KLAY-INSTRUMENTS

INSTRUCTION MANUAL

AquaCER with TTL OUTPUT

DESCRIPTION:
The AquaCER TTL is a hydrostatic pressure transmitter, with a capacitive ceramic sensor, and can withstand very high burst pressures. The applied pressure is converted by the intelligent electronics to a digital signal (a Binary code of zero's and ones). The transmitter has a very low power consumption (< 1 mA). This makes it particularly suitable for using in a data logger application with sleep and wake-up function on level measurements. The load of the internal battery of the data logger is therefore very minimal and resulting to a prolonged lifetime of the battery. The compact electronics are located in a fully stainless-steel housing (AISI 316).

The ceramic sensor is sealed with an O-Ring (Material: VITON ®). Other materials are available on request.

The standard cable length is 3 meters. Other lengths up to a maximum of 80 meters should be specified when ordering.

The AquaCER is delivered with a **F**ixed **R**ange. The AquaCER has an accuracy of 0.1 %.

The AquaCER TTL is unique in its kind. By making use of an interface and Klay software, the transmitter is fully adjustable.

WARNING:
Before installing the AquaCER, read the warnings and advises on the last page. For personal and system safety, and for optimum performance, make sure you thoroughly understand the contents before installing.

3.15

2.91

⌀0.31

⑧

Length to be specified

± 7.08

⑨

⑩

⑪ ⌀0.87

6.89

⑦

1.77
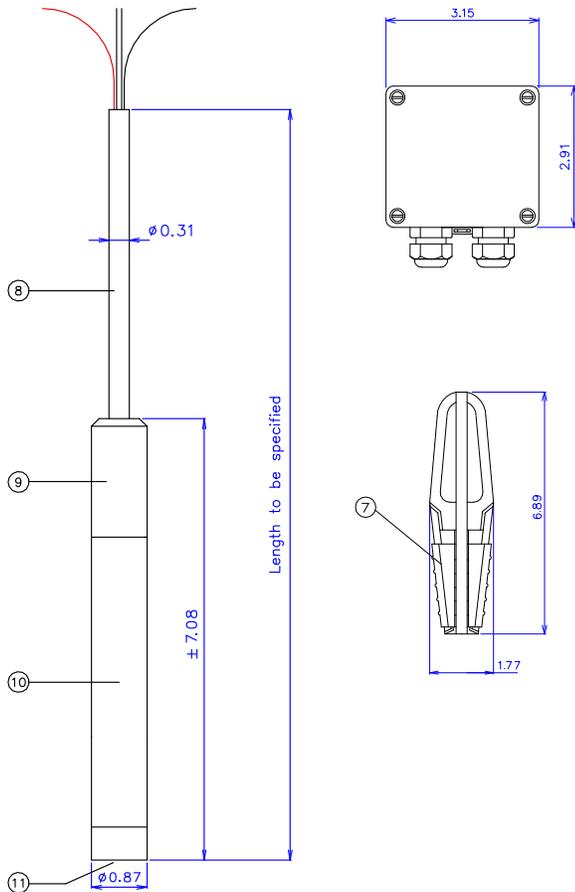
AquaCER-TTL (3 m)
If the (adjustment) interface of the transmitter is not going to be used then the adjustment of the transmitter must be specified during the ordering process. After delivery of the transmitter, the adjustments can only be changed by making use of the Klay software, and a USB interface.
We recommend the following interface:
TTL-232R-5V-WE = TTL 5V 75mA

Driver: Windows VCP driver 2.12.XX
http://www.ftdichip.com/Drivers/VCP.htm

The material ⑧ of the cable is Polyurethane (PUR) with a diameter of 8 mm. The standard cable length (L) is 3 meters, however any cable length is available (extra charge) and should be specified in the order code.

A clamp (cable hanger) ⑦ to install the transmitter at the desired height is available (extra charge). The clamp is made of stainless steel 304 and PA.

TEMPERATURE COMPENSATION
The temperature compensation of the AquaCER TTL is activated at a temperature change. We strongly recommend to wait 5 till 10 minutes after installation to check the output signal, related to the depth (measuring range) of the transmitter to have a good temperature compensation.

BAROMETRIC REFERENCE
The AquaCER TTL is a relative pressure sensor. The end of the cable must be placed in an absolute **dry** area to prevent moisture coming into the venting tube. **A special junction box with a protection degree of IP 66 is available (extra charge). Dimensions:** 3.15 x 2.95 x 3. **This junction box ⑥ is provided with a special venting nipple. Blockage of this venting nipple must be prevented. Standard two M20 cable glands are mounted on one side.**

The transmitter must always be grounded.
Please ensure that the instrument is not connected to ground twice to prevent the occurrence of an Earth loop.

TRACEBILITY/YEAR OF MANUFACTURING
The year of manufacturing of the transmitter can be traced as follows: take the first two numbers from the serial number that is engraved in the transmitter and add 1908. For example: if the serial number is 10509426. The year of manufacturing is 1908 + 105 = 2013.

Description
The AquaCER TTL is an AquaCER supplied with a serial TTL interface. Through this interface, digital communication is possible with a very low power consumption.

Table 1, Power supply and interface

	Standard	Max	Unit
Operating voltage	5	6.5	V DC
Power consumption	< 1.5		mA
Data transmission	Serial UART		
Transmission configuration	4800, 8, N, 1		
Refresh Interval	200	10000	ms
Startup Time	900		ms

Cable
Standard length: 3 meter

Table 2, Cable Connections

Number	Color	Function	Description
1	Blue	Rxd	Reception pin SERIEEL
2	Yellow	Txd	Send pin SERIEEL
3	Red	+5v	Pole +
4	Black	GND	Pole -
5	Green / Shielding	Ground / Shielding	Ground / Shielding

Green = Ground

Shielding
(example)
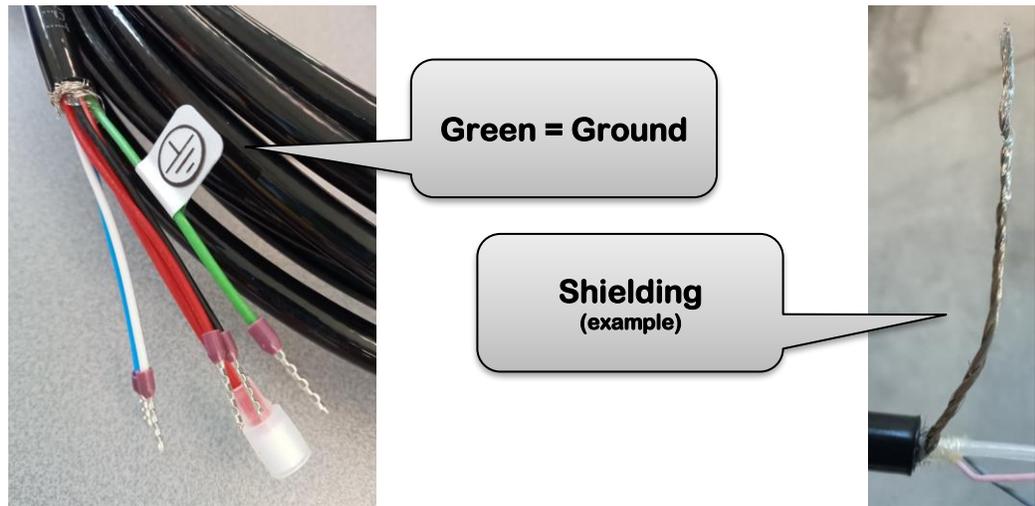
Transmission protocol

After the transmitters is connected to a power supply for the first time an initialization string is send. This string contains information about the pressure transmitter as it is seen in Table 3. After that the process data is send periodically. The process data is a pressure value that is normalized between 0 and 1. After 5 times a pressure value is send, a temperature value will be send. This cycle will be repeated 10 times. After this the transmitter is operating in normal mode. The temperature will be send every 30 seconds. See Table 4 for the structure of the process data.

Table 3, Initialization string

Byte No:	Name	Description	Data format
0	'I'	Start character	ASCII
1	'N'	Start character	ASCII
2 .. 5	SERIAL	Serial number	32 bits unsigned integer

6	MANUFACTURING_MONTH	Manufacturing month	8 bits unsigned integer
7	MANUFACTURING_YEAR	Manufacturing year	8 bits unsigned integer
8	TYPE	Instrument type	8 bits unsigned integer
9	ATTRIBUTE	Instrument attribute	Bit coded field
10..13	LSL	Lower sensor limit	32 bits float
14..17	USL	Upper sensor limit	32 bits float
18..21	ZERO	Customer adjust ZERO	32 bits float
22..25	SPAN	Customer adjust SPAN	32 bits float
26..27	LSS	Lower sensor stop	16 bits signed integer
28..29	USS	Upper sensor stop	16 bits signed integer
30	EMPTY	Reserved	8 bits
31	EMPTY	Reserved	8 bits
32	CRC	CRC check (Byte 2..31)	8 bits
33		Reserved	8 bits

Table 4, Process data

Byte No:	Name	Description	Data format
0..3	PROCESS_VALUE	Pressure / Temperature value	32 bits float
4	STATUS	Status field	Bit coded field
5	CRC	CRC check(Byte 0..4)	

Table 5, Status byte

Bit No:	Name	Description	
0	PRESSURE_HIGH	Pressure above measureable pressure range	Will be put back to 0 when the pressure is back in the valid range.
1	PRESSURE_LOW	Pressure below measureable pressure range	Will be put back to 0 when the pressure is back in the valid range.
2	TEMPERATURE_HIGH	Temperature above measureable Temperature range	Will be put back to 0 when the pressure is back in the valid range.
3	TEMPERATURE_LOW	Temperature below measureable Temperature range	Will be put back to 0 when the pressure is back in the valid range.
4	CRC_EEPROM	Fault in saved data	
5	EMPTY		
6	UNSTABLE	Measurement not stable	
7	TEMPERATURE	Measurement is a Temperature value	

Floating point format

The floating point format of the value in the initialization string and the process data deviates from the "binary-32" described in the IEEE-754. The content of the data is shown in Table 6. To calculate the value, the following formula can be used:

$$\text{FLOAT} = (1-2*S) * (1+M*2+^{-23}) * 2^{(E - 0x7f)}$$

Table 6, Floating point format

Byte No:	Name	Description	Data format
31..25	E	Exponent	E – 0x7f

24	S	Sign	(1-2*S)
22..0	M	Mantissa	$(1+M*2+^{-23})$

CRC Calculation

To check the integrity of the transmitted data, a CRC check is send with each message. The value of the CRC check is calculated on the basis of Table 7. Below is an example of code for the calculation of the CRC check.

```
// CRC calculation for a message with length "N"
crcValue = 0;
for (i = 0; i < n; ++i) {
        crcValue = crcTabel[crcValue] ^ dataByte[i];
}
```

Table 7, CRC table

	0x0	0x1	0x2	0x3	0x4	0x5	0x6	0x7
	0x8	0x9	0xA	0xB	0xC	0xD	0xE	0xF
0x00	0x00	0x9b	0xad	0x36	0xc1	0x5a	0x6c	0xf7
0x08	0x19	0x82	0xb4	0x2f	0xd8	0x43	0x75	0xee
0x10	0x32	0xa9	0x9f	0x04	0xf3	0x68	0x5e	0xc5
0x18	0x2b	0xb0	0x86	0x1d	0xea	0x71	0x47	0xdc
0x20	0x64	0xff	0xc9	0x52	0xa5	0x3e	0x08	0x93
0x28	0x7d	0xe6	0xd0	0x4b	0xbc	0x27	0x11	0x8a
0x30	0x56	0xcd	0xfb	0x60	0x97	0x0c	0x3a	0xa1
0x38	0x4f	0xd4	0xe2	0x79	0x8e	0x15	0x23	0xb8
0x40	0xc8	0x53	0x65	0xfe	0x09	0x92	0xa4	0x3f
0x48	0xd1	0x4a	0x7c	0xe7	0x10	0x8b	0xbd	0x26
0x50	0xfa	0x61	0x57	0xcc	0x3b	0xa0	0x96	0x0d
0x58	0xe3	0x78	0x4e	0xd5	0x22	0xb9	0x8f	0x14
0x60	0xac	0x37	0x01	0x9a	0x6d	0xf6	0xc0	0x5b
0x68	0xb5	0x2e	0x18	0x83	0x74	0xef	0xd9	0x42
0x70	0x9e	0x05	0x33	0xa8	0x5f	0xc4	0xf2	0x69
0x78	0x87	0x1c	0x2a	0xb1	0x46	0xdd	0xeb	0x70
0x80	0x0b	0x90	0xa6	0x3d	0xca	0x51	0x67	0xfc
0x88	0x12	0x89	0xbf	0x24	0xd3	0x48	0x7e	0xe5
0x90	0x39	0xa2	0x94	0x0f	0xf8	0x63	0x55	0xce
0x98	0x20	0xbb	0x8d	0x16	0xe1	0x7a	0x4c	0xd7
0xA0	0x6f	0xf4	0xc2	0x59	0xae	0x35	0x03	0x98
0xA8	0x76	0xed	0xdb	0x40	0xb7	0x2c	0x1a	0x81
0xB0	0x5d	0xc6	0xf0	0x6b	0x9c	0x07	0x31	0xaa
0xB8	0x44	0xdf	0xe9	0x72	0x85	0x1e	0x28	0xb3
0xC0	0xc3	0x58	0x6e	0xf5	0x02	0x99	0xaf	0x34
0xC8	0xda	0x41	0x77	0xec	0x1b	0x80	0xb6	0x2d
0xD0	0xf1	0x6a	0x5c	0xc7	0x30	0xab	0x9d	0x06
0xD8	0xe8	0x73	0x45	0xde	0x29	0xb2	0x84	0x1f

0xE0	0xa7	0x3c	0x0a	0x91	0x66	0xfd	0xcb	0x50
0xE8	0xbe	0x25	0x13	0x88	0x7f	0xe4	0xd2	0x49
0xF0	0x95	0x0e	0x38	0xa3	0x54	0xcf	0xf9	0x62
0xF8	0x8c	0x17	0x21	0xba	0x4d	0xd6	0xe0	0x7b

Software installation

Software requirements
Windows XP or higher.

Installation
The installation consists of two parts, the software installation and the installation of the driver for the USB cable.

Installation software
Run the setup.exe file and follow the installation wizard.

Installation driver USB cable
The driver for the USB cable is a Virtual Comport driver, the driver will be a installed in two stages. First, the driver for the USB to serial converter must be installed, then the driver for the COM port emulator.

The most recent version is downloadable on:
http://www.ftdichip.com/Drivers/VCP.htm

Installation guide:
http://www.ftdichip.com/Support/Documents/InstallGuides.htm

Troubleshooting "Microsoft BallPoint Mouse"
The FTDI driver is sometimes seen by Windows XP as a Microsoft Ballpoint Mouse. Usually this occurs when the instrument is connected to the USB port when the PC is booted. If this occurs, the communication with the device is not working properly, all communication is seen by Windows as a mouse so that the cursor can jump on the screen. The solution is to turn off the mouse on the same serial port.

In Windows, open the Device Manager window. Click with the right mouse button on "My Computer". From the menu that appears, select "Properties". In the new window, select the "Hardware" tab, and finally click on "Device Manager".

A window appears on the screen with a list of all devices in your computer. Click on "Mouse" to see all installed mice. Click with the right mouse button on the "Microsoft Serial Ballpoint" and select "Properties". At the bottom of the new window, you can disable it by selecting "Disable in the current profile". Click OK and close all windows. The next time you connect the module, it may be that a "Microsoft Serial Ballpoint" is recognized, but windows will not use it as a "mouse".

Program Operations
After the software and driver are installed the transmitter can be connected to the computer.

After starting the program AquaCER_ttl.exe is an information screen will be appear. In this screen the revision of the software will be shown.

In the next screen, the connection with transmitter can be made. The transmitter must be connected to the computer using the USB cable. When the driver is installed properly the mode "automatic" is recommended. All virtual COM-Port devices will be shown in the dropdown list.

If the cable is inserted after the program is started, click on the "Refresh list" button. The computer will discover the inserted cable.

When the program cannot find any USB cable, you can use the mode "Manual".
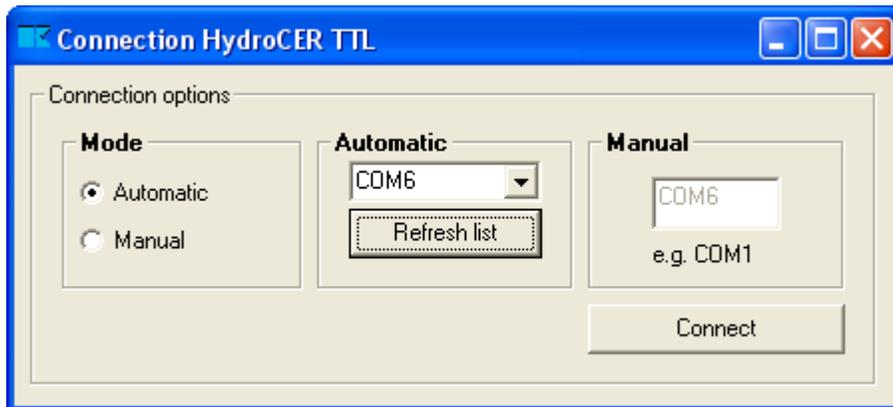
When the correct serial port is selected, click on the button "Connect" to start the serial connection. The following screen appears:
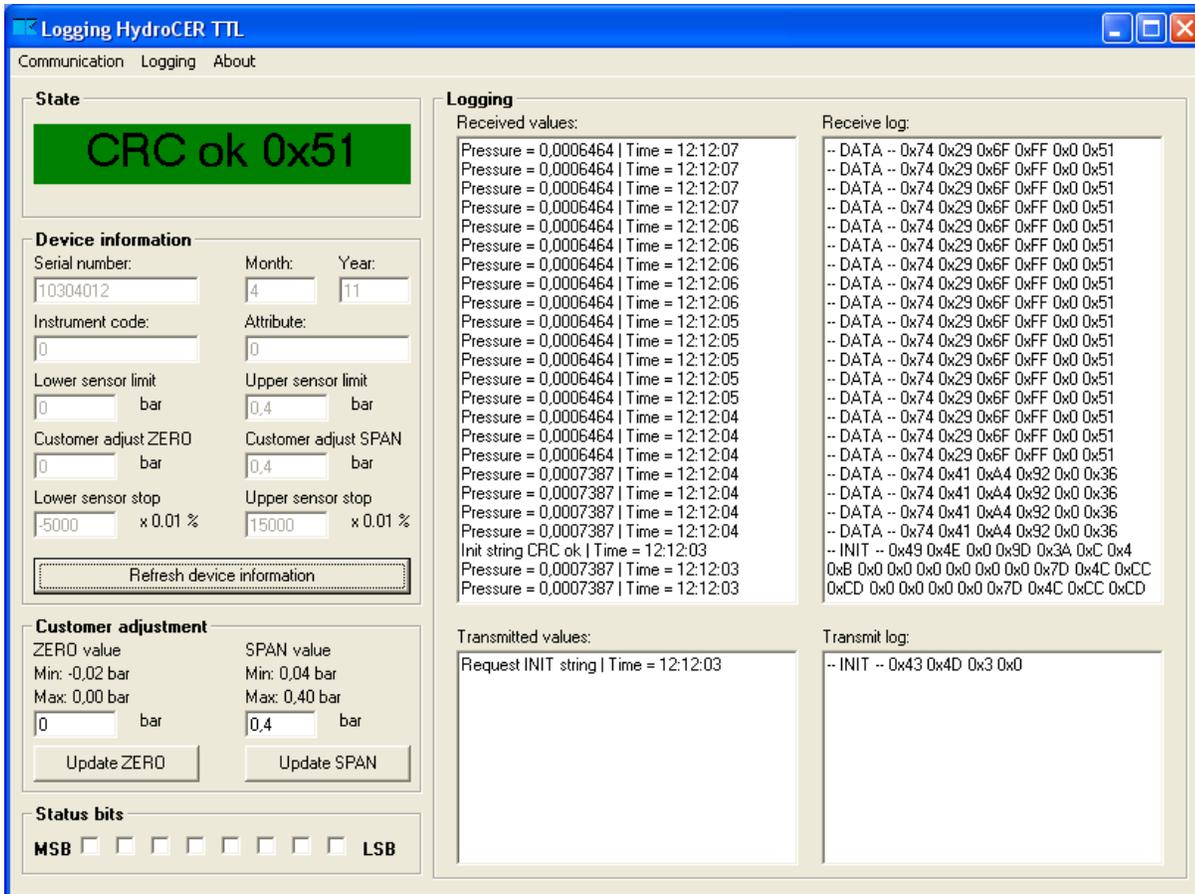
Field Descriptions

Device information

This contains all the information that is sent in the INIT string. Click on "Refresh device information" button to request the INIT string again.

Customer adjustment

This contains two fields that can be adjusted by the user. This is done by entering the referred value's in these two fields. Click on "Update ZERO" and "Update SPAN" when a new value is entered. After a change, the limits for the ZERO and SPAN are updated.

Update ZERO

This button sends the new value for the ZERO setting. The possible new values are listed behind "Min" and "Max". When changing the SPAN setting these limits are adjusted.

Update SPAN

This button sends the new value for the SPAN setting. The possible new values are listed after "Min" and "Max". When changing the ZERO setting these limits are adjusted.

Status bits

If a bit of the status field is high, the corresponding checkbox is checked.

Bit No:	Name	Description	
0 LSB	PRESSURE_HIGH	Pressure above measureable pressure range	Will be put back to 0 when the pressure comes back in the valid range.
1	PRESSURE_LOW	Pressure below measureable pressure range	Will be put back to 0 when the pressure comes back in the valid range.
2	TEMPERATURE_HIGH	Temperature above measureable Temperature range	Will be put back to 0 when the pressure comes back in the valid range.
3	TEMPERATURE_LOW	Temperature below measureable Temperature range	Will be put back to 0 when the pressure comes back in the valid range.
4	CRC_EEPROM	Fault in saved data	
5	EMPTY		
6	UNSTABLE	Measurement not stable	
7 MSB	TEMPERATURE	Measurement is a Temperature value	

Logging

Within the "Logging" frame four different fields are displayed:
- Receive values: Received values + time
- Receive log: Received values in hexadecimal code displayed
- Transmit values: Send messages + time
- Transmit log: Send messages in hexadecimal code displayed

Menu's

Communication-> Connect

This menu will show the connect menu again.

Communication-> Disconnect

After clicking on this menu a conformation screen appears on the screen confirming if you would like to disconnect the serial connection with the transmitter. Choose "Yes" to disconnect or "No" to continue the serial connection.
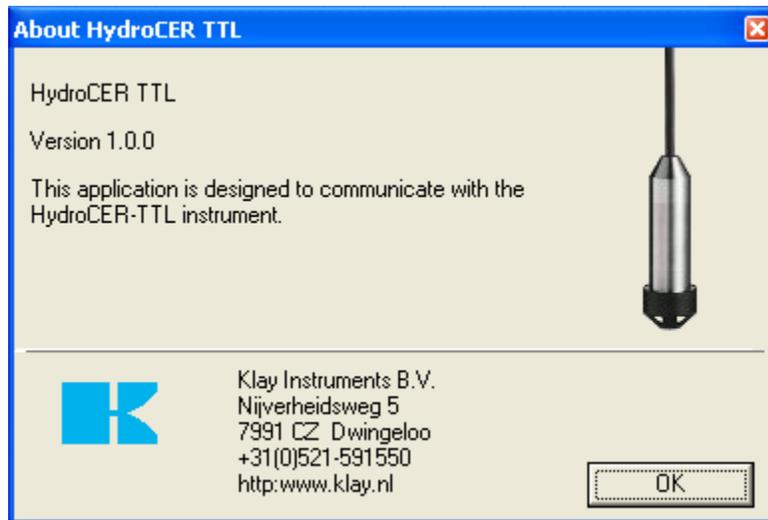
Logging-> Clear logging
Within this menu the saved logging data can be erased. This will clear all the data as shown in the frame "Logging"
Before erasing a conformation screen will ask to confirm your choice.

About
This menu shows information about the application and the contact information of Klay instruments B.V..

PRECAUTIONS AND WARNINGS

Below is a list of some recommendations concerning the application and installation of the electronic level transmitter, the AquaCER TTL:

- **Check if the specification of the AquaCER TTL meet the process conditions.**

- **To achieve the most accurate measurement with the AquaCER TTL, 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.**

⚠ **Prevent damage to the diaphragm. Guarantee will not be granted.**
Damage to the gasket is not covered under warranty.

- **WARRANTY: The warranty is 1 year after delivery.**
  Klay Instruments does not accept liability for consequential damage of any kind due to use or miss use of the AquaCER TTL. Warranty will be given, to be decided by the manufacturer. The transmitter must be shipped free of charge to the factory on manufacturer's authorization.

- <u>**NOTE:**</u> **Klay Instruments reserves the right to change its specifications at any time, without notice. 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.**

<u>**OPTIONS:**</u>
- **Robust cable clamp (Stainless steel and PA).**
- **A special junction box with a protection rating of IP 66 is available:**
  Dimensions: 3.15 x 2.95 x 3.

<u>**CE/EMC Rules:**</u>
All our transmitters are manufactured according to the CE-Rules. All transmitters are standard equipped with RFI filters. The influence on Radio Frequency Interference between 10 MHz to 10 GHz is neglect able.