KLAY-INSTRUMENTS

MANUAL
HYDROBAR "I"

WARNING

Before installing the *Hydrobar "I"*, read the warnings and advisements on page 14.

For personal and system safety, and for optimum performance, make sure you thoroughly understand the contents before installing.

Manufactured by:

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CONTENTS

1. INTRODUCTION

1.1 DESCRIPTION OF THE HYDROBAR I

The *Hydrobar "I"* is an "Intelligent" *free adjustable* hydrostatic submersible level transmitter with a cable (IP 68) for level measurement in water and waste water (pumping stations, basements, concrete bunkers, etc.). But also for level applications on pulp, slurry, ballast tanks, etc. the *Hydrobar "I"* can be used. Zero and Span are adjustable by means of the HART ® protocol (via HHT or PC). With the software the engineering unit and the electronic damping can be adjusted. ***For further description of the software go to page 7 till 11.***

The active temperature compensation on the *Hydrobar "I"* in combination with the very strong (laser welded) diaphragm (AISI 316 L) results in a perfect long term stability.
The compact electronics are mounted in a "Stainless Steel" body which is fixed to the cable. The whole part can be submersed (IP 68) and the transmitter can be installed on the requested height by means of a cable hanger (extra price).

1.2 BAROMETRIC REFERENCE

The *Hydrobar "I"* is in basic a so-called "relative transmitter" which means that barometric changes will not affect the zero (4 mA). The venting tube in the center of the cable makes the reference to atmospheric pressure. This venting at the end of the cable must be placed in an ***absolute dry area*** to prevent moisture coming into the transmitter.

A special junction box can be delivered as an option. This junction box has a protection grade of IP 66 and has a special venting nipple. This venting must be kept clean.
Dimensions: 80 x 75 x 76.
As standard there are two M20 cable glands available.

1.3 WIRING (HYDROBAR " I")

Black wire = **–**
Red wire = **+**

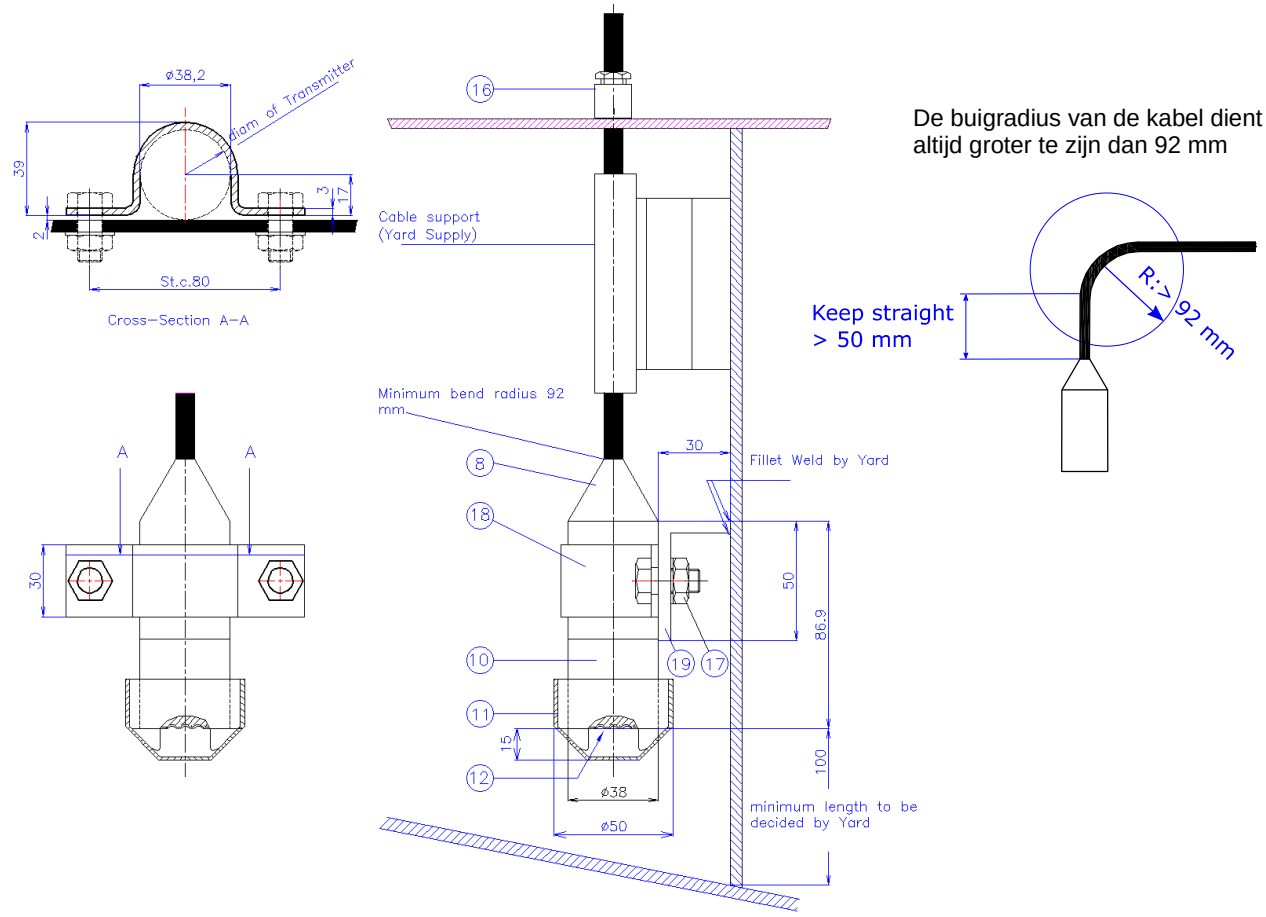
The transmitter must be connected with standard two-wire shielded cable. Do ***NOT*** run signal wiring in open trays with power wiring, or near "heavy" electrical equipment (E.g. Frequency controllers or heavy pumps). Shielding must always be connected at the side of the power supply. **The instrument always needs to be connected to ground. The transmitters must be connected to earth.**
Please ensure that the instrument is not connected to ground twice to prevent the occurrence of an 'earth loop'.

Reversing the polarity will not damage the transmitter, but the transmitter will not function until the **+** and **–** are properly connected.

1.4 MARINE APPLICATIONS

When the Hydrobar "I" is applied in the ship building industry (for example inside ballast tanks or mud tanks) it is strongly recommended to fix the sensor part (transducer part) onto the tank wall (according to the drawing below). To do this in a proper way a separate mounting bracket is available: position 18: drawing number: 8160, article number 10744) for an extra price. This bracket needs to be mounted on an angle steel (position 19 yard supply) and should be mounted with 2x M8 bolts + screw and washer. These are a part of the delivery from the bracket.

The bracket is designed in such a way that there is always a good contact between the sensor foot of the Hydrobar "I" (position 10) and the bracket (position 18). When doing this there is always a good earthing (grounding) from the Hydrobar "I" to the tank wall. When the Hydrobar "I" is mounted in this way, the signal wire does **not** need to be earthed. Always make sure that the instrument is not connected to earth twice to prevent the occurrence of an 'earth loop'.



ITEM	QUANTITY	DESCRIPTION	MATERIAL
8	1	Connection to cable (IP68) bottom part	AISI 316 L
10	1	Foot with pressure sensor inside	AISI 316 L
11	1	Diaphragm protection cap	PE or POM
12	1	Diaphragm *	AISI 316 L
16	1	Cable gland (Optionally extra price or Yard supply)	
17	2	M8 bolts, screw and washers	AISI 316 L
18	1	Mounting bracket for sensor foot	AISI 316 L
19	1	Angle steel (Optionally extra price or Yard supply)	AISI 316 L

For ballast water level applications, we strongly recommend to apply a **Titanium diaphragm and body (Option G191, extra price) or a Gold plated diaphragm (Option G16, extra price).*

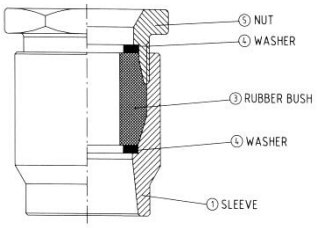
BULKHEAD PENETRATION GLAND – SERIES 1000

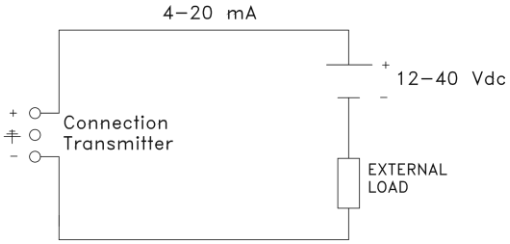
For marine applications a Bulkhead Penetration gland (⑯ - Page 4) can be delivered as an option. The Gland enables cables to pass through bulkheads and decks without causing any leaks. The gland is **DNV-GL Type approved** and the Rubber Bushing is Oil and Sea water resistant. The outer sleeve, nut and washers are from AISI 316 (Other materials and dimensions on request).

Important notes before use:

- Before welding remove the Rubber Bush
- Always use **two** Washers.
- Maximum Torque of the Nut: **150 Nm**.

For more details: D/E/Bulkhead penetration gland/08-2014/01

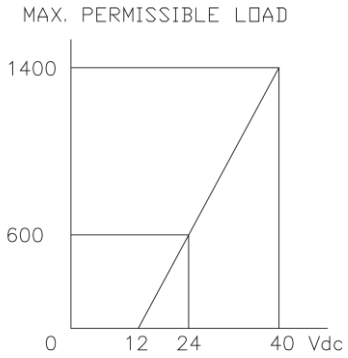




1.5 CALIBRATION

All transmitters are fully calibrated at the factory, to customer specified range. If calibration is not specified, the transmitter will be calibrated at the maximum span.
For calibration by using test pressure test nipples are available.

For "dry" calibration the software should be used which is included in the delivery (for explanation see page 4 till 8).



1.6 POWER SUPPLY / EXTERNAL LOAD

The minimum power supply is based on the total circuit resistance. The maximum permissible load (Ri max.) in case of 24 Vdc will be 600 Ohm. By increasing the power supply, the external load can be higher, till 1400 Ohm / 40 Vdc. (see figure left).

$$RI\ max. = \frac{\text{Power Supply - 12 Vdc (min. Power supply)}}{20\ mA}$$

Note: At 250 Ohm the power supply must be at least 17 Vdc.

2. INTRINSICALLY SAFE

The Hydrobar-I-Cable is certified for use in hazardous areas in category Ex-ia for **ATEX** and **IECEx** (option, extra price).

ATEX - II 1 G Ex ia IIC T4 Ga
Certificate : DEKRA 20ATEX0025 X, Issue No. 0

IECEx - Ex ia IIC T4 Ga
Certificate: DEK 14.0079 X, Issue No. 1

Use a certified power supply in an intrinsic safe area from: 13 - 26,5 Vdc.
Installation of this device has to be carried out by a qualified mechanic / installer.

Transmitter type and options	Equipment category	Temperature range
Pressure / Level Transmitter type	II 1 G	Ambient temperature range -20°C till +70°C Process temperature range -20°C till +70°C

Electrical data for Ex transmitters
Pressure / Level Transmitter Type Hydrobar-I-Cable: Supply/output circuit (terminals F1 '-' and F2 '+'): in type of protection intrinsic safety Ex ia IIC, only for connection to a certified intrinsically safe circuit, with the following maximum values: U_i = 26,5 Vdc; I_i = 110 mA; P_i = 0,9 W (linear source); L_i = 1,2 mH; C_i = 84 nF, including a maximum of 100 m cable, between terminals F1 F2 and shield.

Special Instructions for Safe use
As category 1G equipment may be applied directly in the process, electrostatic discharge from the cable and the protection cap of transmitter Series Hydrobar-I by the flow of non-conductive media (e.g. in stirring vessels or pipes) shall be avoid.

All certifications are in compliance with IECEx scheme rules, and the International Standards: EN IEC 60079-0:2018, EN 60079-7 :2015/ A1 :2018. The transmitters are certified for use in hazardous areas by DEKRA Certification.

2.1 FUNCTIONAL SAFETY – SIL

The device is certified as "Proven in use" for a functional safety environment according to IEC-61511 and to IEC-61508.

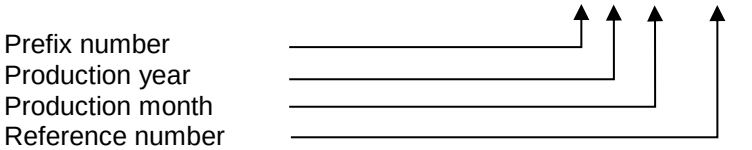
Note : Option SIL (Proven in use) is valid on transmitters with a serial number > 7309014, and only applicable with software version V9.17.

When ordered as a SIL (Proven in use) transmitter, the safety manual will be supplied. (Option G200). Detailed information can be found in the Safety manual of the instrument. The most recent version of the Safety manual is available on:
http://www.klay.nl under section "Downloads".

2.2 TRACEABILITY YEAR OF MANUFACTURING

The year of manufacturing of the transmitter can be traced as follows:
The first code (Prefix number) identifies the transmitter as a Hydrobar "I".
The second code from the serial number that is engraved in the transmitter is the year of manufacturing. For example: if the serial number is 6401001.The second code indicates 2004, the third codes indicates the month (2 positions) January and it was the first transmitter in this month (Reference number).

Serial number **6 4 01 001**

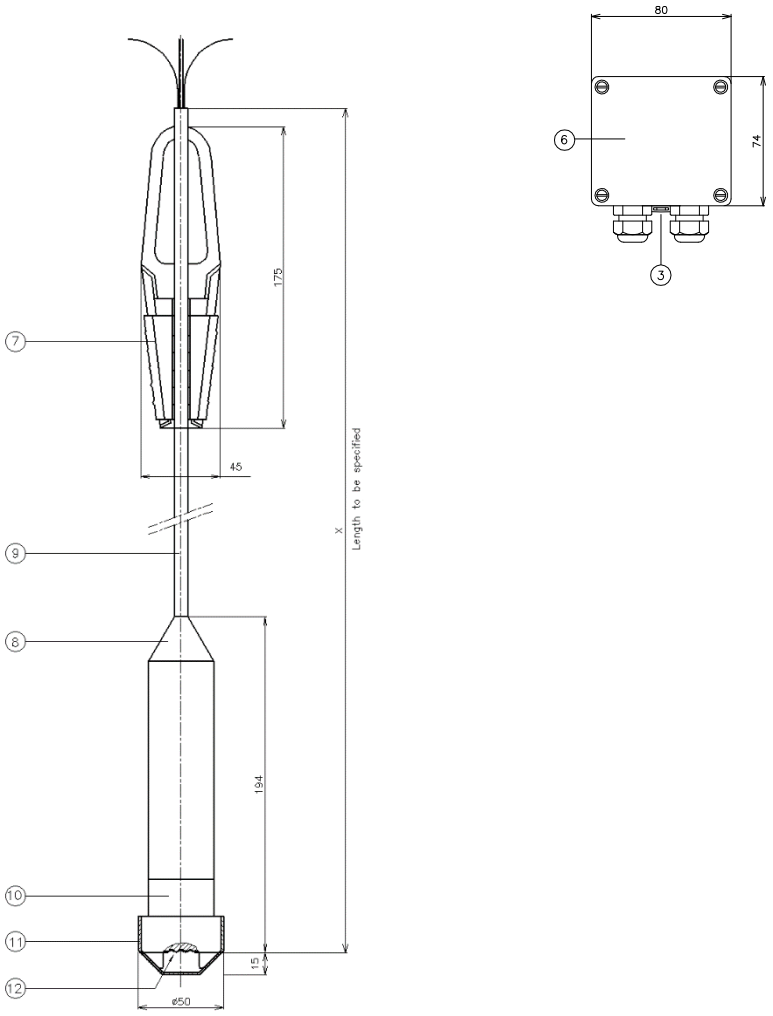


In case the prefix number is 7, 10 years must be added to the production year.
Example 2: Serial number 7309014, is produced in September 2013, and the 14th of the series.

"Intelligent Hydrostatic Submersible Level transmitter"

Type: Hydrobar "I"-Cable (..m)-range

Included Hart® Protocol



3. DESCRIPTION PARTS

Item	Quantity	Description	Material
3	1	Venting nipple (option, extra price)	PA
6	1	Connection box with venting (option, extra price)	PC
7	1	Cable Hanger (option, extra price)	304 and PE
8	1	Connection to cable	AISI 316
9	1	Cable with venting tube (diameter 10 mm)	PE
10	1	Foot with sensor	AISI 316
11	1	Diaphragm protection cap	PE
12	1	Diaphragm	AISI 316 L

The cable material (9) is Poly Ethylene (PE) with an outside diameter of 10 mm.
As standard the cable length (L) is 3 meters, however every cable length can be delivered on request and has to be specified in the ordering code (extra price above 3 meters).
The venting tube at the end of the cable must be placed in an ***absolute dry area*** to prevent moisture coming into the foot. This is extremely important. For a good venting a junction box (6) with a protection grade of IP 66 can be delivered on request (extra price). This connection box has a special venting nipple (3). A cable hanger (7) to mount the transmitter on every desired length can be delivered (extra price).

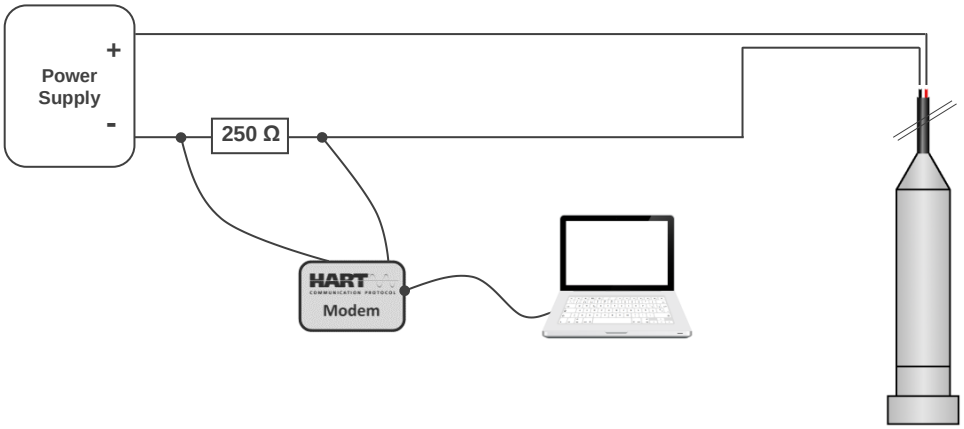
4. PROGRAMMING THE HYDROBAR "I" VIA THE PC

For programming the Hydrobar "I" on the PC a Hart modem must be used.
A resistance of at least 250 ohms must be placed in the 2-wire system. This is necessary for proper communication. If other devices in the circuit is incorporated with a resistance of 250 ohms or more, this is not necessary. Below the connection methods are shown.

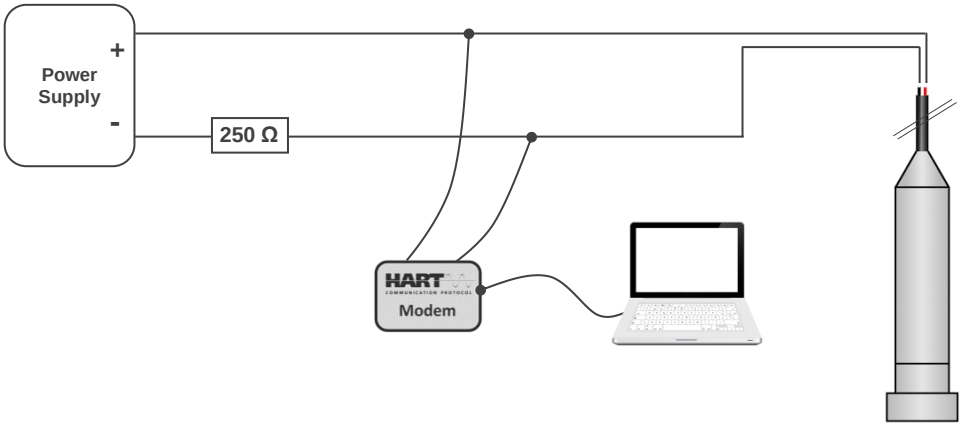
Advisements

- A Hand Held Terminal (HHT) of the "HART Foundation" or the HHT from "Rosemount" (type 275 Hart Communicator) can also be used for communicating with the Hydrobar-I. The connection method is similar as shown below.
- When a loop resistance of 250 Ω is used, a supply voltage of at least 17 Vdc must be connected.
- Below two connection methods are shown. Other connection methods can possible limit the function of the HART modem.

***Option 1**: HART ® Modem connected across the loop resistor.*

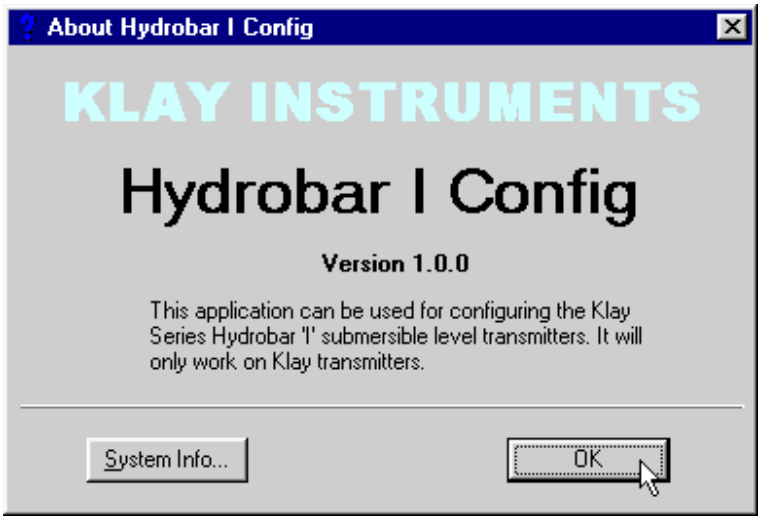


***Option 2**: HART ® Modem connected across the transmitter.*

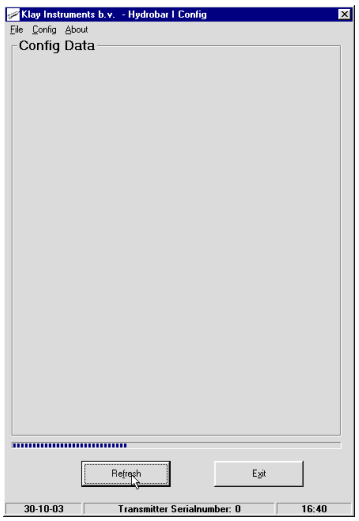


5. INSTALLATION OF THE SOFTWARE (is included in the shipment)

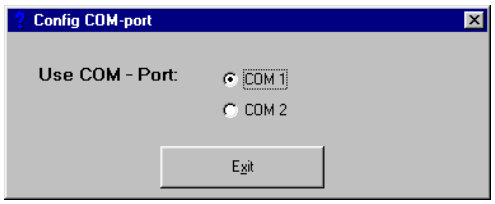
Run the "*setup.exe"* from the CD-ROM or the station where the software is stored.
After the setup in the directory programs an additional program called "*Hydrobar I config"* is visible. If you push this button the following window appears:



Push "*Ok"* to get the next window.

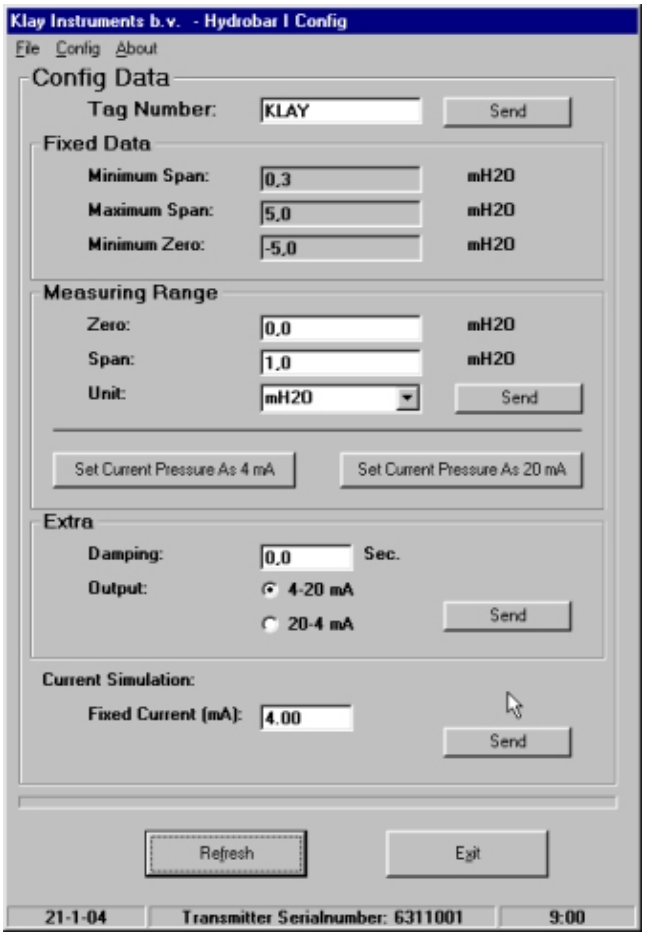


The software will automatically search for the Hydrobar "I" that is connected (can take a few seconds).
When the transmitter is not found you have to choose another COM-port.
Via Config (Com settings) you can do this (see window below).



If this also does ***not*** work, the connection between the modem and the computer or the connection between the modem and he Hydrobar "I" must be checked.
Push again Connect.

Now the next window appears:



All the settings from the transmitter will be shown.
The information in the white areas can be changed and must be confirmed with ***Send***.

Config Data:
Importing or Changing the Tag number. This can be figures and letters.

Fixed Data:
The maximum and minimum values from the span and the minimum value from the zero which can be programmed.

Measuring Range:
These are the actual values where the transmitter has been adjusted at.
Zero : the zero which equals 4 mA
Span : the span which equals 20 mA
Unit : the engineering unit which is used for the adjustments on zero and span.
If the *Unit* (engineering unit) is changed, automatically the values for the *zero* and the *span* will be converted to the new *Unit*. (see also the conversion table on the next page).

The values for the *zero* and *span* can be changed within the limits that are shown below ***Fixed Data.***

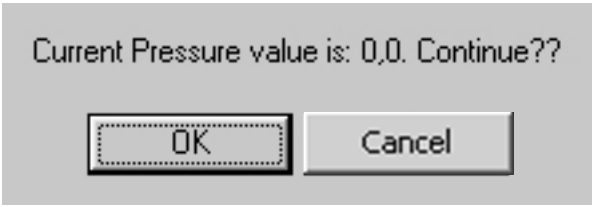
6. CONVERSION TABLE

CONVERSION FACTOR	DISPLAY
1.000	mH_2O (mWC)
1000	mmH_2O (mmWC)
0.09806	bar
98.0665	mbar
1.4223	psi
0.0967	atm
9.80665	kPa
0.009807	MPa
0.1	kgf/cm^2
73.556	mmHg
40.81633	inH_20 (inWC)
2.895906	inHg

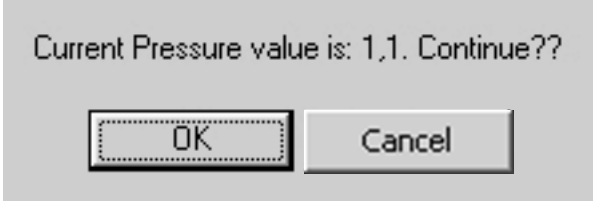
If the Hydrobar "I" has be adjusted by using test (air) pressure you have to use the buttons "*set current pressure at 4 mA*" and "*set current pressure at 20 mA".*

Set current pressure at 4 mA
The next window appears.
This is the value at 4 mA. In most cases this is the atmospheric pressure.
If the *zero* must be 0 barg (= atmospheric pressure) push *"OK"* .

After this has been done the main window will appear again (see page 6).



Set current pressure at 20 mA
The next window appears.
This is the value at (20 mA). If the *span* must be for example 1,1 barg you have to put test (air) pressure on the diaphragm equal to 1,1 barg. Now push *"OK"* .
After this has been done the main window will appear again.



7. EXTRA

Damping: Electronic damping can be adjusted from 0 till 25 seconds.

Output: The transmitter has an output of 4-20 mA as standard.
You can have a reversed output 20-4 mA.

Current Simulation: You can simulate the current between 4 and 20 mA.

Fixed Current (mA): Put the requested current value in the white area and push **<enter>** or ***Send***.

The output from the transmitter will now give the imported current.
To get another current output, you have to change the value and confirm with **<enter>.**

To quit the current simulation push ***Abort.***

Note
If the program has not been closed in a proper way, the current simulation remains active. To abort the simulation the transmitter must be switched off (disconnect the wires).

Error Messages
The next message appears if the *span* will be lower as the *minimum span* **or** if the *zero* will be lower than the *minimum zero.*

The next message appears if the requested *span* is higher as the m*aximum span.*

8. TECHNICAL SPECIFICATIONS

Manufacturer:	Klay Instruments B.V.		
Instrument:	Hydrobar "I"		
Output:	4-20 mA (+ HART ® Protocol)		
Power supply:	**Standard :** 12 – 36 Vdc **Ex :** 13 – 26,5 Vdc **HART ® :** 17 – 36 Vdc (Standard) *min. 250 Ω* 17 – 26,5 Vdc (Ex) *min. 250 Ω*		
Accuracy:	0,1% from the adjusted range		
Measuring Range: ***Hydrobar I***	*Code*	*Fixed Measuring Range(bar) Minimum / maximum*	*Max. over pressure (bar)*
	1	0 - 0,04 / 0 – 0,4	6,4
	2	0 - 0,12 / 0 – 1,2	10,5
	3	0 – 1 / 0 – 10	30
	4	0 - 5 / 0 – 30	100
	0	0 - 0,4 / 0 – 4	16
Process temperature	-20° C tot + 70° C (-4° F tot + 158° F)		
Temperature effect:	0,01% / K		
Ambient temperature:	-20° C tot +70° C (-4° F tot + 158° F)		
Damping:	0,5 till 25 seconds (free adjustable) Factory setting: 0,5 second		
Protection grade	IP 68 (only the submersible parts) IP 65 (the venting tube at the end of the cable)		
Material wetted parts:	Foot and connection: AISI 316 Diaphragm: AISI 316 L Cable: Poly Ethylene (PE) Sealing between Cable and connection: Viton ***Other materials on request.*** ***Hasteloy C 276 diaphragm (Option G7, extra price).*** ***Gold plated diaphragm (Option G16, extra price).*** ***Titanium diaphragm and body (Option G191, extra price).***		

Technical specifications can change without notice.

9. ADVISEMENTS and WARNINGS

We herewith give a list of some advisements and warnings concerning the application and installation of the electronic level transmitters, the Hydrobar "I":

* ***Check if the specifications of the Hydrobar "I" meet the needs of the process conditions.***

* ***To achieve the most accurate measurement with the Hydrobar "I", be aware of the place where the transmitter is mounted. Here are some advises:***

  1. ***Don't mount a level transmitter in- or near filling or discharging pipes.***
  2. ***In case of automatic cleaning systems or hand cleaning: never point the water jets on the diaphragm, take necessary steps to avoid this.***

     Warranty will not be granted if the diaphragm is damaged.

* ***The diaphragm of the Hydrobar "I" is protected with a special protection cab. Prevent damaging of the diaphragm. Warranty will not be granted.***

* ***The venting at the end of the cable must be placed in an absolute dry area to prevent moisture coming into the transmitter.***
  For a good venting a special junction box can be delivered as an option.
  This junction box has a protection grade of IP 66 and has a special venting nipple.
  Dimensions: 80 x 75 x 76.

* ***Avoid high pressure water-jets pointed at the venting.***

* ***<u>WARRANTY:</u> The warranty is 1 year after delivery date.***
  Klay Instruments B.V. does not accept liability for consequential damage of any kind due to use or misuse of the Hydrobar "I". Warranty will be given, to be decided by the manufacturer. Transmitter must be shipped free of charge to the factory.
  Klay Instruments B.V. is not an expert in the customer's process (technical field) and therefore does not warrant the suitability of its product for the application selected by the customer.

* ***Klay Instruments B.V. reserves the right to change its specifications at any time, without notice.***

* ***<u>CE / EMC - Rules</u>:***
  All Klay transmitters are manufactured in accordance with the RFI / EMC directives and comply with the CE standard. All transmitters are fitted with RFI filters, which provide optimum, trouble-free operation. Our products are in conformity with EMC-Directive 2014/30/EU based on test results using harmonized standards.

Manufactured by:

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Attachment: EU-Declaration of conformity

EU-DECLARATION OF CONFORMITY

KLAY-INSTRUMENTS

Klay Instruments B.V.

Nijverheidsweg 5, 7991 CZ Dwingeloo, The Netherlands

Certify that the equipment intended for use in potentially explosive atmospheres, only new products, indicated here after:

Electronic Pressure / Level Transmitter Series 2000, Series 2000-SAN, Series 2000-Cable, Series 2000-SAN-Cable, Series CER-2000 and Series 2000-Hydrobar-Cable, Series 2000-Hydrobar-EXTD, Hydrobar-I-Cable and Temperature Transmitter Series TT-2000.

Are in accordance with:

- Directive 2014/34/EU (Equipment and protective systems for use in potentially explosive atmospheres)
- Directive 2014/30/EU (Electro Magnetic Compatibility).
- Harmonized standards:
  - EN 60079-0: 2018 (General rules)
  - EN 60079-7: 2015/ A1:2018 (Equipment protection by increased safety ''e'')
  - EN 60079-11: 2012 (Equipment protection by intrinsic safety "i")
  - EN-ISO-IEC 80079-34: 2018 (Potentially explosive atmospheres – Application of quality systems)
  - EN 55032:2016
  - Lloyds Register Type Approval System and DNV Rules 2.4
  - E10 – Test Specification for type Approval (REV7) (only EMC tests)
  - IEC 61000-6-2: 2016 (EMC, Immunity in industrial location)
  - IEC 61000-6-3: 2006+AMD1:2010 (EMC, Immunity in industrial location)
  - IEC 61000-6-1: 2019 (EMC, Emission in industrial location)
  - IEC 61000-6-4: 2018 (EMC, Emission in industrial location)
  - IEC 61000-6-5: 2015 (zone 2) (EMC, Emission in industrial location)

- The type (protection mode Intrinsic Safety "ia", "ib" and Non-sparking "ec") which has been the subject of;
  EC-type Examination, Certificate Number: ATEX-DEKRA 20ATEX0025 X and ATEX-DEKRA 20ATEX0026 X. Delivered by the DEKRA, Meander 1051, 6825 MJ Arnhem, The Netherlands, Notified Body No. 0344
  Manufacturing plant in Dwingeloo which has been the subject of;
  Production Quality Assurance, Notification Number: DEKRA 12ATEXQ0041, Issue 4
  Delivered by the DEKRA, Meander 1051, 6825 MJ Arnhem, The Netherlands, Notified Body No. 0344

Date: May 25st , 2021. E. Timmer Managing Director – Klay Instruments B.V.	Signature:
The marking of the equipment for gas group for use in zone 0:	***II 1 G Ex ia IIC T4 Ga***
The marking of the equipment for dust group for use in zone 1:	***II 2 D Ex ib IIIC T100°C Db***
The marking of equipment for gas group for use in zone 2.	***II 3 G Ex ec IIC T4 Gc***

II	equipment for use in industries above ground (and not in mines endangered by firedamp).
1	equipment for use in Zone 0 (if G), Zone 20 (if D)
2	equipment for use in Zone 1 (if D), Zone 20 (if D)
3	equipment for use in Zone 2
G	equipment for use with gas, vapours or mists
D	equipment for use with dust
Ex	equipment in compliance with European standards for explosive atmospheres

Ia	equipment in compliance with specific building rules for intrinsically save
Ib	equipment equipment in compliance with specific building rules for intrinsically save equipment
ec	equipment in compliance with specific building rules for non-sparking save equipment
IIC	equipment for use with gas of subdivision C
IIIC	equipment for use in places with conductive dust.
T4	equipment whose surface temperature does not exceed 135°C with < 70°C Ambient temperature.
T100°C	maximum surface temperature of the equipment covered with a dust layer of 5 mm

Ingress Protection Grade, Series 2000, 2000-SAN, CER-2000: **IP 66**
Ingress Protection Grade, Series 2000-Hydrobar-Cable and 2000-Hydrobar-EXTD: **IP 66**
The Hydrobar-I-Cable and all other submersible parts from the Series 2000-Hydrobar, 2000-Cable and 2000-SAN-Cable are IP 68.
Furthermore, whatever the protection mode, only use cable glands with a protection degree of at least IP 66.
Be sure the cable diameter complies with the selected cable gland. Tighten the cable gland in a proper way.
Never forget to mount the covers of the electronics housings in a proper way.
For other technical details, refer to the instruction manuals of the transmitters.