VAKI®

MSD Animal Health Intelligence

Pico Counter

Manual

Waste management
Sort and recycle electronics and batteries to reduce waste and conserve resources. Many electronics contain hazardous chemicals that must be handled appropriately, as well as precious metals that can be used again.

PREFACE

We at VAKI Aquaculture Systems thank you for choosing our Pico Range Counter designed for accurate, high speed counting of fry and smolt. The Pico Counters are easily deployed and maintain a high accuracy. The Pico Counter has all the benefits of the complete Macro Counter Range with remote online support, count reports and image recording for count validation. The Pico Counter can be used to count all non-transparent fish and has proven to be one of the best shrimp counters available.

The counter uses VAKI computer vision technology originally developed for counting fry, smolts and juvenile fish. The fish is pumped through a scanner with an imaging line scanning camera to grab a silhouette image of every single fish. The silhouettes are analyzed and used for counting and size estimation. The touch pad screen on the counter head is used to operate the counter. After each count an image file and a report file are saved. Files can be displayed on screen and transferred to a flash drive or internal network or the VAKI Cloud.

This manual will guide you through the setup, use and maintenance of the Pico Counter.

If you have questions or need help, please contact VAKI by:

e-mail **service@vaki.is**
or phone **+(354) 595 3000**

We wish you happy and productive counting with your VAKI Pico Counter.

Pico Range Counter features

The VAKI Pico Counters are designed for accurate, high speed counting of fry in 2,5”, 4” and 6” fullwater pipes. The Pico Counters are easily deployed and maintain high accuracy. The Pico Counter has all the benefits of the complete Macro Counter Range with remote online support, count reports and image recording for count validation. The Pico Counter is available for all non-transparent fish and has proven to be one of the best shrimp counters available.

	Pico 2.5"	Pico 4"	Pico 6"
Capacity at 1m/s (1g fish)	100.000 fish/hr @ 1g	160.000 fish/hr @ 1g	240.000 fish/hr @ 1g
Fish size	0,0003g - 3g	0,0003g - 10g	0,01g - 30g
Weight	45kg	50kg	85kg
Dimensions	70 x 50 x 130cm	70 x 50 x 130cm	70 x 50 x 130cm
Counting channel width	156mm	250mm	375mm
Counting channel height (water depth inside counter)	25mm	41mm	61mm
Power supply	110/220V	110/220V	110/220V

Table 1: Pico Counters in comparison

Warranty

VAKI Aquaculture Systems Ltd. offers a warranty for manufacturing defects that appear **within two (2) years from the date of delivery** from VAKI Iceland, on condition that the equipment has been assembled, used and maintained in accordance with the instructions for assembly and use. Changes affecting the start of this warranty, such as a delayed delivery, must be reported to VAKI immediately.

VAKI undertakes the repair of all defects that are due to faults in the design, materials used, or manufacture of the equipment. These defects will be fixed by repairing or replacing the faulty components. The customer may be required to return the complete unit or parts of it to the factory in Iceland for repair. VAKI accepts a corresponding warranty for original parts fitted by VAKI as replacements, for a period of one (1) year from the date supplied.

VAKI is ***not*** liable for defects resulting from:

- *incorrect assembly and use, or inadequate maintenance*
- *fitting of materials, components or devices by the user that are not supplied by VAKI*
- *changes made to the equipment by the user without the written consent of VAKI*
- *faulty or inadequate repairs carried out by the user*
- *normal wear and tear of the equipment*
- *faulty connection of electrical equipment*
- *faults caused by excessive voltage*
- *damage or stoppage due to immersion of the computer or camera in water*
- *damage to electrical supply cables*
- *any economic loss that may arise from production stoppage*

Any faults or defects in the equipment must be reported to VAKI in written form **as soon as possible**. The report must be sent within two (2) weeks from the expiration date of the warranty.

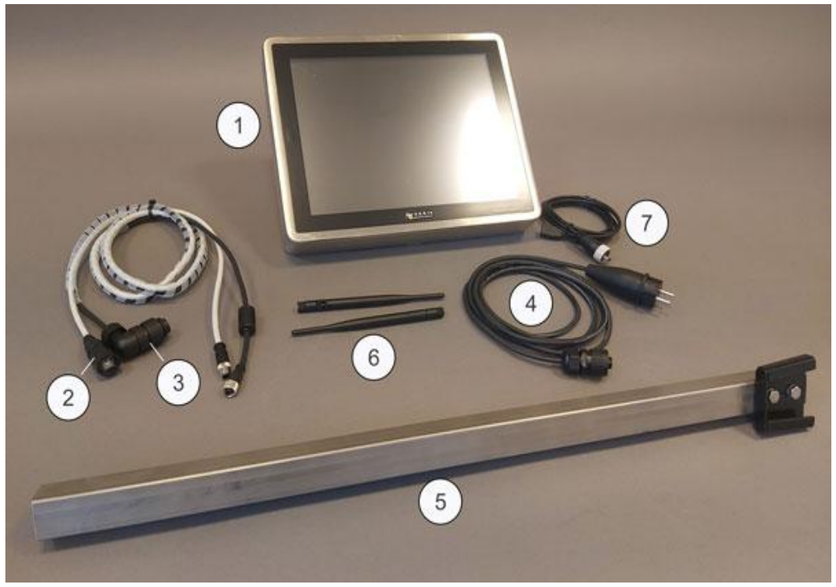
1 ASSEMBLY

The counter is fully assembled on delivery, the only thing to do is to attach the computer and connect all the cables. The 2.5", 4" and 6" counters all use the same type of computer and cables.

1.1 Counter parts and other equipment supplied

The following parts are included in the delivery:

1. Computer
2. Ethernet cable
3. DC Power cable
4. AC Power cable
5. Computer stand
6. 2xWIFI antenna
7. USB connector



1.2 Equipment setup

The counter should be placed on a flat and stable surface, in a location with minimal exposure to water and direct sunlight. Fasten the computer stand to the counter. Place the computer on the stand. Connect all the cables (the cables are designed in a manner that they can only be plugged in where they are supposed to be). Attach the antennas to the computer. Finally plug the counter in 110-230VAC. When the counter is plugged in the light inside the counter will turn on. Fully assembled the counter should look like it is presented here on the right.

Figure 1: Cables connected

2. The Software

The VAKI Pico Counter software has been in development for over 25 years and is running on Windows 10 ltcs. The counter operates by having the fish / shrimp pass through the counter over a light source in front of a high-resolution digital line scanning camera. The shape of the counter is designed to separate the fish / shrimp from one another for accurate counting. In the middle where the counter is the widest, the fish pass over the light source and a mirror above reflects silhouette images back to the camera. The VAKI software analyses and counts each individual. All of this is done in real time. The images are stored and can be used to validate and check the accuracy of the count later.

2.1 Starting the counter and the computer

To turn the counter on, press the button on the left side of the computer. The counting application is called Ori and it will start automatically. It takes about 1-2 minutes from turning on the computer to the system being ready to operate.

2.2 Main screen

The main screen of the program holds all the functions to operate the counter and displays counted fish, average weight and throughput. A graph shows the rate of fish going through the counter and the recommended maximum capacity. If the counter be overloaded a warning signal will appear.

2.2.1 Main buttons

1. **Flow last one minute** changes between "Total count" and the "Flow last X minutes" as it's pressed. The button is used to see the flow through the counter for the last 1-10 minutes (the number of minutes can be adjusted with the Up / Down arrow buttons to the right.
2. **START/STOP SESSION** button starts a new counting session, stops the current session and generates a report.
3. **Settings** opens the settings menu.
    a. When a counting session is running the Settings button will turn into a store button.
    b. **Store** stores the current values for the counting channel but does not clear the values. The stored values are shown in the counting report.
4. **Images** displays the recorded images from previous counting sessions.
    a. When a counting session is running the Image button will turn into a pause button.
    b. **Pause** lets you pause the session, for example if you need to clean the mirror during a counting session. **The counter should not be paused for extended periods, it is only meant for short time pausing.**
5. **Report** is used to review the count report from a previous counting session.
6. The counter needs to be run through a system check before each counting session by pressing the **Calibrate** button.
7. **Exit** closes the counting software.

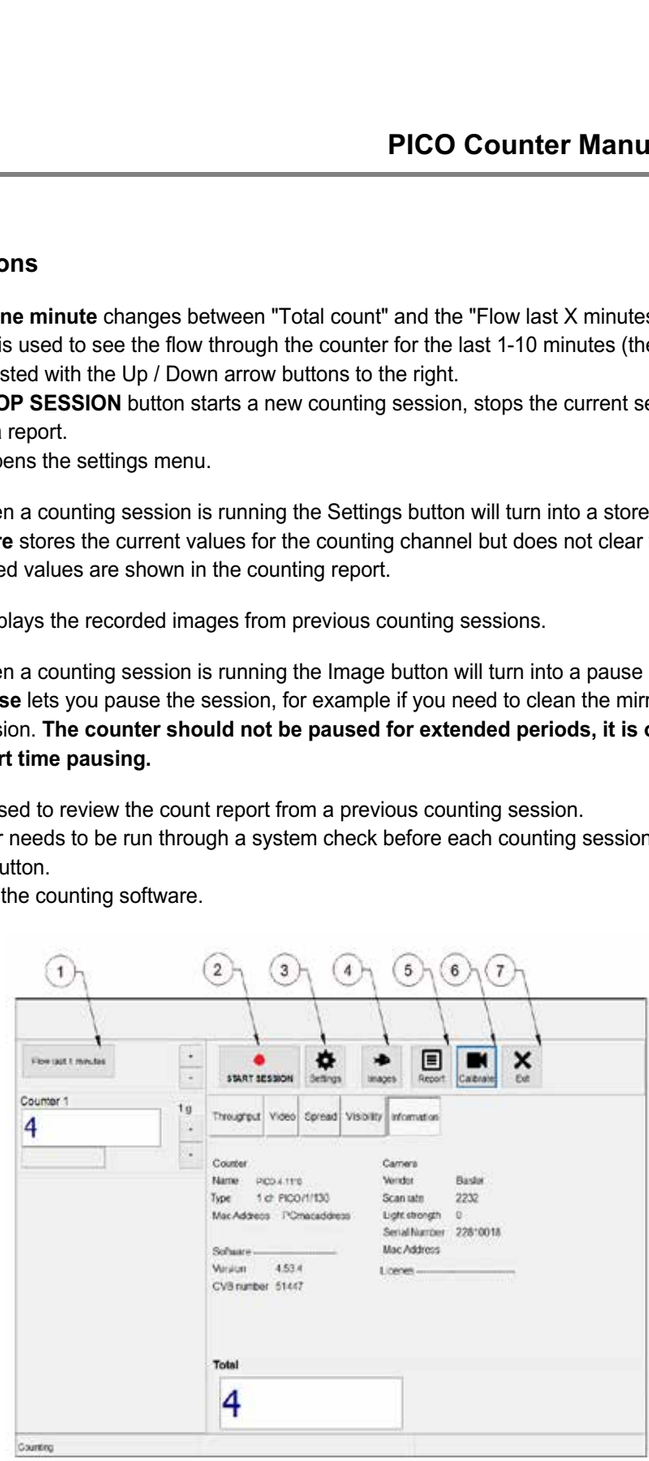


Figure 2: The main screen

2.2.2 Counting session controls

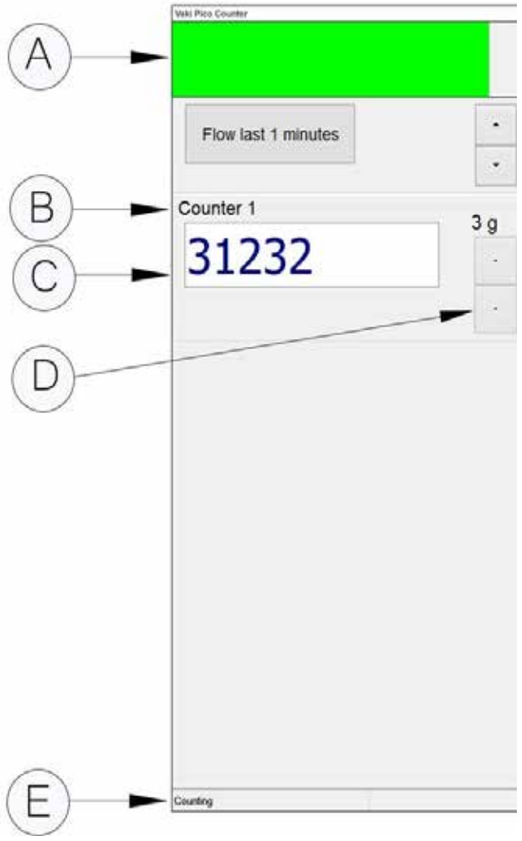
A. **Capacity indicator.** The bar will be green at 0-70% of maximum counting capacity, yellow at 70-100% and red at a load over 100%. The risk count accuracy decreases when the load is over 100%.

B. **Channel**. The name can be changed by pressing on the channel name, the on-screen keyboard will then appear.

C. **Total number of fish** counted. Double-clicking the field will clear the number to zero. The cleared number will be stored in the report.

D. **Weight adjustment buttons** to select the average size of the fish to be counted. Choose the weight closest to the expected average. Selected weight is displayed directly above the buttons.

E. **Counting/Not Counting** indicates the state of the counter. If this area is red, "Not counting" is displayed and there is an error message regarding visibility and / or calibration. See chapter Calibration and Visibility for more details.



2.2.3 Tabs

Different information about the counter can be accessed by the tabs in the main screen. Each view holds different information about the counter, and all of them assist in getting the best results out of the counter.

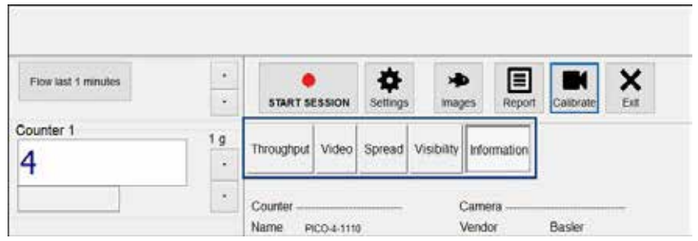


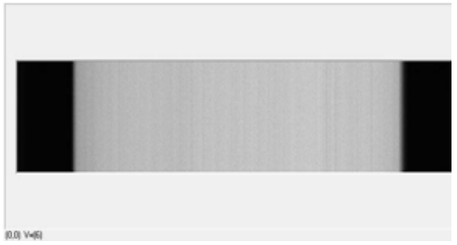
Figure 3: The main counters tabs and views

2.2.3.1 Throughput

Graph will show the number of fish per minute passing through the counter. The red line indicates the maximum capacity and the blue line shows the actual number of counted fish per minute.

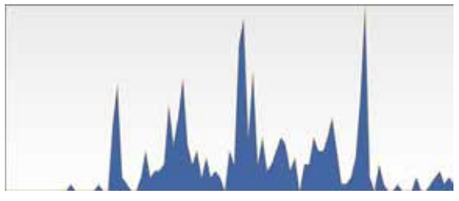
2.2.3.2 Video

Real-time display of the camera's video. This can be used to see fish passing through the counter, any impurities or bubbles in the water, or residue on the glass or mirrors.



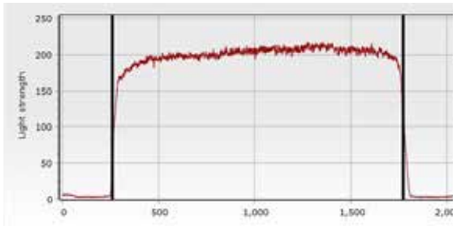
2.2.3.3 Spread

A graphical representation of where fish are passing through over the width of the counting channel.



2.2.3.4 Visibility

Represents the light intensity recorded by the camera. An optimal visibility curve is square shaped with a light intensity @ 200 or above.



2.2.3.5 Information

Technical information about the counter. In the information field, it is important to note the **Scan rate** – it shows how many scans the camera performs each second. This value should be ~ 2250.

2.2.4 Counter capacity

The maximum counter capacity is shown at any given moment on the throughput graph (Ref. 2.2.3.1). It is in direct relation to the fish size. The smaller the fish the higher the counting capacity. During counting the counter will note the average size of the fish going through and adjust the maximum capacity.

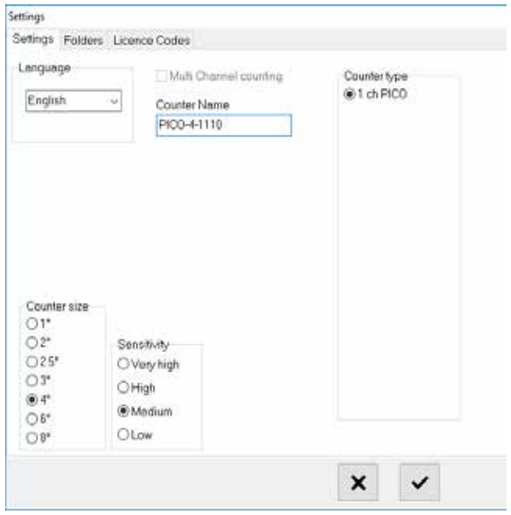
Figure 4: Counter capacity example

The capacity is an important factor for counting accurately. The capacity indicator at the top of the counter software will display a green progress bar. when counting below the maximum counter capacity. When the counter is reaching its upper limit, it will turn yellow and eventually red as represented in the figure. Continuing a count for extended periods at red capacity can result in a miscount. This will be discussed in more detail in the chapter **Getting the best results**.

2.2.5 Settings

In the “Settings” you can change the operating language, name of the counter and the sensitivity of the counter. The most important factor is the **sensitivity**. The sensitivity controls how sensitive the counter is to light. The more sensitive it is the more likely it is to see small and transparent objects, like juvenile eels and shrimp. The downside to a high sensitivity is that the counter is more likely to count bubbles and small debris in the water. To avoid this the operator has to be more careful when counting.

In the “**Folders**” tab the name of the operator/company and a logo can be set. This information is displayed on all reports generated by the counter.



3. PERFORMING A COUNT

When in operation the counter is always counting but will not record and store any data unless a counting session has been started. Before starting a counting session some things need to be addressed first.

3.1 Preparation

The counter should be on an even surface, try to make the counter level. Before starting a counting session, it is a good practice to make sure the counter is in a good condition. The glass in front of the camera and over the light should be clean. This can be checked by looking at the visibility curve (2.2.3.4 Visibility) and the video (2.2.3.2 Video).

If necessary, clean the counter and then make a system check, by pressing the calibrate button on the main screen. **It is important to calibrate without water in the counter**. The calibration resets the camera and checks visibility etc. While the calibration is in progress the counter will turn red and *"Not Counting"* will appear at the bottom left corner of the screen, this will change to *"Counting"* when the calibration is successful. It is helpful to review the visibility curve and the video while cleaning and calibrating.

Now all hoses can be connected to the counter and water can be pumped into the counter. While the counter is filling up with water the counter will count a lot of water droplets and bubbles. Before starting a counting session, continue to pump water on the size setting you plan to use to ensure the counter is not counting bubbles, debris or anything else. Keeping an eye on the video is very helpful here. If the counter is counting, it may help to increase the size settings and let the counter adjust a little. When the counter is not counting with only water going through then the counter is ready to start a new counting session.

3.2 Setting fish size

The size settings should be reviewed and adjusted before starting a new counting session. Using the size group buttons (D), set the size group closest to the average size you intend to count. Each size setting covers a range of fish approximately five times smaller and five times larger than the size setting. If a small size setting (like for very small fry) causes counting of air bubbles, water disturbance, or suspended particles, it is advisable to increase the size.

The size groups are as follows: 0.001g, 0.003g, 0.01g, 0.03g, 0.1g, 0.3g, 1g, 3g, 10g and 30g.

3.2 Starting a session

To start a counting session press *"New counting session"* and enter the session data. It is important to **use only letters and numbers** in the session description field. The session details will be reflected in the final counting report, which is generated when the counting session is ended. The counter should now be reset and show 0. At this stage the counter is ready to receive fish. It's a good practice to start off by moving a small amount of fish through the counter to make sure the counter is counting well. Steadily increase the amount of fish, while being careful not to overflow the counter. Here it is good to monitor the capacity and throughput.

3.3 Moving fish into the counter

Whether the fish are pumped or siphoned into the counter, it is important to have an even and steady flow of fish going through the counter within the counter's capacity limits and minimize any air bubbles or debris in the water to ensure accurate counting .

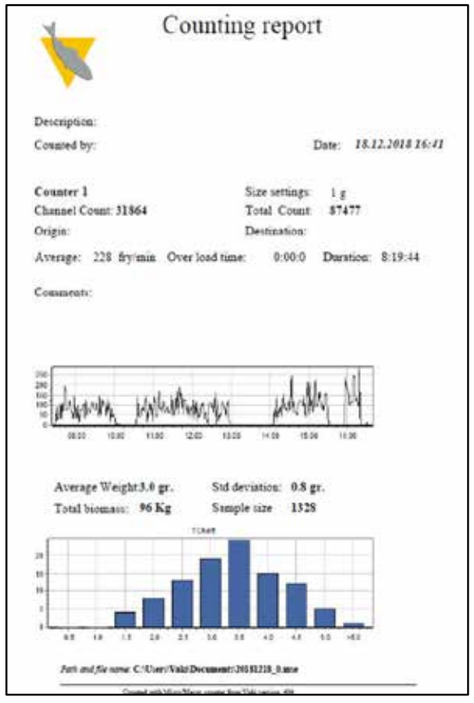
The most common ways of moving fish into the counter is via a syphoning or centrifugal pump. We recommend using the VAKI Syphoning System or the VAKI Fish Pump.

3.4 Ending a session

When all fish have been counted end the counting session by pressing the stop button. When the session is stopped the counter will close all data logs, move files and generate a report. Depending on the counting time this process may take several minutes. If the counter is connected to the internet and the **VAKI Cloud**, all the data from the count that was just performed will be automatically synchronized to the cloud. We highly recommend using the VAKI Cloud - see chapter 4.1 for more details.

4. REPORTS & RECORDS

For each count that is performed a count report is generated alongside image records of the counting session. The count report and image record can be used to review the counting session to evaluate count quality. If necessary, the image record can be used to recount a session. If the biomass measurement is activated, the report will also contain average weight, total biomass, standard deviation and a chart showing the size distribution.


Counting report

Description:

Counted by: Date: 18.12.2018 16:41

Counter 1 Size settings: 1 g
Channel Count: 31864 Total Count: 87477
Origin: Destination:
Average: 228 fry/min Over load time: 0:00:0 Duration: 8:19:44

Comments:

Average Weight:3.0 gr. Std deviation: 0.8 gr.
Total biomass: 96 Kg Sample size 1328

Figure 4: A sample report

4.1 VAKI Cloud

VAKI Cloud is a web application that provides the user with an overview of detailed information and data from a VAKI Counter. A copy of the data created by the counter is uploaded to a remote database. The VAKI Cloud web application gives authorized users and VAKI Customer Support technicians the ability to view this data from anywhere, at any time. The VAKI Cloud is an extremely valuable tool that is utilized by commercial fish farming operations worldwide. VAKI Cloud enables a new level of quality control and ease of use.

4.2 Reviewing the counting session

Press *"Images"* on the main screen to view records or images of previous counting sessions. These files have the same name as the report, date and description. Each image represents approximately one second of the recording.

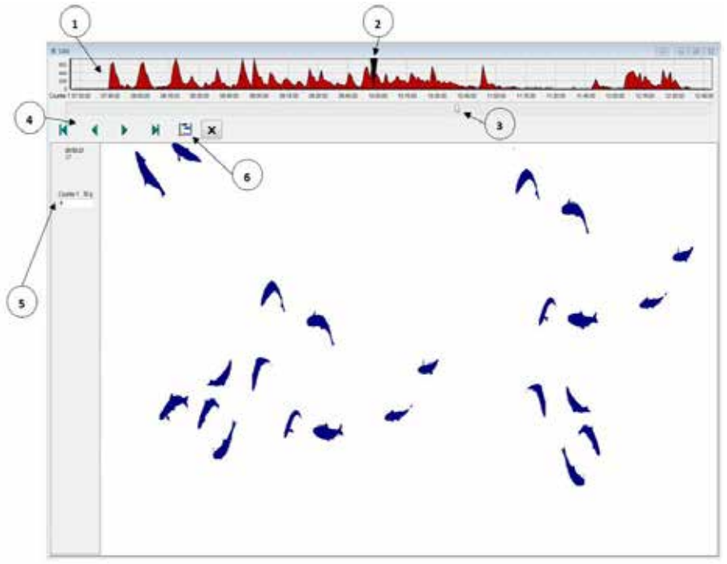
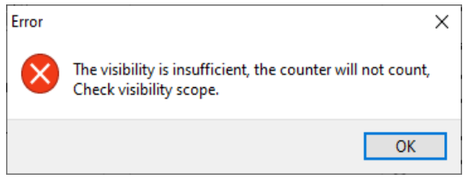


Figure 6: Counting session in review

1. The upper graph shows the fish flow through the counter,
2. The black pointer shows from where in the recording the images shown are being viewed.
3. The smaller pointer below the graph can be used to navigate to a point in the recording.
4. Navigation buttons:
   ◄ ► - the arrow buttons are used to move back/forward one step. The outer buttons with vertical lines are used to go directly to the beginning end of the record.
5. This field contains the name of the channel, the size setting and the number of fish shown in the image. Note that if ► is pressed, the number shown will be added to the previous screen number. If ◄ is pressed, the number displayed will reset to the current number of the current image. Partial fish images are counted in the next frame.
6. The START / END button is used to select a specific section of the count to be analyzed. The number of fish in a selected start and end point within the count can be recounted as follows:
   - Set the pointer (3) to the desired start time.
   - Press the START button (the button then changes to END).
   - Move the pointer (3) to the desired end time and press the END button.

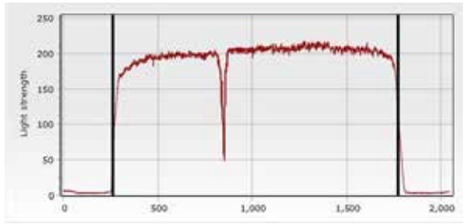
5. TROUBLESHOOTING

In this chapter usual problems are showcased with examples and possible solutions. The most common problem is with the camera visibility. If the visibility is insufficient the counter will appear red, not count and display the following error message.



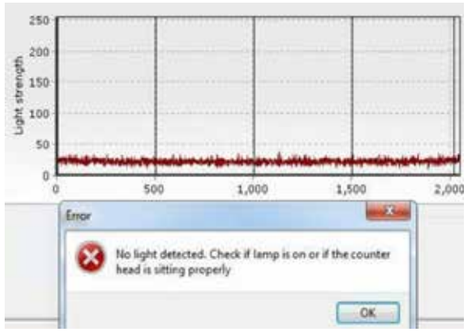
5.1 Visibility issues

The diagram on the right shows how the graph can look like if there are impurities on the glass located over the light source, and the brightness is somewhat low. It is reasonable to assume that there are impurities on the glass when there are abrupt falls in the brightness graph, possibly at the x-axis value between 750 and 850. In this case, it would be good to clean the glass and calibrate the counter.



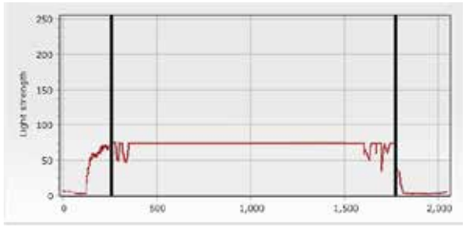
5.2 No light detected

To the right is an example of how the visibility graph may look if the light is not turned on or the camera is incorrectly mounted. In both cases service is needed and VAKI service technicians may need to be called in to adjust the camera or fix the light.



5.3 Aperture problems

If the aperture on the camera lens is too wide open, the visibility curve will resemble something like the image on the right. To fix this you need access to the camera. To gain access to the camera the panel on the counter must be removed. On the lens there are two calibration rings with screws holding the ring. The one closer to the camera is the focus and should be set to just above one (1). The second ring further from the camera controls the aperture and should be set to 16. These are just approximate settings - for fine tuning it is recommended to have VAKI service technicians on site or on the phone. Look for *"Light strength"* in the Information tab - it should be set to 1200 (± 100). If it is not, try moving the aperture in 1mm or less increments (recalibrate after each movement) until it is within that range.



5.4 Camera not connected

If the counter cannot find the camera an error message will be displayed which reads. **The Camera is not set up correctly.** The most common reason for this is that the camera cable is not connected or is loosely connected. The camera cable is shown as time 2 in chapter 1.1. If that does not resolve the issue, please contact VAKI Service Support.

Figure 7: Pico 4" open

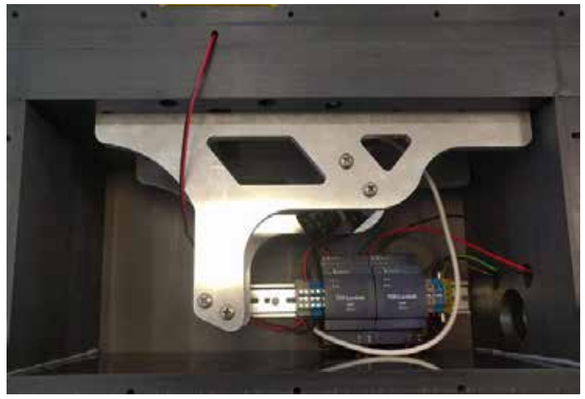


Figure 8: Pico 2" open

6. Examples of use

The Pico Counter is available for all non-transparent fish and has proven to be one of the best shrimp counters available. The Pico Counters have been successfully deployed to count small juveniles of lumpfish, salmonids, shrimp, eel and fish ova.

In most cases the counters are used to count when moving fish without having to dewater. It gives the farmer the ability to know the exact number of fish or shrimp in a tank when moving in various growth stages without having to dewater.

6.1 VAKI Syphoning System

The syphoning system consists of two **Priming Fixtures**, **Control Valve** and a **Priming Pump.** The Priming fixture is placed at the pipe's highest point (usually over the edge of a tank). When syphoning between two tanks, one Priming Fixture is placed on each tank. Once the system has been set up, the priming can start.

1. Keep the Control Valve open and connect the Priming Pump to the Upstream Priming fixture.
2. Start pumping and wait until the water level is higher than the Control Valve. Note that there should still be air in the Upstream Priming Fixture.
3. Once the water level is above the Control Valve, close the Control Valve and keep pumping.
4. Stop the pump once all air has been pumped out of the Upstream Priming Fixture.
5. Unplug the Priming pump, connect to the Downstream Priming Fixture and pump until all air is out of the system.
6. Once the Priming Pump has been unplugged, a counting session can be initiated on the Pico counter and the Control Valve can be opened to start the flow.

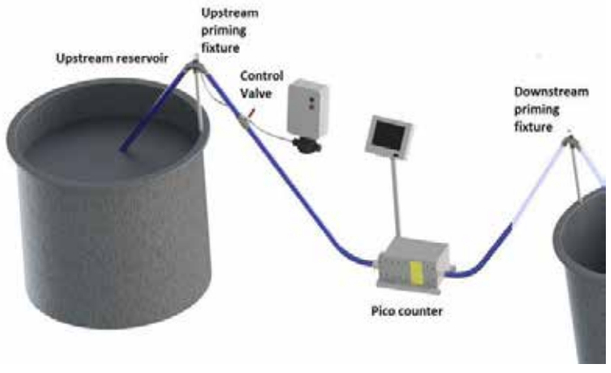


Figure 9: VAKI Syphoning System

6.2 Counting Shrimp

When using the Pico Counter to count shrimp the following should be observed.

1. The counter uses machine vision technology to identify each counted individual. Thus, it will function best in relatively clear water. Counting can become difficult when biofloc levels are too high. This is especially prudent when dealing with smaller sized shrimp.
2. Biofloc is usually the thickest at the bottom of the tank and can cause faulty counts at the end of an otherwise successful counting session. It is the best to keep an eye on the video feed of the counter. If the biofloc gets too thick it will become obvious on the screen. The count should be paused and resumed once the issue has been resolved. The relative biofloc level can be lowered by straining/filtering the biofloc away or diluting with water.
3. The counter is not very sensitive to changing water speed. A good goal for the flow is to be around 1 meter / 3 feet per second however the water flow should be fast enough so that individuals are not able to swim against the direction of the flow.

Figure 10: Transporting fish/shrimp with VAKI 6" Pump and 4" Pico Counter

6.3 Screenshots

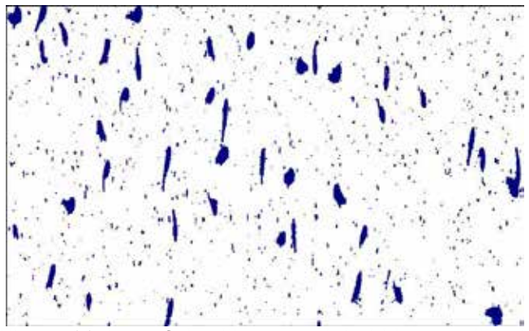


Figure 11: Lumpfish with some air bubbles, quality ok

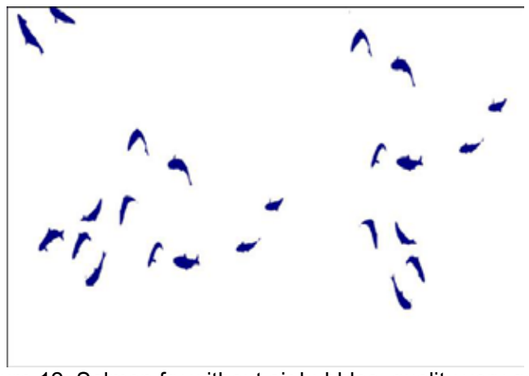


Figure 12: Salmon fry without air bubbles, quality very good

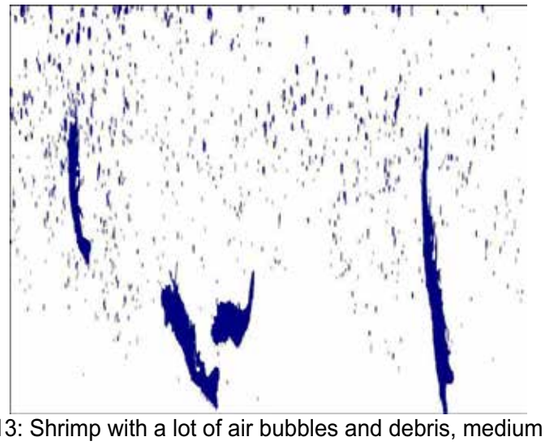


Figure 13: Shrimp with a lot of air bubbles and debris, medium quality

VAKI®

MSD Animal Health Intelligence

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