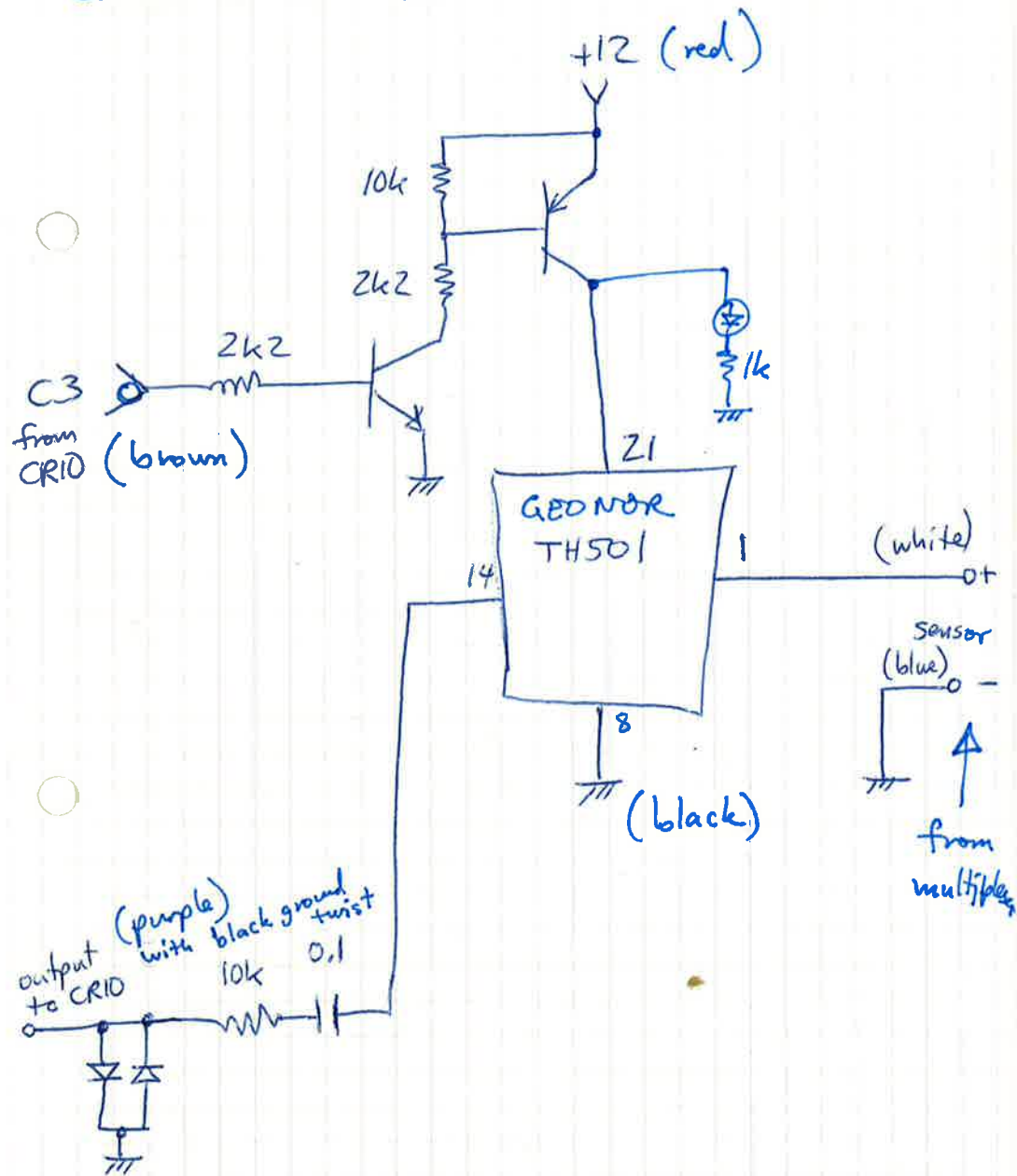
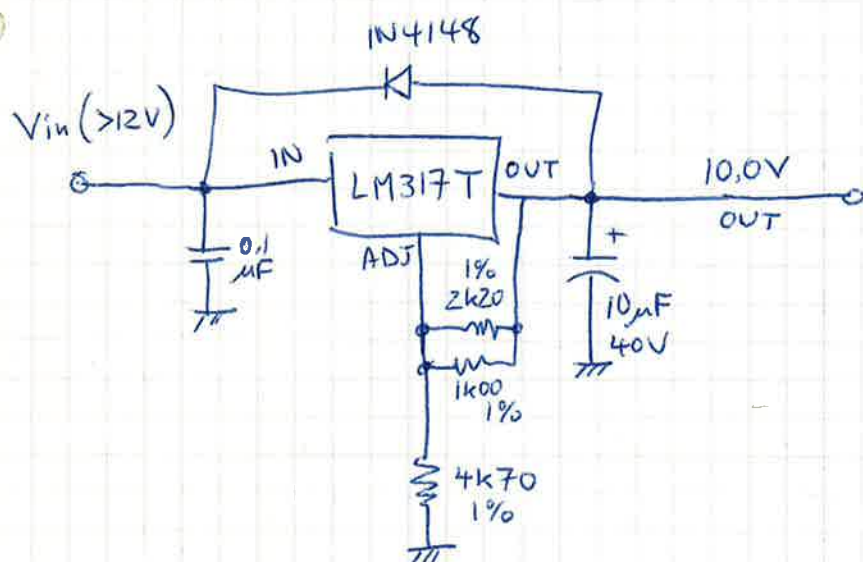


Circuit for vib-wire



V_{ref} inside
wheel instrument



Cable code	Connector *	Wire (in pairs)
1	G	+15 vert. rot.
2	F	-15 " "
3	K	+15 hor. rot.
4	J	-15 " "
5	M	+12 Press
6	P	GND "
7	S	+12 Temp
8	T	GND "
9	R	Signal Press
10	P	AG "
11	X	Signal Hor. rot.
12	W	AG " "
13	B	Signal Vert. rot.
14	C	AG " "
15	U	signal Temp +
16	V	signal Temp -
17	D	0/360 vert rot.
18	C	GND vert rot.
19	H	0/360° hor rot
20	W	GND hor rot.
Shield	A/N	- instrument case

* connections E & L not used (used to be for external supply of reference voltage for potentiometers, but now supplied by local regulators).

Tabell nr.: 4

UTGANGSKONTAKT			
Pin. id.	Pin. nr.	Leidnings-farge	Funksjon/kommentar
A	1	Skjerm	
B	2 ✓	Hvit	O/P-sign. Vert.rot. >S
C	2 ✓	Brun <i>power</i>	Ana.gnd. Vert.rot. >S
D	4 ✓	Fiolett	"Zero"/360° V.rot.
E	5 ✓	Orange	+ 11 V.DC. Vert.rot. 10.01V
F	6 ✓	Blå	- 15 V.DC. Vert.rot.
G	7 ✓	Rød	+ 15 V.DC. Vert.rot.
H	8	Gul *SR	"Zero"/360° H.rot.
J	9	Orange SR	- 15 V.DC. Hor.rot.
K	10	Rød SR	+ 15 V.DC. Hor.rot.
L	11	Grønn SR	+ 11 V.DC. Hor.rot. 10.03V
M	12 ✓	Rød	+ 9-20 V.DC. Trykk
N	13 ✓	Skjerm	<i>from pressure sensor</i>
P	14 ✓	Svart	Ana.gnd <i>power gnd</i> Trykk >S
R	15 ✓	Hvit	O/P-sign. Trykk >S
S	16	Hvt/Svt SR	+ 12 V.dc. Temp. >P
T	17	Hvit SR	12 V.com. Temp. >P
U	18	Grå SR	+ O/P-sign. Temp. >S
V	19	Fiolett SR	- O/P-sign. Temp. >S
W	20	Brun SR	Ana.gnd <i>power</i> Hor.rot. >S
X	21	Svart SR	O/P-sign. Hor.rot. >S

*SR = faste ledninger fra sleperingskontakten

*
NOT CONN.
TO CABLE*
NOT CONN.
TO CABLE

*

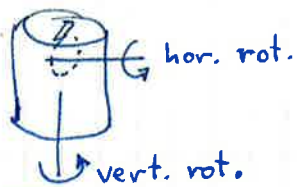
Kontakt type:
62GB PT-02E 22 21SLeverandør: AFU
Tel: 02.35.02.10Antall:
1

ISBREMALER, Intern kobling, chassis-kontakt

Sign.: RSHa

Dato: 91/10/21

Prosjekt nr.: B-91605



Wire

Current

Voltage out (V)

Voltage out (V)
(no -15V supply)

Voltage out (V)
(no Vref or +15V)

+15	vert rot.	5.15 mA	✓			
-15	vert. rot.	4.52 mA	✓			
+15	Hor rot.	0.00 mA	?			
-15	Hor rot.	0.00 mA	?			
+10.00	vert. rot. ref	0.97 mA	✓			
+10.00	hor. rot. ref	0.00 mA	?			
+12	Pressure	13.25 mA	✓	0.999 ✓		
+12	Temp.	6.76 mA	✓			
0/360°	vert. rot	—		+14.94 ✓	+14.95 ✓	+0.376
0/360°	hor rot.	—		-13.92 ?	0.00 ✗	-14.80
	Vert. rot signal			3.33 ✗ ✓	13.98	-0.41
	Hor' rot. signal			-13.99 ?	-0.115	-13.92

✓ = expected

? = unexpected

- I suspect that the wires to the horizontal axis rotation potentiometer are cut or disconnected somewhere inside the instrument. The slipring seems OK.
- The vertical ^{axis} rotation ^{sensor} ~~instrument~~ seems OK, but it seems as if it is mechanically disconnected from the rotation of the pressure chamber since the output does not change.

Calibration of erosion water ($\log f$ (kHz) vs. length of core (mm))

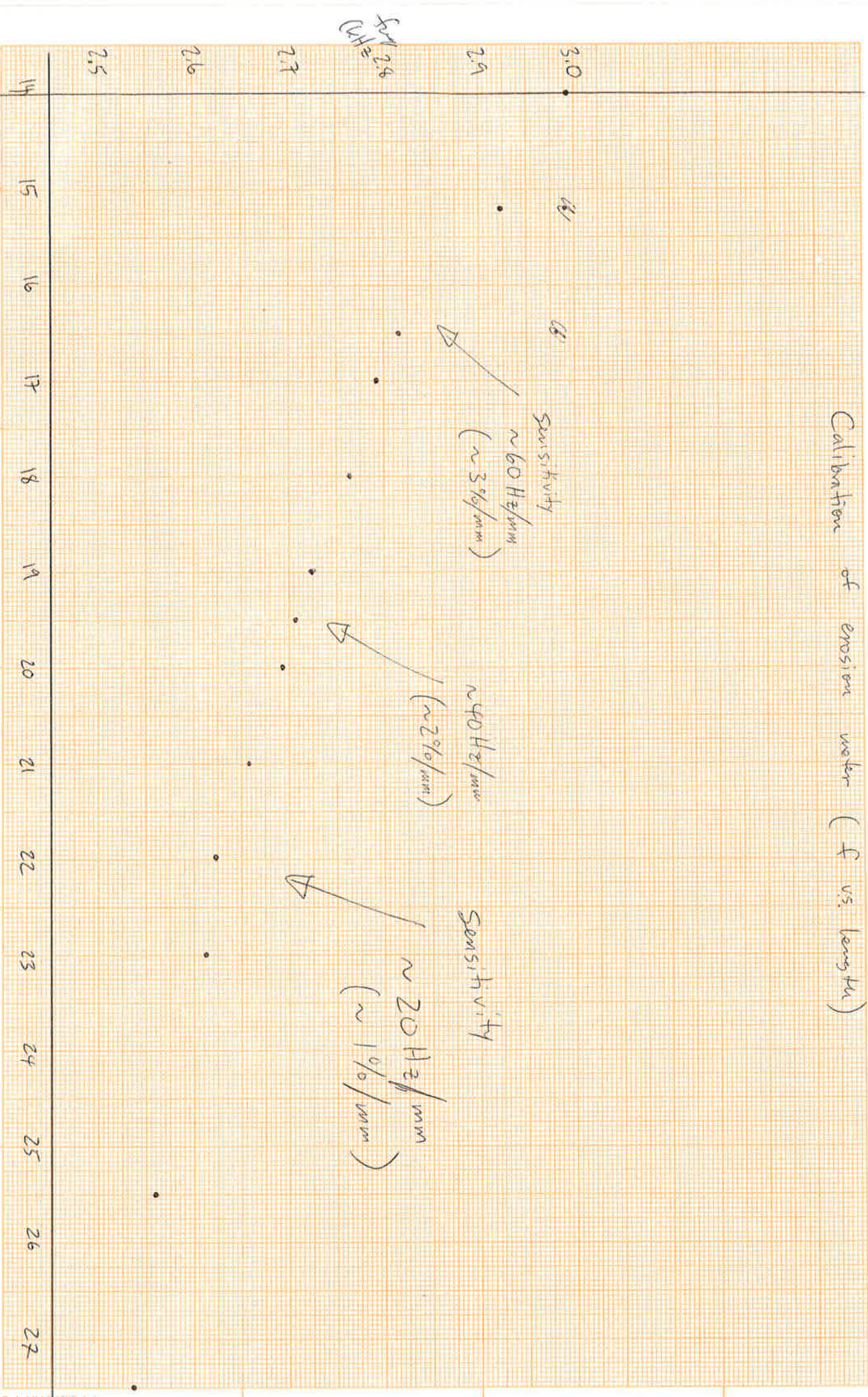
$\log f$
(kHz)

0.47
0.46
0.45
0.44
0.43
0.42
0.41
0.40

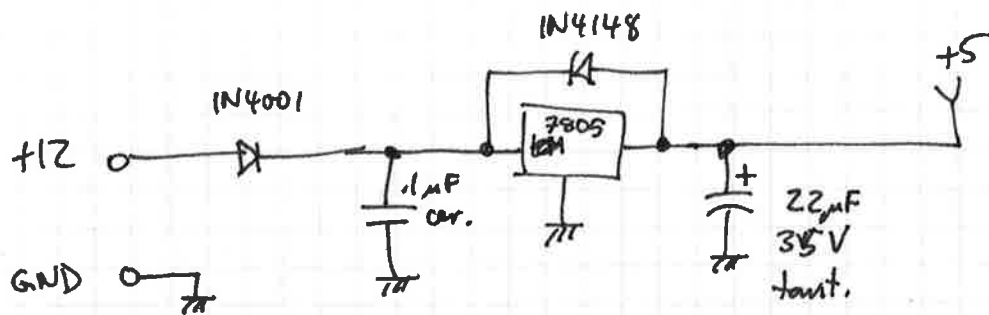
14 15 16 17 18 19 20 21 22 23 24 25 26 27

length (mm)

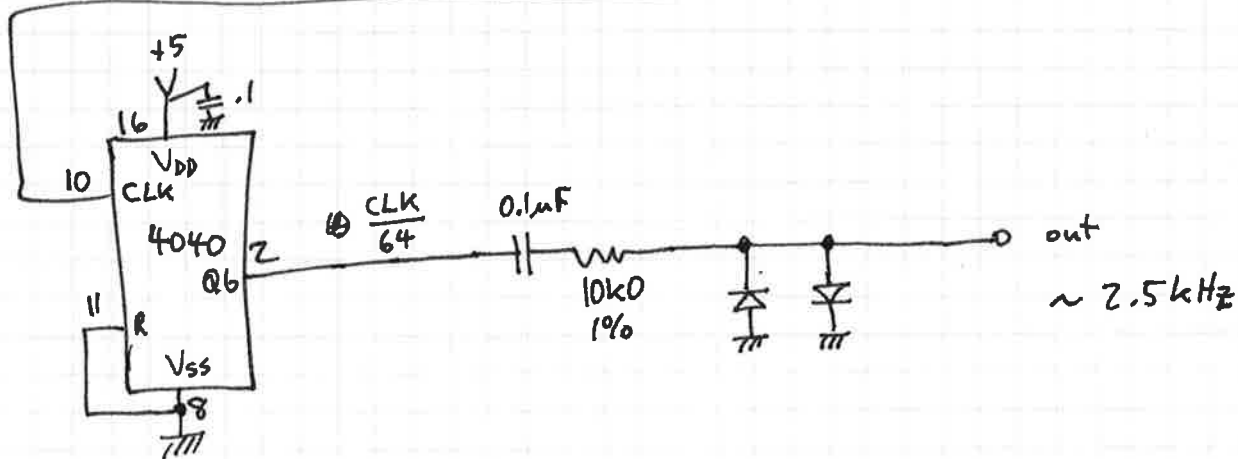
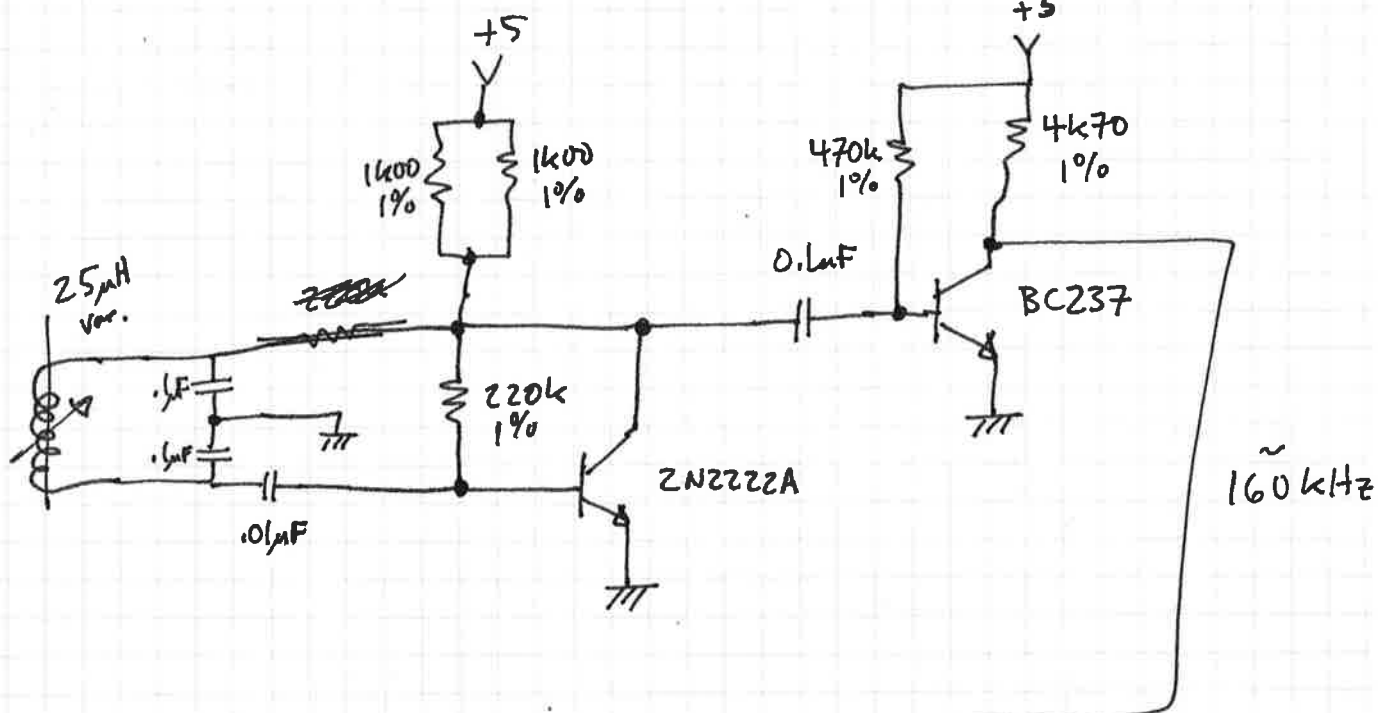
Calibration of erosion water (f vs. length)



EROSION METER



Shoddy biasing.



Calibration of erosion meter @ 22°C

<u>Sp</u>	<u>length</u>	<u>freq.</u>	<u>log f</u>
	27.5 ± .1	2.5385	.4046
	25.5 ± .4	2.5607	.4084
	23.0 ± .3	2.6137	.4173
	22.0 ± .5	2.6231	.4188
	21.0 ± .5	2.6580	.4246
	20.0 ± .2	2.6940	.4304
	19.5 ± .4	2.7081	.4327
	19.0 ± .4	2.7245	.4343
	18.0 ± .3	2.7642	.4416
	17.0 ± .2	2.7919	.4459
	16.5 ± .3	2.8164	.4497
	15.2 ± .2	2.9242	.4660
	14.0 ± .3	2.9939	.4763
	0.0	7.7473	

$$f \propto l$$

$$f = Al$$

$$\log f \propto l$$

$$~~f = Ae^{Al}~~ f = Ae^l + B$$

$$f \propto \log l$$

$$l = Ae^f$$

$$f^n = l^m$$

$$n \log f = m \log l$$

NORWEGIAN WATER RESOURCES
AND ENERGY ADMINISTRATION
P.O. Box 5091, Majorstua
N-0301 OSLO
NORWAY

TELEFAX

To: Rein Sørnes Hansen

Att:

Telefax no: 02 58 3565

Date: 23/11-92

Time: 13:25

From: Erik Blake

Sign:

Our fax no:

~~+47 2 05 00 00~~

081 51853

Our telex no:

56 79397 NVEO N

Our phone no:

~~+47 2 05 05 95~~

090 4⁸⁷⁷~~886~~ (X)

Note:

Here's the documentation for the rotation sensor and a summary of voltages and currents for the wheel device. Do you agree with my analysis of the faults?

It looks like I will need to open the instrument - could you fax some instructions on how to do that. A mechanical drawing or sketch would be helpful.

I will phone you in a little while

Erik

Special Features:

- Value-for-money Absolute Angle encoding module
- Gap-free output over all 360°
- High absolute linearity
- Interchangeable without adjustment
(no zero offset and constant voltage gradient)
- Guaranteed 12 bit resolution and repeatability
- Two grades for 10 or 11 bit absolute accuracy
- Long life – 50×10^6 revolutions
- High operating speeds 6000 r.p.m. for short periods
1500 r.p.m. continuous use
- Rugged Industrial grade construction, sealed shaft,
connector to IP 65
- Maximum reliability through the combination of the
Dinopot HQ5 system* and hybrid technology
- DBP 2733949, U.S. Pat 4,203,074 and other patents

This potentiometer has been designed to be used as an absolute 360° angle encoder.

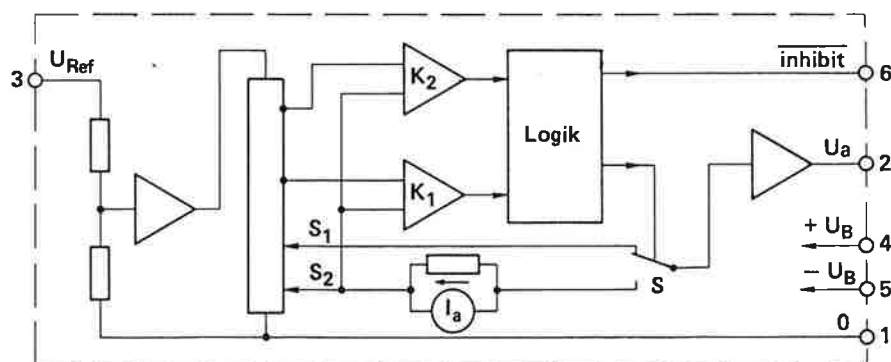
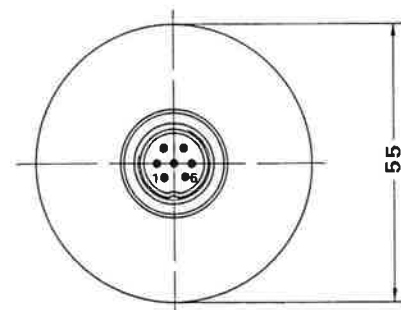
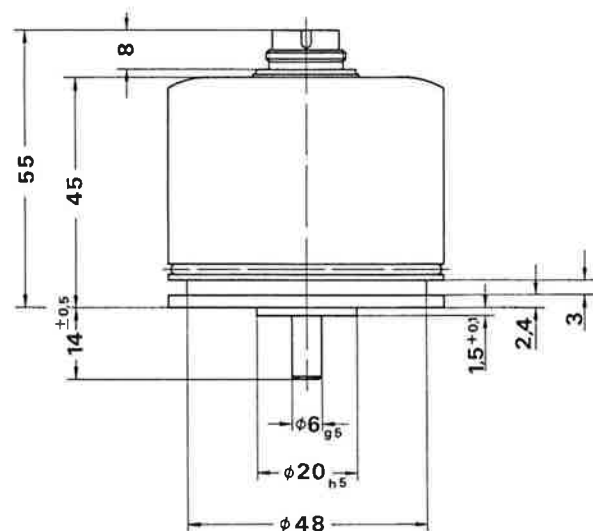
When used in conjunction with an external A/D converter, the unit operates as an angle transducer with 12 bit resolution and offering 10 or 11 bit absolute accuracy.

The transducer requires only 7 connections and these are made via a 7 pole, waterproof plug and socket.

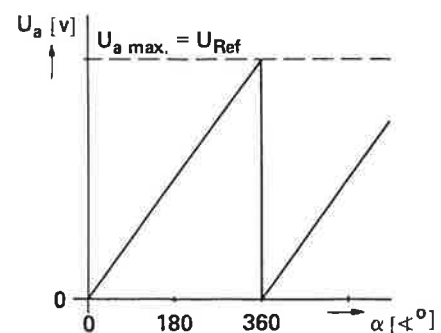
The A/D converter can be mounted in an external rack, thereby, offering ease of connection with protection from noise.

Contrary to the limitation encountered with other potentiometers, the AW 360 ZE can be used over all 360° of rotation since it has no dead band. This limitation has been overcome by the use of two wipers and a special Hybrid circuit.

The reset voltage at the beginning and end of the sawtooth are well defined and there is no function angle tolerance as is normally associated with potentiometers. These features coupled with the fact that the maximum output voltage is determined by the applied voltage means that units may be interchanged or replaced without the need to adjust or trim. The transducer delivers a logic signal quite separately from the analogue output which can be used to inhibit the A/D conversion during the reset period.



Connection diagram



Output signal

Description

Case	black anodized aluminium; degree of protection IP 65; sealed shaft
Shaft	stainless steel
Bearings	stainless steel ball bearings
Resistance element	conductive plastic
Wipers	for collectors and resistance element precious-metal multi-finger wipers- elastomer damped
Collectors	conductive plastic on silver paste
Electronic circuitry	hybrid circuit built into potentiometer housing
Connections	7-pin connector (see "Accessories")

Electrical Data

Actual electrical travel	°	360
Total resistance	K ohm	10
Resistance tolerance	%	± 10
Absolute linearity		
AW 360 ZE 10	%	± 0.07
AW 360 ZE 11	%	± 0.035
Micro-linearity	%	± 0.01 typ.
(linearity change over 1% of the range)		
Temperature coefficient of the resistance	ppm/°C	100
Supply voltage $\pm U_B$ of the electronic circuitry	V	$\pm 10 \dots \pm 16$
Potentiometer supply voltage U_{Ref}	V	+6 ... +12
therefore $U_{Ref} + U_B - 4$ V		
Inhibit Signal from + U_B to zero within ca. 50 μ s		
Zero offset	mV	<2
Output Voltage, max.	U_{Ref}	± 2 mV
Output Current, max.	mA	5, shortcircuit protected
Output Resistance	ohm	<0.1
Quiescent current of electronic circuitry	mA	10
Insulation resistance at 250 V	M ohm	100

Mechanical Data

Dimensions	see drawing	
Mounting	3 mounting clamps	
Tolerances:		
shaft-end play	mm	0.05
shaft-radial play	mm	0.05
shaft runout	mm	0.03
pilot surface runout	mm	0.05
lateral runout	mm	0.05
Mechanical travel	°	360, continuous
Starting torque	Ncm	<1.5
Allowable wiper velocity		
continuous	rad s ⁻¹	200
for short periods		600
Weight	g	170

Operating Conditions

Ambient temperature range	0 ... +70°C
Shock	50 g, 11 ms
Vibration	10 ... 2000 Hz, $A_{max.} = 0.76$ mm, $a_{max.} = 20$ g
Life	50 · 10 ⁶ revolutions

Accessories Supplied

3 mounting clamps Z3-31

Optional Accessories

Mating connector EEM 33-78
Degree of protection, IP 65

(alternatively: mating connector EEM 33-79, degree of protection IP 40; Right-angled connector EEM 33-80, degree of protection IP 63)

*The Dinopot HQ-5 System is a NOVOTECHNIK trade-mark. It represents 5 special characteristics of utmost quality.

1. Linearization of assembled unit using its own wiper.
2. Elastomer damped wiper
3. Stress-relieved connections to resistance track.
4. Conductive Plastic collector track
5. Exactly aligned precision bearings

