX DSUB25p

El BOX part no 571 600 089

Cabel J7(Dsub 25) - Analog 2(Hyls 20s)

J7	Analog 2
1	1
2	20
3	2
4	19
5	3
6	18
7	4
8	17
9	5
10	16
11	6
12	15
13	7
14	14
15	8
16	13
17	9
18	12
19	10
20	11
21	NC
22	NC
23	NC
24	NC
25	NC



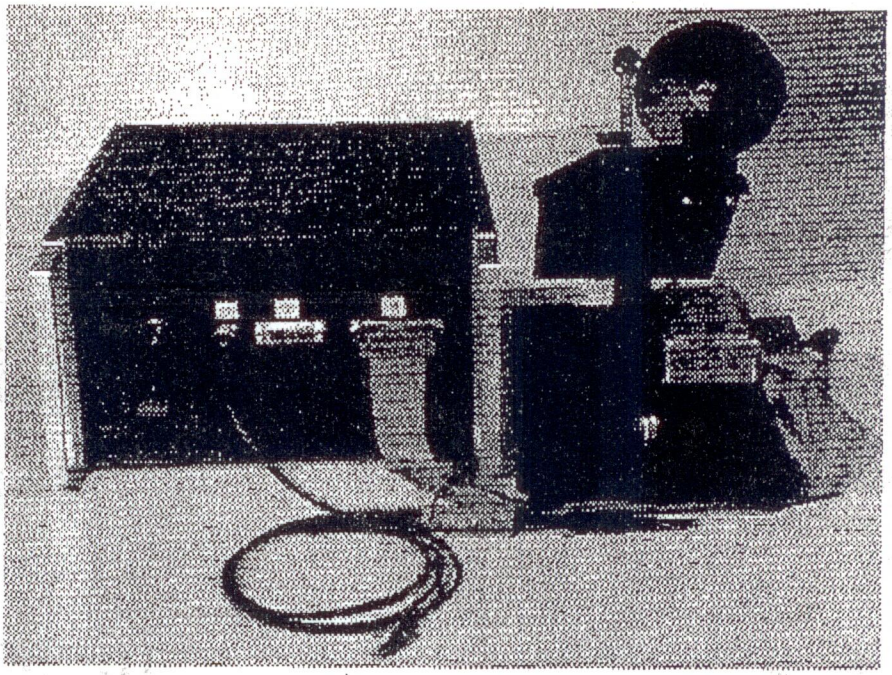
J7

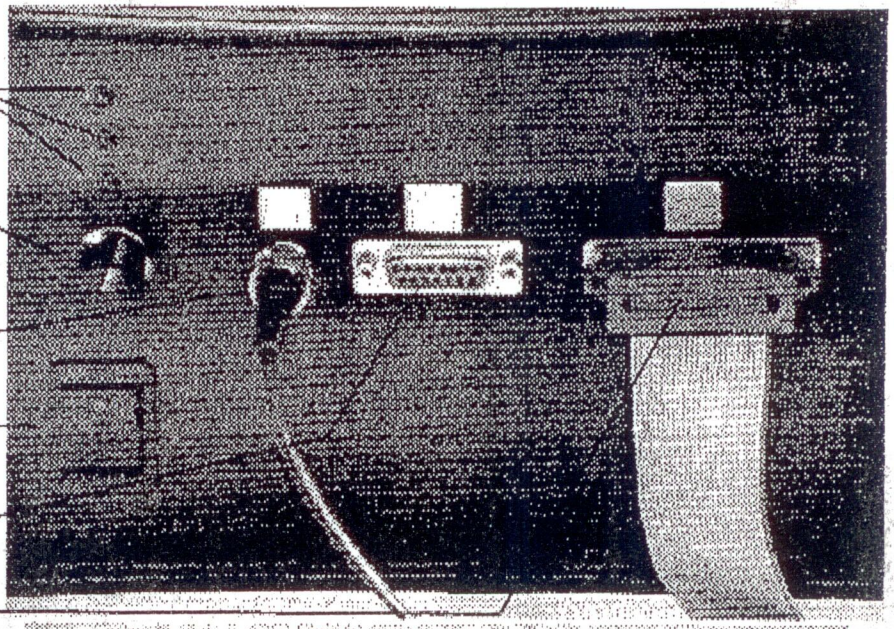
ANALOG 2 (LABCARD)

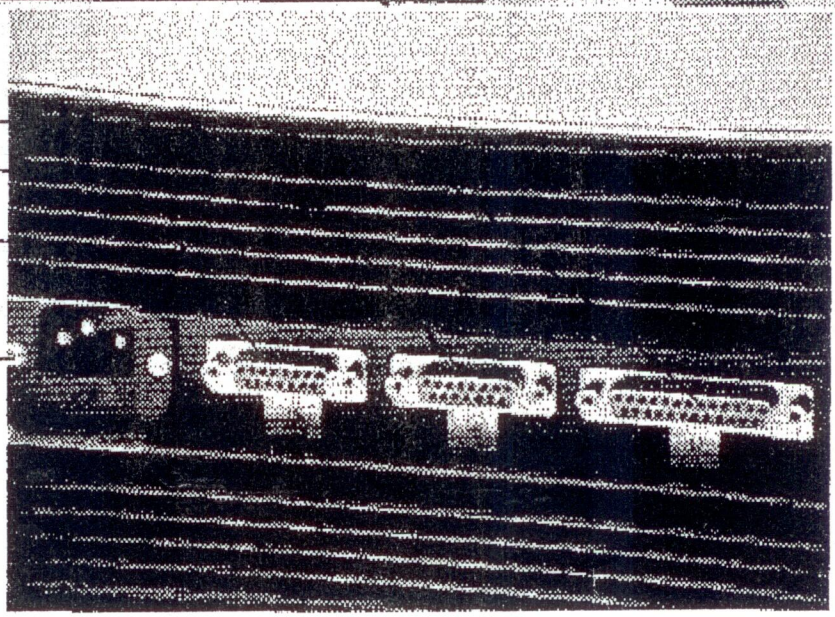
EL BOX GDM 500
PART NO:
571 600 089

AND

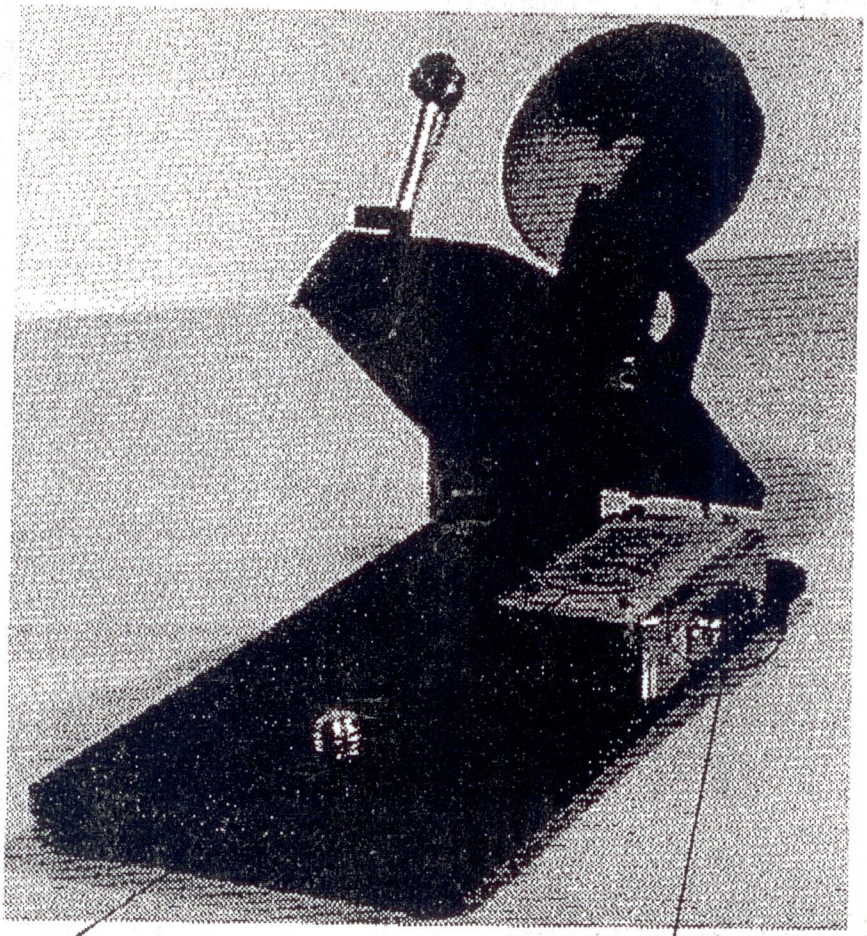
TRIM FIXTURE 500
PART NO:
571 600 106







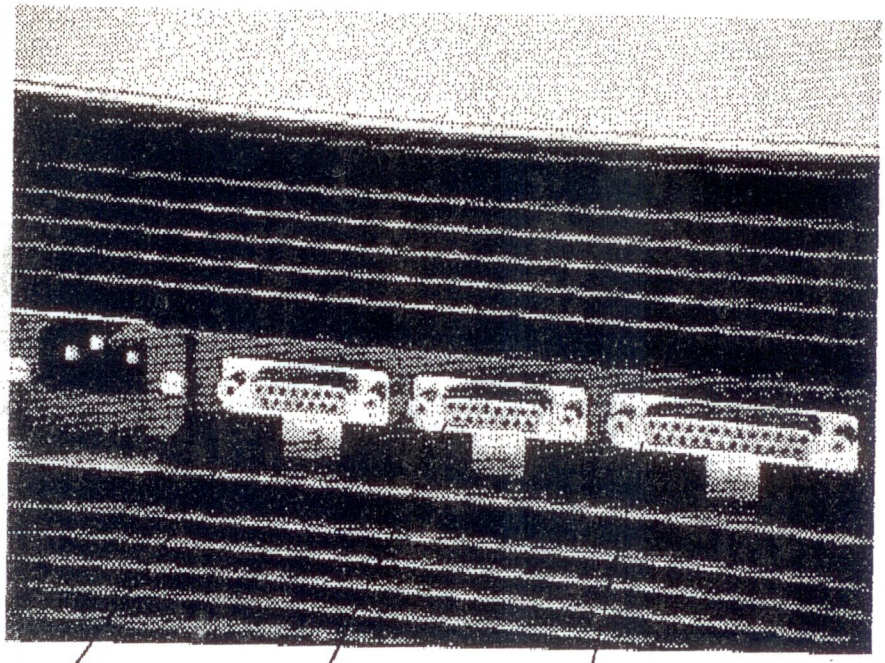
TRIM FIXTURE 500 PART NO: 571 600 106



J9 CONNECT TO
J21 ON THE DIC BOARD

J8 CONNECT TO
J3 EL BOX PART NO:
571 600 089

BACK PANEL
EL BOX GDM 500
PART NO:
571 600 089

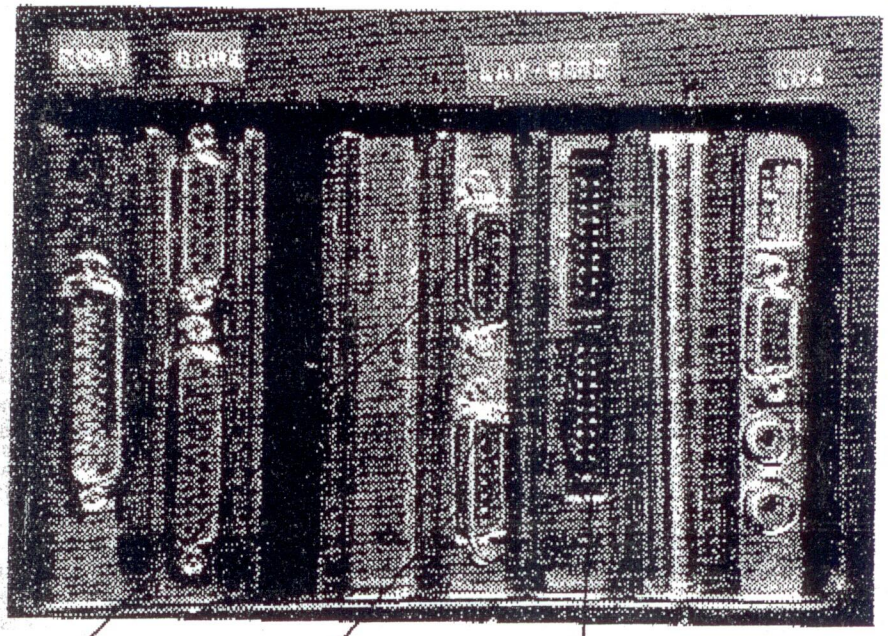


J5
To digital 2

J6
To digital 1

J7
To analog 2

BACK PANEL
PC WITH LABCARD



DIGITAL 1
To J6

DIGITAL 2
To J5

ANALOG 2
To J7

TRIMRESULT OF

4. Light power =
5. Signal level in search mode = 7 Volt ± 1V DC
6. Signal in inner path = 100 mVolt ± 30 mV AC
   Spread (of 3 cycles) =
7. Signal level at squelch =
   Lin. signal in F2 = F_1 = 5mV $F_2 = F_1 + 1mV \pm 0{,}5mV$ ($F_2 > F_1$
   Diff. of lin. signal =
8. Grey wedge work p., sig. level = 6,3 ± 0,3 V (too low)
   Grey wedge work p., lin. sign. = 120mV ± 30mV
9. Diff. strong-weak signal =
   Mean v. strong signal =
   Mean v. weak signal =
   Spread, strong signal =
   Spread, weak signal =
   Measure time in sec. = 3,3 sek. ± 1 sek.
10. The beeper is
11. The cross hairs illumination is
    TRK MOD-level =

TIC-D mit Punkt 5 mit Signal anders 6 Volt ± 1V DC

11.) Probe x 10 mittlere Messpunkt auf kleine Platine

8.6 TEST PLUG (J59).

The test plug signals are:

LIN SIGNAL : 5 mV at the signal/noise treshold
150 mV at the working point
3500 mV when overrange

REF : Reference frequency 1529Hz

SIG LEVEL : 4.6-5.1 V at the signal/noise treshold
5.9-6.3 V at the working point
7.2-7.4 V when overrange

GND : Analog ground.

J59

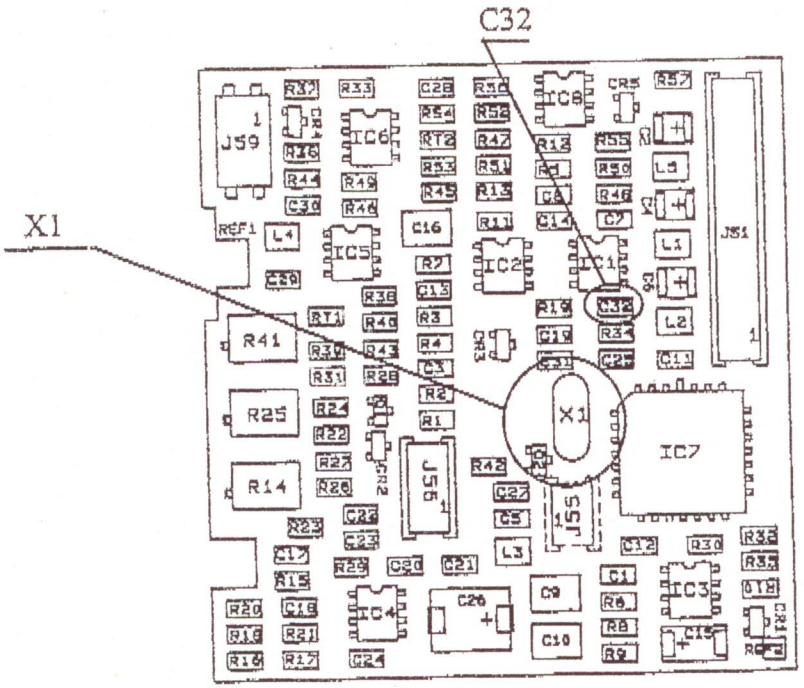
LIN SIGNAL	*	*	REF
GND	*	*	SIG LEVEL

DIP-BOARD.

DIP BOARD (571 201 040)

1. Changing X1 on the DIP board.

Loosen the three screws and remove the top cover of the GDM. Loosen the DIT(-H) and DIC boards, check the X1 type and if it is a KOYO type, remove the DIP board and carefully remove X1 and remount a TELEQUARTZ type X1. The KOYO type is identified by the KOYO name thats printed in black text on the crystal. When changing crystal also change C32 to 100pf .



Additional parts
X1 part no: 571 905 570
C32 part no: 571 801 201

Remount DIP, DIC, DIT(-T) boards and top cover, verify function.

cc: Rocamp
Retronic
Herzog
PY, fuca
Geo Service

Electrical adjusting tools.

4.1.1 General Description.

With the help of the software (571 600 113), elbox (571 600 089) and trim fixture (571 600 106) the distance unit for system 500 is electrically adjusted. A set of adjusting steps is gone trough one by one:

1. Power connection to the distance unit.
2. Adjustment of the light output (not used).
3. Measuring signal, in search mode.
4. Adjustment of the inner-path signal level.
5. F1/F2 adjustment.
6. Adjustment of the greywedge working point.
7. Distance check at low and high signal.
8. Haircross illumination and tracklight control.
9. Range check.

4.1.2 Tools.

Software program "TROL"	part no:	571 600 113
Elbox (Interface)	part no:	571600 089 (including cables)
Adjustment fixture	part no:	571 600 106
Accurate volt meter (DMM)		

The program contains:

- Instructions how the adjustments shall be performed.
- Input of measured values: Sig.level (DC), Lin.signal (AC)

- Control of external greywedge.
- Input and output of measured signals.
- Control signals and communication with the distance unit via LabCard

4.1.3 Voltage measurment.

Voltage measurement are made via labcard 14 bit analog inputs.

Analog input channels:

Probe DC
Probe mean value (DC)
Probe AC
Sig.level

Probe measurment specification:

Probe X1:

Measurment range:	-1.5V - +1.5V
Resolution:	0.1mV
Accuracy:	+/- 0.3mV DC, +/- 1.1 mV AC;
Max divergence in range:	0 - 1V

Probe X10

Same as above multiplied by 10 with maintained resolution 0.1mV

Accurate calibration of volt meter and probe is needed to get relevant measurment values.

4.2.1 How to use the program.

Root menu.

F1-Help
Help text/manual.

F2-Trim
Will show a table menu,
where the different adjustment steps are shown.

Root
Serial no:
Scratch ? Y/N

1. Main power on
2. High/Low light power
3. Signal in search mode.
4. Inner path adjustment.
5. Freq1/Freq2 adjustment
6. Greywedge working point
7. Strong/weak signal check
8. Crosshair/Tracklight
9. Range check

Finished

F3-Volt meter
Possibilities to use the LabCard voltmeter outside the adjustiment program. One or two channels can be used. Via the first menu at the root directory the right analog channel is chosen:
F1-lower
F2-upper
F10-ready

In the second menu the channel:
F1-probe DC
F2-Probe MV
F3-Probe AC
F4-signal level
F5-Photo detector is chosen

Then max reading is set:
0 - 2V = X1 probe
2 -15V= X10 probe

When the key F10-Ready is pressed the measurements starts.

F4-Calibration:
Calibration of the LabCard voltmeter.
When the calibration has been performed the obtained calibration constants will be used at every voltmeter measurement in the program. Every channel has it's own scale factor and offset (note: X10 probe setting has it's own constant). The calibration constant is saved in a file called SCF.DEF.

In the menu F4 calibrate:
- F1-Probe DC
- F2-Probe MV (DC)
- F3-Probe AC (note: no X10 in probe AC)
- F4-Signal.level
- F5-Photo-detector

To perform calibration:
Press F2, main power on, then press the "esc" key
Press F4 calibration
Follow TROL program instructions.

- F1 Probe X1: DC - short circuit probe, then connectmax 1.5V DC
- F1 Probe X10: DC - short circuit probe, then connectmax 15V DC

- F2 Probe X1: MV (DC) - short circuit probe, then connect max 1.5V DC
- F2 Probe X10: MV (DC) - short circuit probe, then connect max 15V DC

- F3 Probe X1: AC=1.5khz - connect 5mV AC, then connect 100mV AC

- F4 Signal level: DC - short circuit pin 7 and pin14 (GND) on J3,
  - connect 1-7V DC to pin 7 and pin 14(GND) on J3.

- F5 Photo detect: DC - short circuit pin 23 and pin14 (GND) on J3,
  - connect 1 - 7V DC to pin 23 and pin14 (GND) on J3

Any power source that will provide this type of voltages can be used for calibration purposes,
- DC 1-15 V (DC POWER SUPPLY),
- AC 5mV-100mV 1.5khz (SIGNAL GENERATOR or GDM)

Also a accurate voltmeter (DMM has to be used).

F5-TrimProt
Text and adjustment results are stored and updated in two files, while adjustments are made.
The text file: TRxxxxxx.TXT and the test result file: TRxxxxxx.DAT.
xxxxxx = serial no:
The test results are possible to print out.

F6- Com port

- Com port no	- 1
- Baud rate	- 1200
- Parity	- even
- Char lenght	- 7
- Stop bit	- 2
- LPT port address	- 888
- Time out	- 15/30 (fast/slow computer)
- End char	- >
- Distance	-
- Pulse/step	-
- Pulse/start	-
- Not used	- C:\
- Path to distance meter	- C:\
- Not used	- C:\
- Switch setting	- MS

4.2.2 Extra command.

There is also an extra commando row, always shown when
"F2 trim" is used
These commands can be performed aside from the trim-menu.
F1-PwrOff
Power from the adjustment box to the distance unit is disconnected
F2-PwrOn F3-Reset
Reset is sent to the distance unit
F4-Pwr d:n
The distance unit is set in "power down" mode
F5-NormPwr
The distance unit is set in "normal" power mode
F6-Done off
Removes the "Done" mark at the row that's marked in the menu
F7-Key
Unlocks the order of the adjustment steps, so that any adjustment
Power from the adjustment box to the distance unit is connected
F10-Quit

4.2.3 The adjusting steps

The trim menu is numbered from 1 to 9. When one adjustment is done,
the prompt automatically jumps to the next position.
The only possibility to change that order is to press the F7 key.
Then any of 9 positions can be chosen. This is indicated by that the key symbol in the upperrighthand corner of the screen will disappear.
There are three ways to go back from the trim menu to the root menu:

- 1. Choose root in the menu
- 2. Press the esc key
- 3. Go through the whole menu and choose.

Both 1 and 2 will work the same way the adjustment state will be saved in the "state.par" file. The compuer can now be shut off. When started again and entering the adjustment menu in the "TROL" program, it will be at the same state as where it was left.
Note: When using alternative 3, the state.par file will be cleared.

file: TRxxxxxx.DAT.
xxxxxx = serial no:

Root:	Back to the root menu.
Serial no:	Press enter and write serial no.
Scratch Y/N:	Start from the beginning and clear the STATE.PAR file.
1. Main power on:	Power to the distance unit, reset and open the external greywedge.
2. High/Low light power:	Option to change the light power, presently not used .
3. Signal in search mode:	Measurement of signal level in search mode. Tolerance 7V +/- 2V DC. If out of tolerance adjust on R41
4. Inner path adjustment:	The instrument is set in the test mode and cal, via the computer. Turn the screw clockwise and adjust to 100mV AC +/- 30 on the first flank. Three test measurements are made, the result should be within 100mV AC +/-30mV.
5. Freq1/Freq2 adjustment:	The greywedge is turned to the signal/noise limit 5 AC. The value shall be F1 + 1mV AC (0.8 /+0.5mV). If out of tolerance adjust on external greywedge to 5mV, then adjust R14 on the DIP board to signal/noise level. Press the "ESC" key and run the test again.
6. Greywedge working point:	Measure the Sig.level and Lin.signal, in D-bar mode. Sig.level = 6,2 +/- 0.3V. Lin.signal = 120 +/- 30mV. If Sig.level out of tolerance adjust R41 on the DIP board and go through the adjustment from step 3 again.
7. Strong/weak signal:	Five measurements with strong signal and five measurements with weak signal are made. Mean values of distances at strong and weak signal and spread is calculated. Measuring time is also calculated
8. Crosshair/tracklight:	Control that the crosshair illumination are flashing. Measure the TRK-mod signal at the TTB board middle pin (probe x 10).
9. Range check	Turn GDM away from the fixed prism use the RC prism (RC = rang check, described in WI 93002), measure Lin signal. Tolerance: 510 = 10 - 13mV 520 = 14 - 20mV 540 = > 20mV

Result saved in directory:TROLDAT.

Mechanical servo assembly, control and adjustment

5.1.1 Tools:	Part no:
Torque wrench	571 600 280
Spring balance	571 600 425
Spring balance	908 143 457
Adjustment fixture vert.	908 143 509
Adjustment fixture hor.	908 143 510
Wheel assembly	908 143 554

5.1.2 Others	Part no:
Sealing wax	571 900 570
Grease NBU 15	571 905 944
High vacuum grease	571 905 946
Grease DF1M	571 905 953
Pliobond	995 100 159
Acetone	

5.1.3 Pos:	Part no:
1. Screw 3X16, X2	571 905 917
2. Spring	571 180 994
3. Bearing plate	571 180 521
4. Screw 4X10, X4	941 104 289
5. Axle bar	571 180 522
6. Worm wheel	571 180 523
7. Shims	571 180 917
8. Wave washer	571 180 524
9. Screw 3X8, X1	941 104 524
10. Screw 3X8, X5	571 905 226
11. Washer	571 180 525
12. Screw 3X10, X4	571 905 918
13. Screw 2X10, X1	941 134 168
14. Micro switch	571 180 530
15 Screw 4X10, X1	571 905 232
16 Screw 3X8, X6	571 905 226
17 Washer M4	571 180 993
18 Wave washer	571 180 524
19 Shims	571 180 917
20 Worm wheel	571 180 523
21 Hub	571 180 992
22 Wheel assembly	908 143 554
23 Screw 2.5X6	941 134 191
24 Washer	571 905 472
25 Wheel	571 180 552
26 Spring, X2	571 180 538
27 Wheel	571 180 531

Cont.

Pos:	Part no:	
28 Hor piston assembly		
29 Vert piston assembly		
30 Motor / Encoder	571 180 418	
31 Gasket vert gear	571 180 529	
32 Gear housing vert	571 180 902	
33 Worm screw complete	571 180 008	
34 Gasket	571 905 069	
35 Cover	571 180 904	
36 Gasket hor gear	571 180 528	
37 Gear housing hor	571 180 900	
38 Screw	941 134 163 (motor: Minimotor)	571 905 228 (motor: ESK)
39 Screw	941 104 220	
40 Gasket	571 905 525	
41 Screw	571 903 482	
42 Screw	571 903 074	
43 Screw	941 104 220	
44 Screw	941 104 230	
45 Brass wheel complete	(pos: 23, 24, 25, 26, 27)	
46 Screw	941 104 291	
47 Piston	571 180 537	
48 Spring	571 905 161 (GDM 500/460)	571 904 624 (GDM 4000)
49 Piston holder	571 180 548	
50 Stop screw	941 368 287	

5.2.1 Vertical worm wheel assembly:

- Clean the parts (3,5,6,7,8,11) with acetone (figure 1)

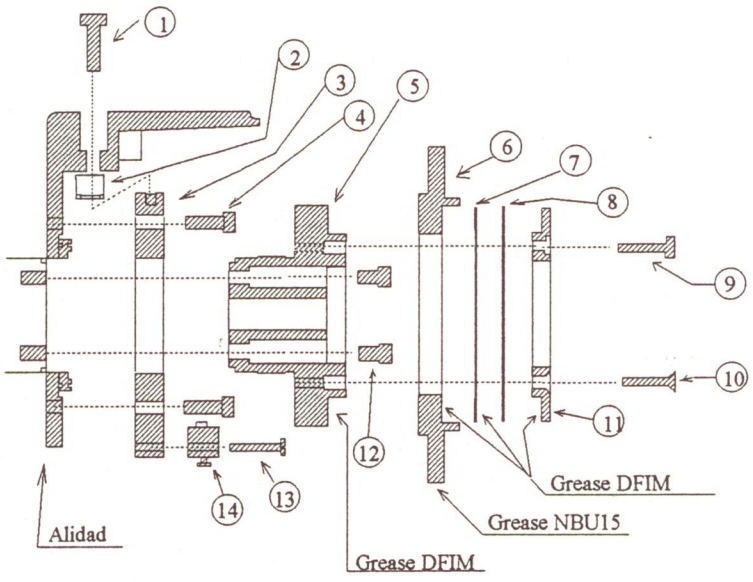
- Mount the worm wheel (6) on the axle bar (5)

- Apply with a small paint brush a thin layer DF1M on the:
  - Axle bar (5)
  - Worm wheel (6)
  - Shims (7)
  - Wave washer (8)
  - Washer (11)

- Fill the cog's with NBU 15 (figure 3)

- Mount on top of the worm wheel (6):
  - Shims (7)
  - Wave washer (8)
  - Washer (11)
  - Tighten the screws (9) and (10)

Figure 1



5.2.2 Horizontal worm wheel assembly:

- Clean the parts (17,18,19,20,21) with acetone (figure 2)

- Apply with a small paint brush a thin layer of DF1M on the
  - Washer (17)
  - Wave washer (18)
  - Shims (19)
  - Worm wheel (20)
  - Hub (21)

- Fill the cog's on the worm wheel with NBU15 (figure 3)

- Mount the hub (21) on the base-unit

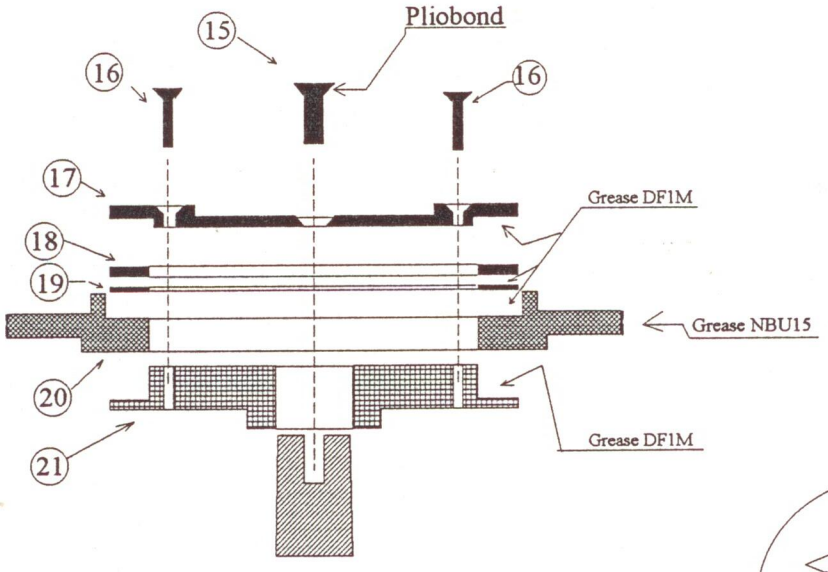
- Mount the worm wheel (20) on the hub (21)

- Mount on top of the worm wheel (20):
  - Shims (19)
  - Wave washer (18)
  - Washer (17)

- Tighten the assembly with the 6 screws (16).

- Tighten and lock the middle screw (15) with Pliobond.

Figure 2



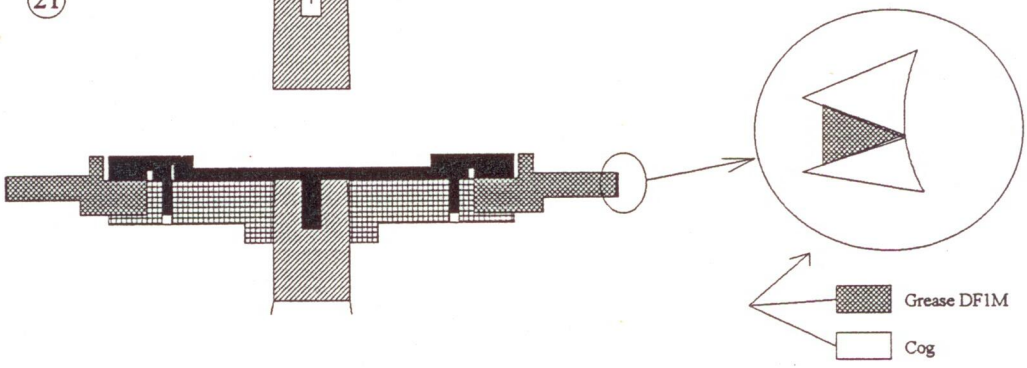


Figure 3

5.2.3 Alidad assembly

Disassembly of mechanical servo parts, remove:

- Side cover of GDM
- PRS2 board
- Cables

Special care should be considered, when removing parts mentioned below (figure 4)

- Screw (43)
- Vertical piston assembly (29)
- Screw (44)
- Horizontal piston assembly (28)

After removing (28 and 29) <u>no turning</u> of alidad horizontally or vertically must be made without pressing the worm screw carefully towards the worm wheel. Otherwise the cog's will be damaged.

- Screw (41)
- Covers (35)
- Screw (23)
- Brass cog wheels (45)
- Loosen and remove the screws (38)
- Motors (30)
- Screw (42)
- Remove <u>carefully</u> the worm screw (33)
- Screws (39)
- Vertical gear housing (32)
- Horizontal gear housing (37)

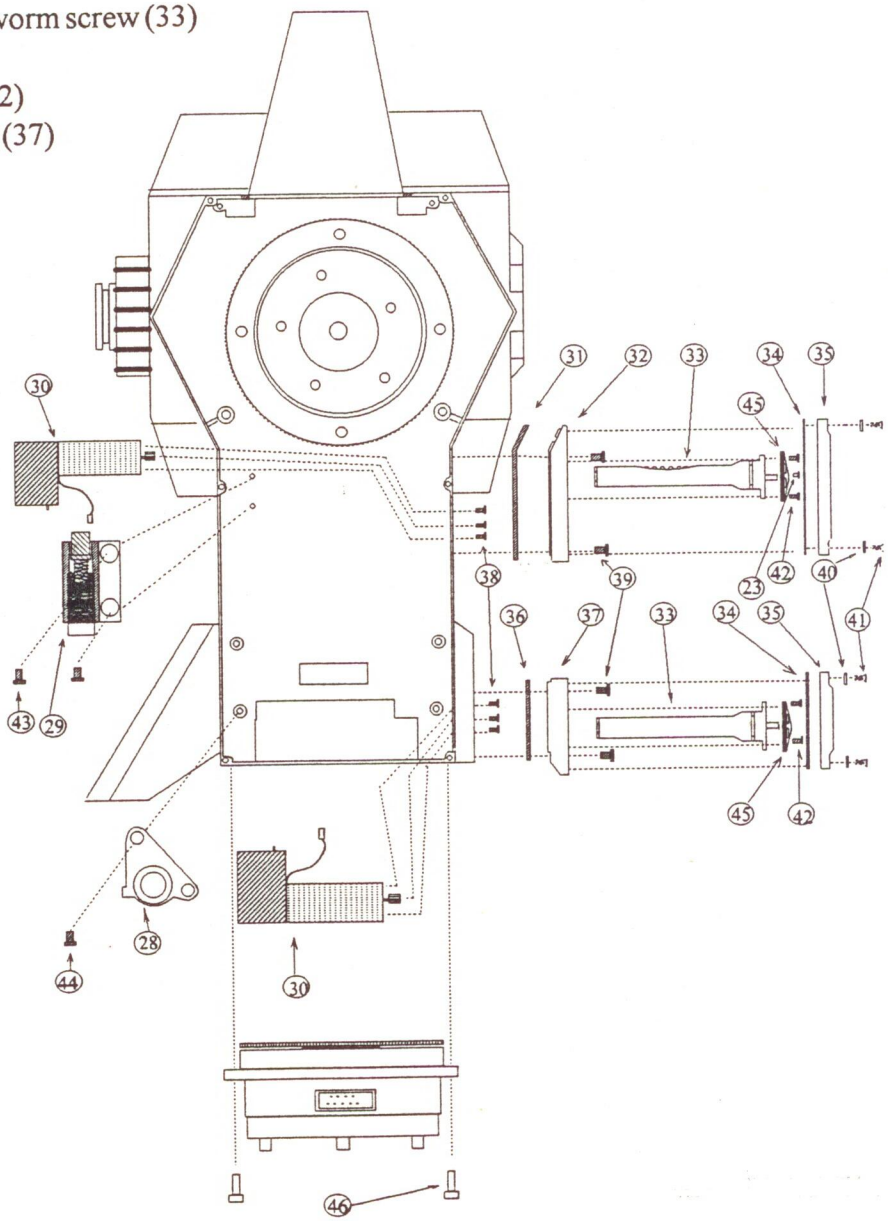


Figure 4

To remove base unit:

- Remove side covers
- Remove PAS and IfPAS2 is used then cable connector from the horizontal sensor has to be removed
- PRS boards
- Loosen screws (46)
- <u>Carefully remove base unit</u>

Reassemble of mechanical servo parts.
Apply a thin layer of high vacuum grease on the gasket (31 and 36) (figure 4a)
- Mount the gasket (31) on the vertical gear housing (32)
- Mount the gasket (36) on the horizontal gear housing (37)

Remounting the base unit:
- Carefully place the base unit in the alidad
- Gently push the base unit towards the PRS board side
- Tighten the screws (46)

Mount:
- Gear housing vertical (32)
- Gear housing horizontal (37)
- Worm screw (33)

After the worm screws have been mounted, the mechanical play must be checked. Described later in chapter "Mechanical control".

Mount:
- Vertical motor, tighten the screws (38) with 30 Ncm torque
- Vertical piston assembly (figure 5)
- Horizontal piston assembly (figure 5)

After the piston assembly has been mounted a piston torque and play check, must be made. Described later in chapter "Mechanical control".

Mount:
- Horizontal motor
- Tighten the screws (38) with 30 Ncm torque
- Brass cog wheels (45) (figure 6)
- Cover (35)

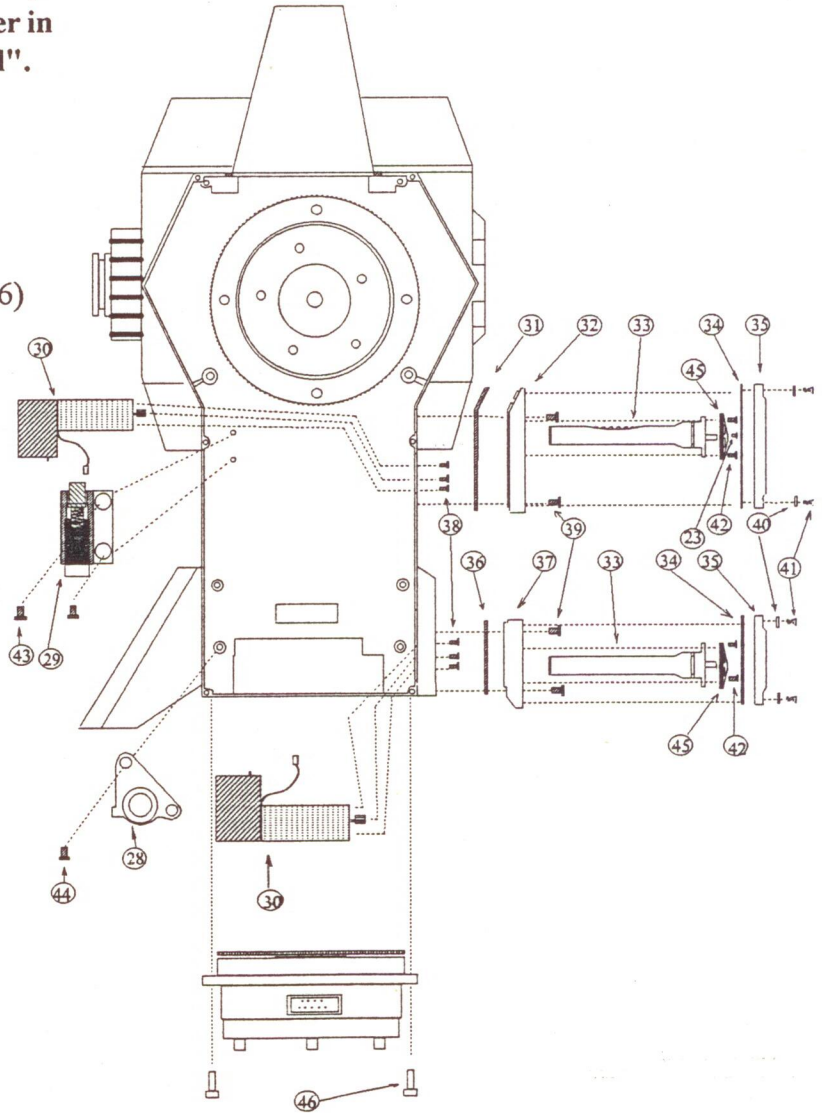


Figure 4a

5.2.4 Piston assembly

The vertical piston assembly consist of four parts:
- Holder (29)
- Piston (47)
- Spring (48)
- Adjustment screw (49)

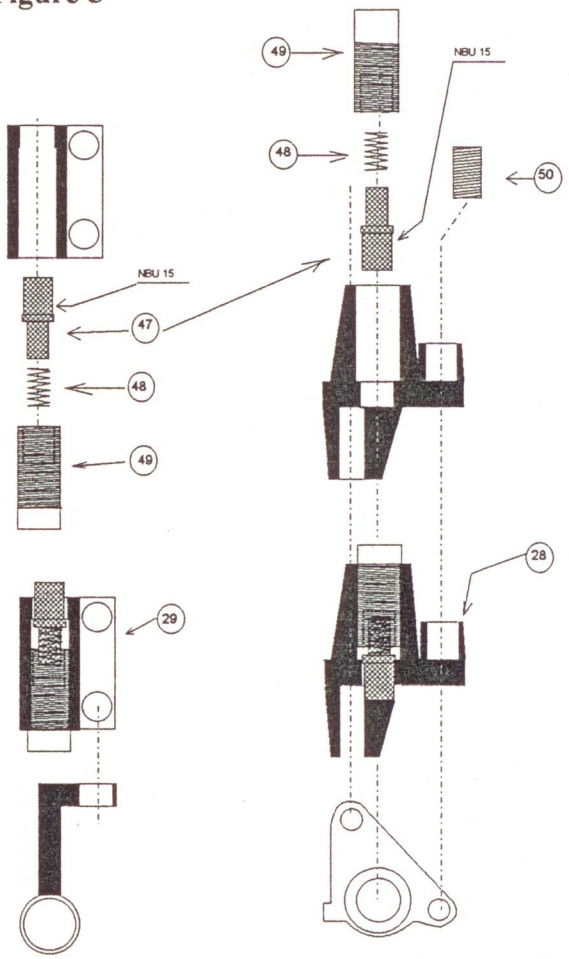
When the vertical piston assembly is mounted, following procedures must be followed:
- Grease the piston with NBU15
- Use the correct spring 400/500 or 4000 (48)

- After mounting the vertical piston assembly, seal the screw holes in the alidad with sealing wax.

The horizontal piston assembly consist of five parts:
- Holder (28)
- Piston (47)
- Spring (48)
- Adjustment screw (49)
- Stop screw (50)

When the horizontal piston assembly is mounted, following procedures must be followed:
- Grease the piston with NBU15
- Use the correct spring 400/500 or 4000 (48)

Figure 5



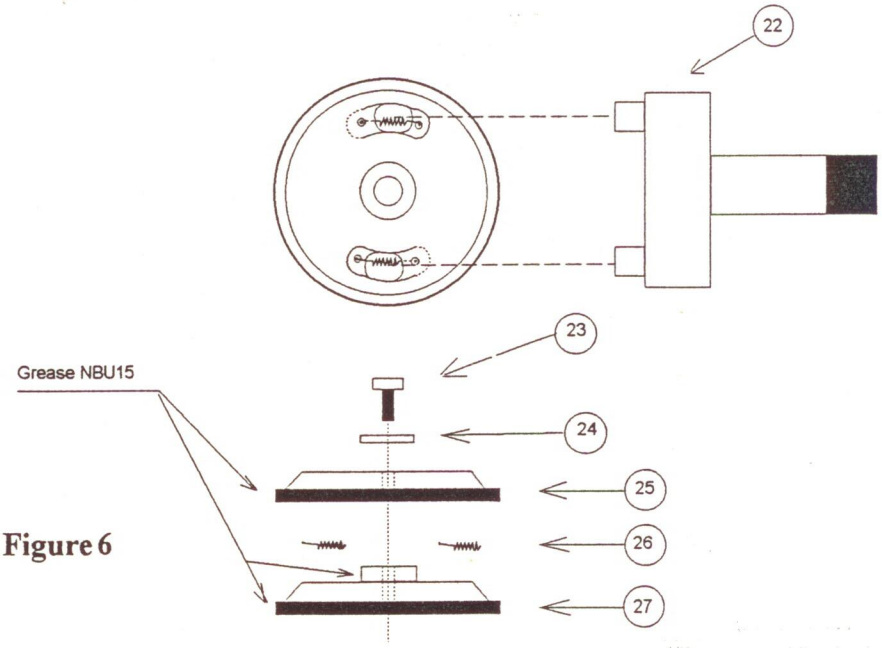


Figure 6

5.3 Mechanical control

After mechanical disassembly and reassembly has been performed, a control of the mechanical play and torque has to be performed. . When the mechanical control is finished, electrical verification of the complete system has to be performed by the use of the "Play analyser", described in document "PLAY ANALYSER FOR GEODIMETER SERVO SYSTEM".

5.3.1 Vertical control:

- Remove side cover on the right hand side (PRS)
- Loosen cables from the PRS board
- Remove the PRS board
- Remove encoder cable
- Remove vertical piston assembly
- Remove motor (30)

Note that no movement of the yoke must be made while the vertical piston assembly is removed, the cog's of the worm wheel or worm screw can be damaged.

Worm screw play adjustment:

- Mount the tool (**908 143 509**) to the alidad (figure 7), adjust measuring point (figure 7a.2) to hit the middle of the wormscrew.

Figure 7

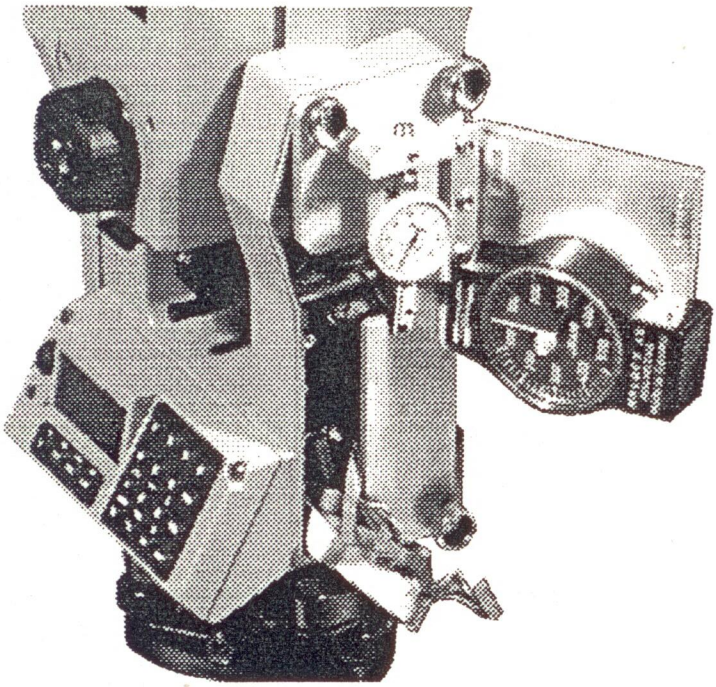
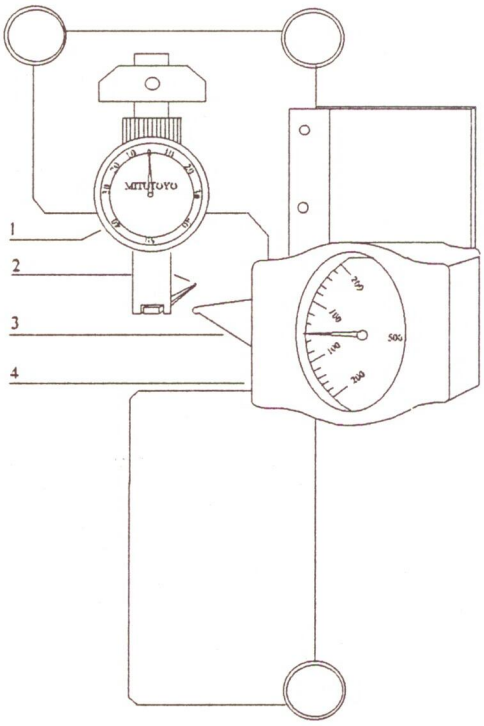


Figure 7a



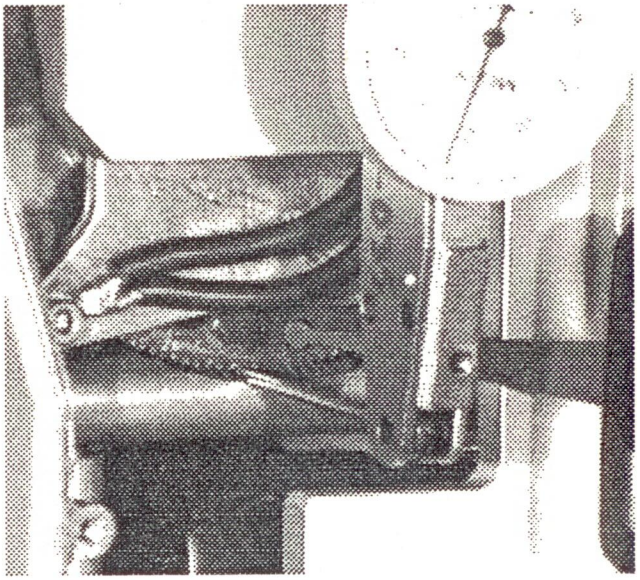
- Set the indicator clock to zero (figure 7a.1)
- Push carefully with a finger the worm screw towards the worm wheel (figure 8)
- Read the indicator clock, (figure 8a.1)

- GDM 460	**0.02 - 0.04 mm**
- GDM 4400	**0.02 - 0.04 mm**
- GDM 500	**0.02 - 0.04 mm**

Control the play at different places of the worm wheel e.g. 100gon 200gon...
If out of tolerance adjust the vertical gear house (figure 8a.2) according to description in chapter "**5.4.4**".

Vertical control cont.

Figure 8



Piston assembly play:
- Mount the piston assembly (figure 4/29)
- Check the mechanical play between the worm screw and the piston assembly by pressing carefully the worm screw towards the piston assembly (figure 8a.3), the play shall be:

- GDM 460	**0.3 - 0.35 mm**
- GDM 4400	**0.3 - 0.35 mm**
- GDM 500	**0.3 - 0.35 mm**

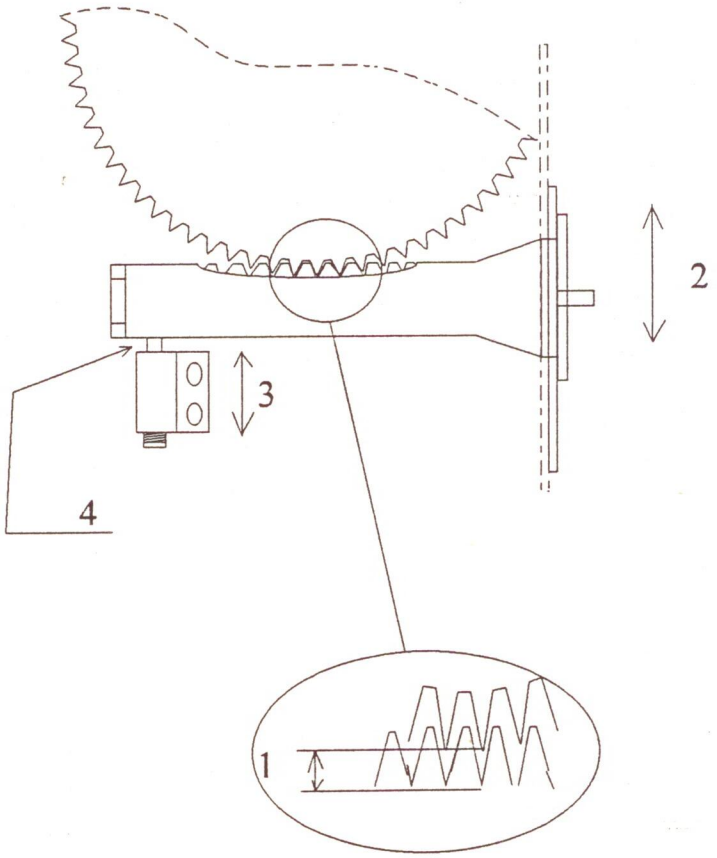
If out of tolerance, adjust according to chapter "**5.4.4**"

Piston assembly torque:
- Check that the torque needed to move the worm screw in direction from the worm wheel **0.03mm** (figure 8a.4) by moving the spring balance (figure7a.4) is:

- GDM 460	**260 - 270g**
- GDM 4400	**310 - 330g**
- GDM 500	**260 - 270g**

If out of tolerance, adjust according to chapter "**5.4.4**"

Figure 8a



5.3.2 Horizontal control:

- Remove side cover on the right hand side (PRS)
- Loosen cables from the PRS board
- Remove the PRS board
- Remove encoder cable
- Remove motor (30)
- Remove horizontal piston assembly

Note that no movement of the alidad must be made while the piston assembly is removed, the cog's of the worm wheel or worm screw can be damaged.

Worm screw play adjustment:

- Mount the tool (**908 143 510**) on the alidad (figure 9)
- Adjust measuring point to hit the middle of the worm screw (figure 9a.3)
- Connect the spring balance to the worm screw (figure 9a.4)

Figure 9

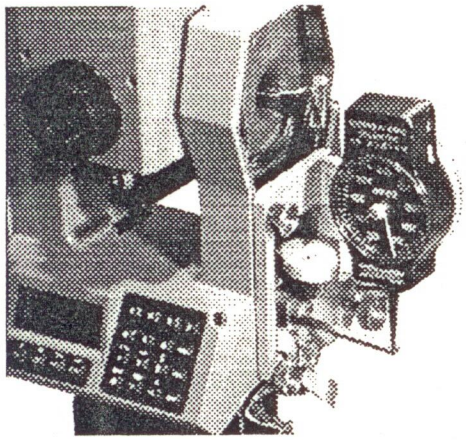
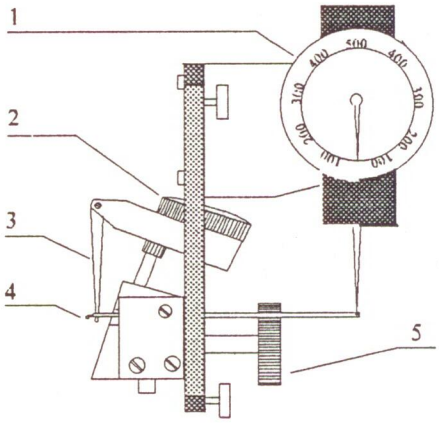


Figure 9a



- Set the indicator clock to zero (figure 9a.2)
- Push carefully with a finger the worm screw towards the worm wheel
- Control the movement by reading the scale

- GDM 460	**0.02 - 0.04mm**
- GDM 4400	**0.02 - 0.04mm**
- GDM 500	**0.02 - 0.04mm**

Control the play at different places of the worm wheel e.g. 100gon 200gon...
If out of tolerance adjust according to description in chapter "**5.4.5**"

Piston assembly play:

- Mount the horizontal piston assembly (figure 4/28)
- Control the mechanical play between the worm screw and the piston assembly by pressing carefully the worm screw towards the piston assembly, the play shall be:

- GDM 460	**0.3 - 0.35 mm**
- GDM 4400	**0.3 - 0.35 mm**
- GDM 500	**0.3 - 0.35 mm**

If out of tolerance adjust according to description in chapter "**5.4.5**"

Piston assembly torque:

- Control that the torque needed to move the worm screw in direction from the worm wheel 0.03mm by moving the spring balance (figure 8a.4) is:

- GDM 460	**160 - 180g**
- GDM 4400	**310 - 330g**
- GDM 500	**160 - 180g**

If out of tolerance adjust according to description in chapter "**5.4.5**"

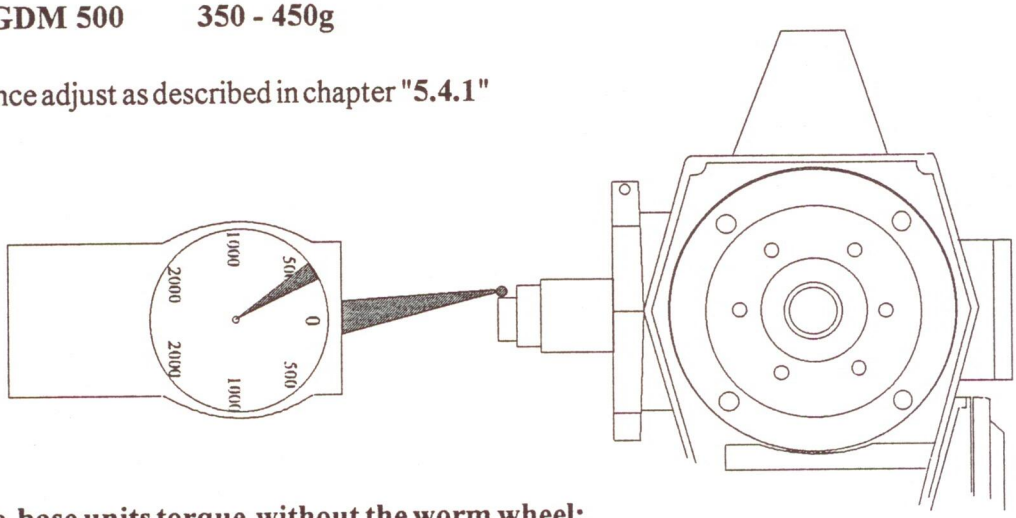
5.3.3 Control of vertical and horizontal clutch:

Control of the vertical clutch torque:

- Hold the spring balance **(908 143 457)** at the edge of the telescope (figure 10)
- Move the spring balance gently downwards
- Read the scale exactly when the telescope starts to move:
  - **GDM 460 350 - 450g**
  - **GDM 4400 350 - 450g**
  - **GDM 500 350 - 450g**

If out of tolerance adjust as described in chapter **"5.4.1"**

Figure 10



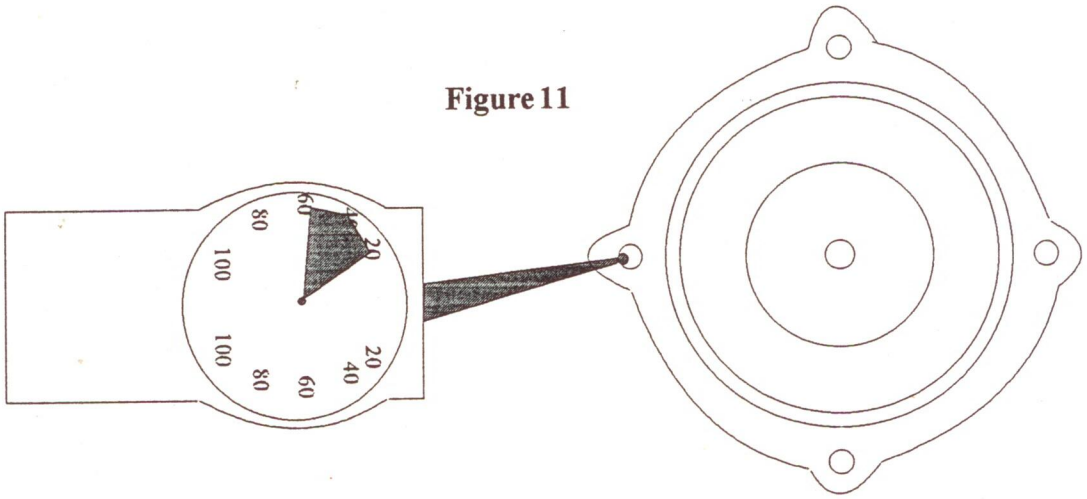
Control of the base units torque without the worm wheel:

This check is only need if base unit has been disassembled or if problems of obtaining result within the tolerance when performing "play analysing test".

- Hold the spring balance **(571 600 425)** to the base unit as in (figure 11)
- Move the spring balance
- Read scale exactly when the base unit upper part starts to move:
  - **GDM 460 20 - 60g**
  - **GDM 4400 20 - 60g**
  - **GDM 500 20 - 60g**

If out of tolerance adjust according to chapter **"5.4.2"**

Figure 11



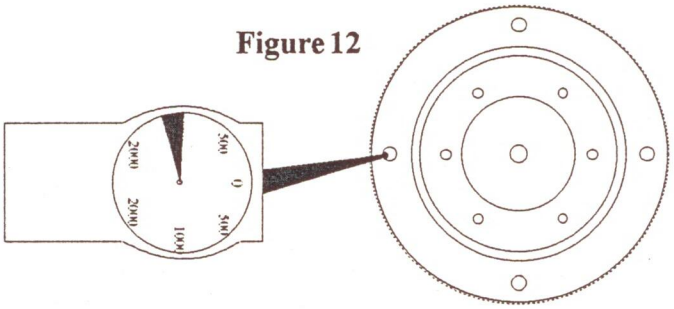
Control of horizontal and vertical clutch cont.

Control of the horizontal torque, base unit with worm wheel and clutch:
- Hold the spring balance **(908 143 457)** to the worm wheel (figure 12)
- Move the spring balance
- Read the scale exactly when the worm wheel starts to move:

- GDM 460	**1000 - 1500g**
- GDM 4400	**1000 - 1500g**
- GDM 500	**1000 - 1500g**

If out of tolerance adjust according to chapter "**5.4.3**"

Figure 12

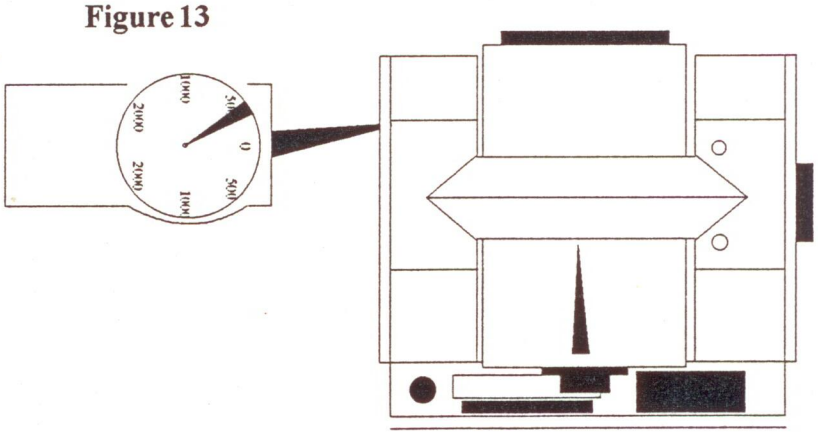


Control of the horizontal clutch torque of the complete GDM:
- Hold the spring balance at the corner of the side cover (figure 13)
- Move the spring balance
- Read the scale exactly when the worm wheel starts to move:

- GDM 460	**350 - 550g**
- GDM 4400	**350 - 550g**
- GDM 500	**350 - 550g**

If out of tolerance adjust according to chapter "**5.4.3**"

Figure 13



5.4 Adjustment

This chapter describes:
- Mechanical adjustment of the vertical and horizontal clutch
- Mechanical adjustment of the vertical servo parts
- Mechanical adjustment of the horizontal servo parts

5.4.1 Vertical clutch

If the torque is to low:
- Clean and add new grease (**DF1M**)
- Add one shims (7)
- Control the torque
- Reassemble

If the torque is to high:
- Remove one shims (7) (min one shims)
- Clean and add new grease (**DF1M**)
- Control the torque
- Reassemble

5.4.2 Base unit torque

If the torque is to low or to high, adjust
contact springs, according to "TI571/93008

5.4.3 Horizontal clutch

If the torque is to low:
- Clean and add new grease (**DF1M**)
- Add one shims (19)
- Control the torque
- Reassemble

If the torque is to high:
- Remove one shims (19) (min one shims)
- Clean and add new grease (**DF1M**)
- Control the torque
- Reassemble

When reassembling the base unit push the base unit towards the worm screw

5.4.4 Mechanical adjustment of vertical servo parts

Three things need to be performed when adjusting the mechanical servo parts vertically

- **Worm screw play**
- **Piston assembly play**
- **Worm screw torque**

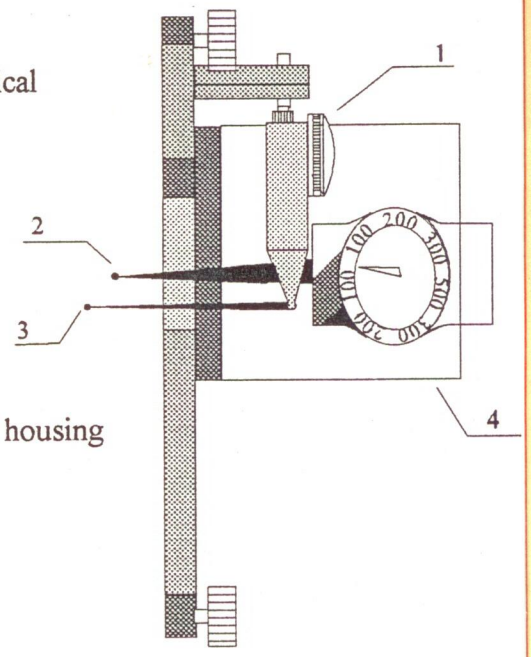


Figure 14

Worm screw play:

- Use a small plastic hammer, to knock on the side of the gear housing
- Move the gear housing away from or closer to the worm wheel (figure 15.2).

Note highest precaution must be taken not to hit the worm screw axis.

- Tighten the screws
- Control the play

Piston assembly play:

- Loosen the two screws that holds the piston assembly (figure 15.9)
- Adjust the position of the assembly by moving the piston assembly closer or further away from the worm screw (figure 15.3)
- Tighten the screws carefully
- Control the play

Piston assembly torque:

- Adjust the screw (figure 15.10)
- Control the torque
- Lock the screw with pliobond

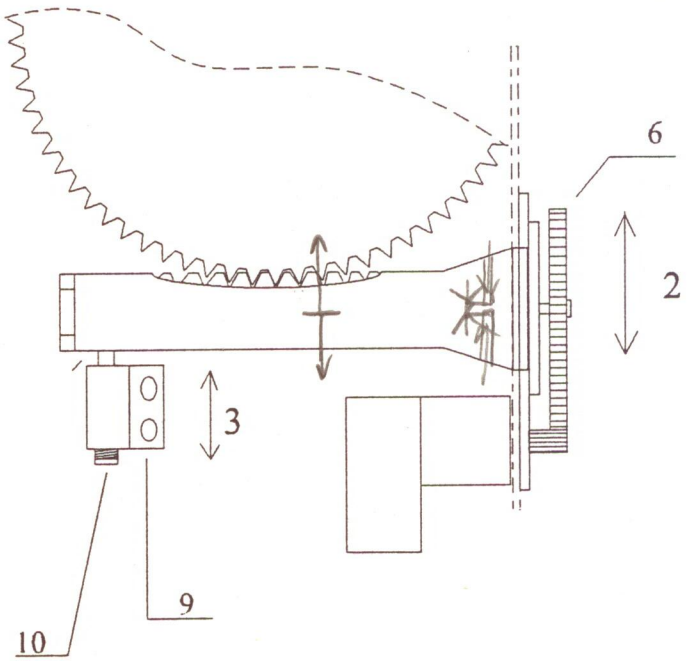


Figure 15

5.4.5 Mechanical adjustment of horizontal servo parts

Three things need to be performed when adjusting the mechanical servo parts both horizontally and vertically

- **Worm screw play**
- **Piston assembly play**
- **Worm screw torque**

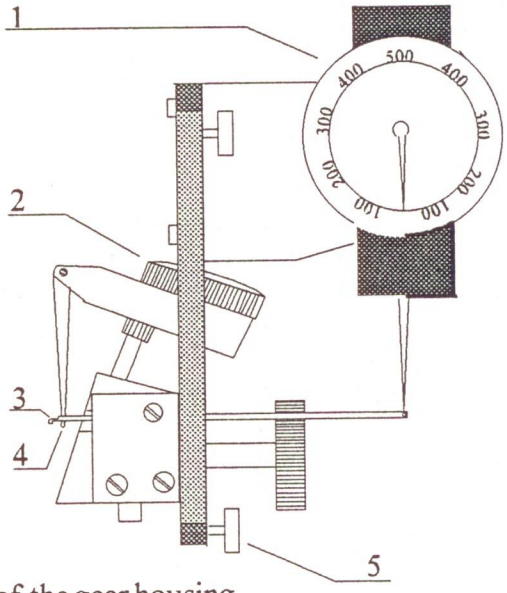


Figure 16

Worm screw play adjustment:

To increase the play

- Use a small plastic hammer, and knock on the right side of the gear housing

To decrease the play

- Adjust the screw on the tool (figure 16.5)

Note highest precaution must be taken not to hit the worm screw axis.

- Tighten the screws
- Control the play

Piston assembly play:

- Adjust the stop screw (figure 5.50)
- Lock the screw wit pliobond
- Control the piston assembly play

Piston assembly torque:

- Adjust on the screw to increase or decrease the torque (figure 5.49)
- Control the torque
- Lock the screw with pliobond