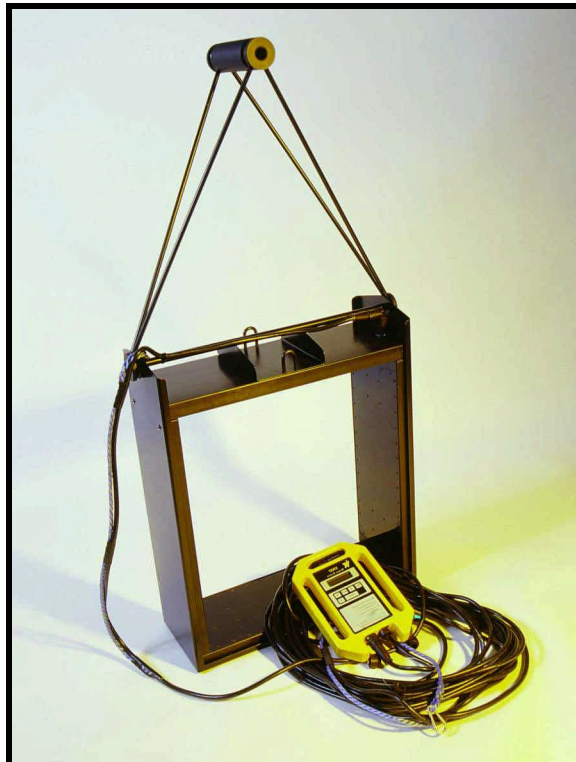


VAKI

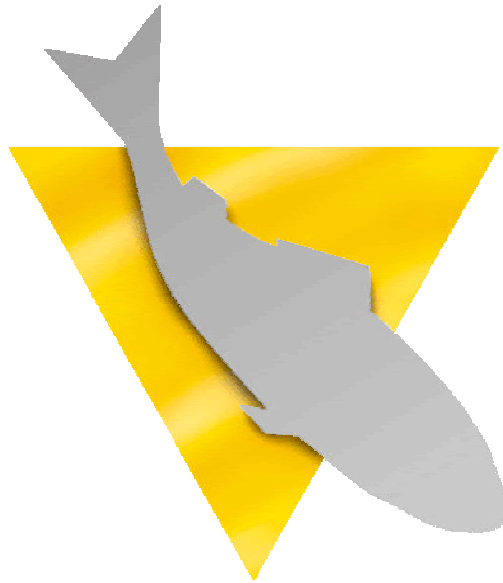
Biomass Counter

MANUAL



(ENGLISH)





Vaki Ltd.

Akralind 4
IS-201 Kopavogur
Iceland

Tel. + 354 - 595 3000

Fax. + 354 - 595 3001

e-mail: vaki@vaki.is

Internet: www.vaki.is

CONTENTS

CONTENTS	2
WARRANTY TERMS & CONDITIONS OF SUPPLY	3
LIST OF ITEMS	4
ADDITIONAL ITEMS IF REQUIRED	4
SET UP	5
1. PREFACE	6
2. BEFORE YOU START	7
2.1. CURRENTS AND TIDES	7
2.2. COMPARISON OF MEASUREMENTS	7
Loss of weight after feeding is stopped	7
Weight loss due to bleeding	7
Weight loss due to gutting (gutting drop)	8
Reject, Superior, Ordinary, Production, Sexual Maturity	8
When only some of the fish in a pen are harvested	8
2.3.EFFECT OF SAMPLE SIZE AND DISTRIBUTION	8
Large samples are needed for high accuracy	8
Effects of fish behavior on the weight results	9
2.4. PRACTICAL TIPS	9
3. USING THE SBC	10
3.1. WEIGHING PROGRAM	11
3.1.1. Check System	12
3.1.2. Mark New Pen	12
3.1.3. Set Clock	12
3.1.4. Get Data	13
3.1.5. Reset	13
3.2. STORAGE	13
4. PROCESSING SAMPLED DATA	14
4.1. Evaluate Data	14
4.2. Program Version	14
4.3. View Rejects	15
5. TROUBLESHOOTING	16
6.TECHNICAL SPECIFICATIONS	17



WARRANTY TERMS & CONDITIONS OF SUPPLY

Vaki Ltd. accepts liability for defects that appear within two (2) year from the date of delivery by Vaki, on condition that the equipment has been assembled, used and maintained in accordance with the instructions for assembly and use.

Vaki undertakes to repair all defects that are due to faults in the design, material or manufacture of the equipment. Such defects will be rectified by repairing the equipment, or replacing components. Equipment must be returned to the factory.

Vaki accepts corresponding liability for original parts it has supplied as replacements, for a period of one (1) year from the date supplied.

Vaki will *not* be liable for:

- * *Incorrect assembly and use, or inadequate maintenance.*
- * *Defects which result from the fitting of materials, components or devices not supplied by Vaki, and which are purchased and fitted by the purchaser.*
- * *Defects due to changes made to the equipment by the purchaser, without the written consent of Vaki.*
- * *Faulty or inadequate repairs carried out by the purchaser.*
- * *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 display unit in water*
- * *Damage to electrical supply cables.*
- * *Any economic loss that may arise from production stoppage.*

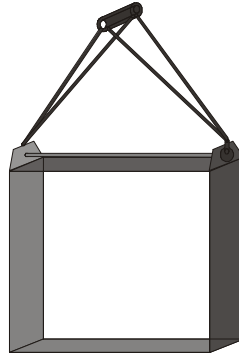
If faults or defects appear in the equipment, the buyer or user must report this in writing as soon as possible, and without unjustified delay, to Vaki or its appointed representative. Such report must be sent, at the latest, within two (2) weeks from the expiry of the deadline, one (1) year from date of supply.

If the purchaser does not inform Vaki or its representative within the time limits stated above, the purchaser shall forfeit the right to claim compensation for faults or defects. Repair of the equipment shall be under the terms indicated above.



LIST OF ITEMS

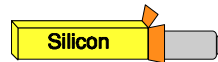
- 1) Scanner frame with hanger and main cable



- 2) Display Unit



- 3) Tube of silicone compound



- 4) Cable for connecting to deep cycle battery.

- 5) Software CD



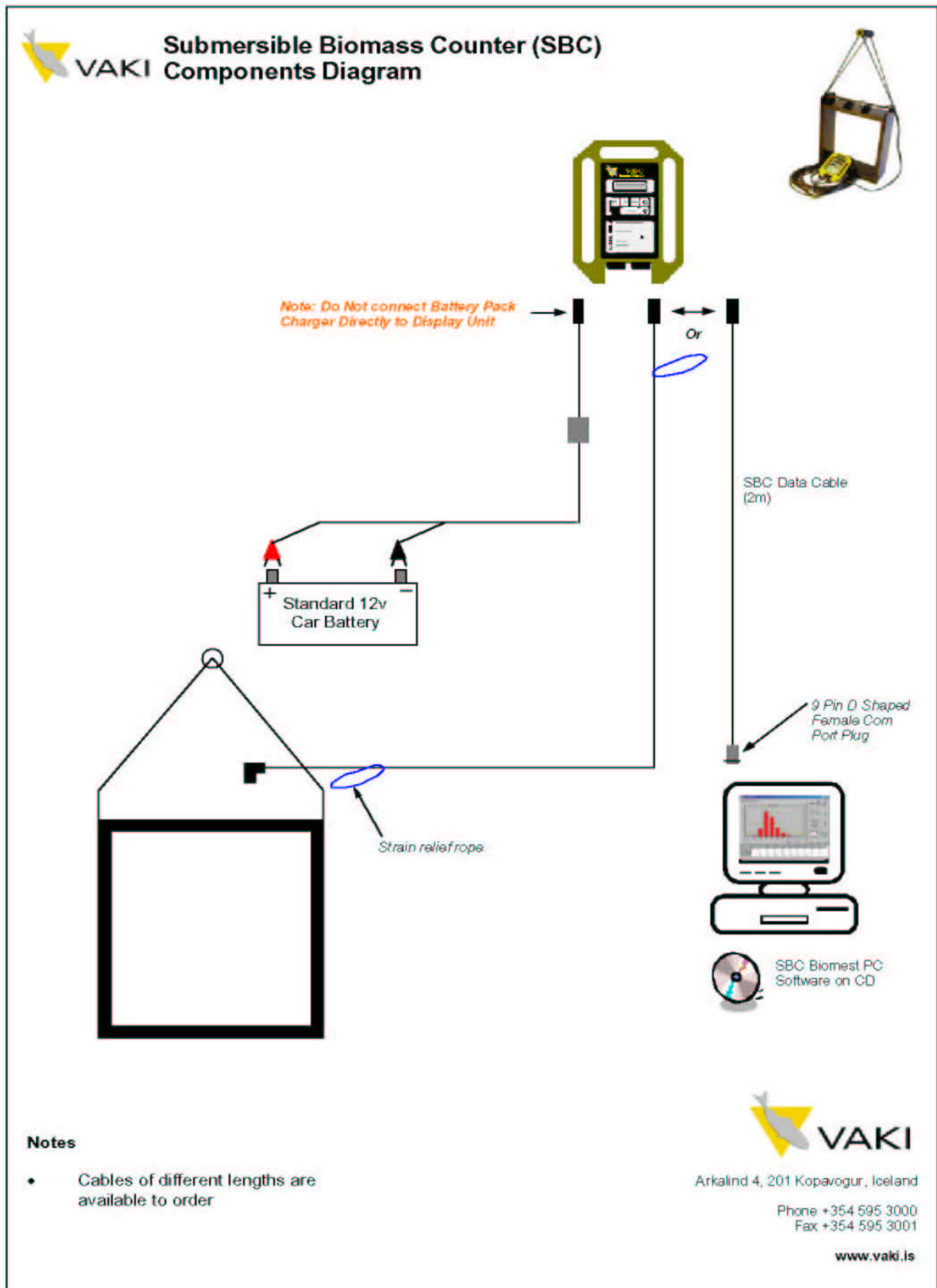
- 6) Data cable (9 pin)

ADDITIONAL ITEMS IF REQUIRED

- 1) Deep cycle battery
2) Battery charger



SET UP



Notes

- Cables of different lengths are available to order



Arkalind 4, 201 Kopavogur, Iceland

Phone +354 595 3000

Fax +354 595 3001

www.vaki.is



1. PREFACE

Vaki Ltd thanks you for choosing the Vaki Submersible Biomass Counter (SBC). More and more aquaculture enterprises are using the Vaki SBC to assist with their day-to-day production and management. An accurate knowledge of the average weight and size distribution of the fish in each pen is the basis for success in today's industry.

Vaki's Biomass Counter has been developed in collaboration with some of the world's largest aquaculture enterprises. It is currently being used for size measurements and counting of, Salmon (Atlantic and Pacific), Trout, Cod, Char, Sea- Bass and Sea-Bream and Yellowtail. Vaki is constantly adapting the counter for use with more species and developing the system to cover more functions.

The SBC system is based on the use of infrared light beams that form a grid inside the Scanner Frame. Each time a fish swims through the frame, this grid is broken and an image of the fish is generated. The image is then used to measure the length and height of the fish, and the weight (W) is then calculated using the following formula:

$$W = c \frac{d * l^2}{1000} \quad (\text{Were } c \text{ is a constant, } d \text{ is the depth of the fish and } l \text{ is the length})$$

A similar formula can be used for calculating the condition factor (C_f):

$$C_f = a \frac{d}{l} \quad (\text{Were } a \text{ is a constant, } d \text{ is the depth and } l \text{ is the length})$$

The constants in this simplified formula depend on the fish type. For instance the constant in the weight formula for Salmon and Trout is generally 7.0 – 8.0 (default value for salmon 7.30) depending on the stock and the locality. For salmonid fish, the constant in the condition factor formula is 0.515 (see table below for other species)

Species:	Weight const. (c)	Cond. Const. (a)
<i>Salmon</i>	7.30	0.515
<i>Rainbow Trout</i>	7,60	0,515
<i>Arctic Char</i>	7,30	0,515
<i>Sea-Bass</i>	6.80	0,430
<i>Sea- Bream</i>	8,90	0,430
<i>Yellowtail</i>	9,30	0,430
<i>Tilapia</i>	<i>In trial phase</i>	<i>In trial phase</i>

This manual is a guide to the use of the Vaki Biomass Counter. Chapter 2 contains some hints on precautions and procedure; Chapter 3 describes the functions of the Control Unit when the Scanner Frame is connected and Chapter 4 covers the use of the Control Unit when it is disconnected from the Scanner Frame. Chapter 5 contains Technical Specifications and Chapter 6 Troubleshooting tips.



2. BEFORE YOU START

Attention should be given to the points in this Chapter when using the biomass counter

2.1. CURRENTS AND TIDES

It is important to realise that strong currents and tides may have an effect on the time it takes to get a good measurement. Position the frame so there is no danger that the net will be moved into the frame by the current, and also so that the frame is at right-angles to the direction of the fish.

2.2. COMPARISON OF MEASUREMENTS

Vaki's SBC calculates the weight of fish swimming in the water. Therefore, when comparing these figures with the harvesting results, it is important to know how much weight loss occurs after feeding is stopped and when harvesting takes place. The figures below apply to salmon other figures apply to other species.

Table: Relation between wet, round and gutted weight

Condition	% of wet weight	% of harvest weight	% of round weight
Fish wet weight	100%	125%	111%
Starving before harvesting (10 days at 7°C)	4%		
Weight after starving	96%	120%	107%
Losses due to bleeding	5%		
Typical overweight in box	1%		
Weight Round fish	90%	112%	100%
Gutting losses	10%		
Weight of gutted fish	80%	100%	90%

Source: Norsk fiskeoppdrett 7/95

Loss of weight after feeding is stopped

The higher the temperature, the quicker fish digest. For example, at 12°C they take about 24 hours to digest food, but at 2° it takes 10 days for the food to be completely broken down and absorbed. When fish are to be harvested, feeding is normally stopped 10–14 days beforehand, as a result of which their digestive tracts are emptied and their flesh acquires a firmer consistency. The content of the digestive tract normally accounts for 2% of the weight of a fish, while the weight loss due to energy consumption as a result of the lack of feed is 0.2% per day at a water temperature of 7°C. Thus, the overall weight loss for a period of 10 days without food comes to 4%.

Weight loss due to bleeding



When a fish is harvested, the jugular is cut and the blood is allowed to drain out. In the case of salmon, 5% of the total weight is blood; hence the weight loss is 5%.

Weight loss due to gutting (gutting drop)

The entrails are removed and traces of blood are washed away. In the case of salmon, the entrails account for 10% of the total weight.

Reject, Superior, Ordinary, Production, Sexual Maturity

When comparing harvesting results with measurements from Vaki's Submersible Biomass Counter, it is important to note that the counter records fish in the following categories: Production, Ordinary and Superior. Similarly, it is also possible to have sexually mature fish recorded specially. Thus it is important to include reject fish in the comparison.

When only some of the fish in a pen are harvested

The Submersible Biomass Counter makes its measurements on the basis of all the fish in the pen. If not all the fish in the pen are harvested, there is a danger that the basis for the comparison will no longer be the same, and so the harvest results and the measurements from the counter will not correspond.

2.3.EFFECT OF SAMPLE SIZE AND DISTRIBUTION

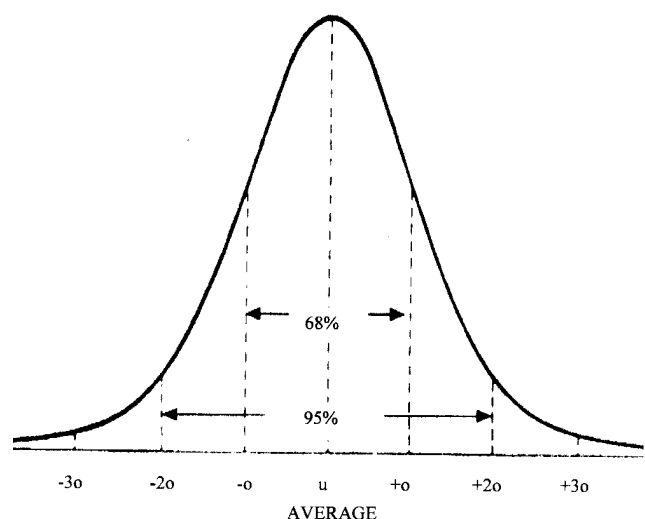
For accurate measurements, it is necessary to use a large enough sample. According to statistical theory, the size of the sample depends on the standard deviation in the population, i.e. how great the variation is within each size range. By using statistical methods to calculate how big the sample needs to be, we used power analysis on a population with normal distribution, 0,05 confidence level and 90% probability. In other words, in nine out of ten samples (90% probability) we wish to tell with 95% certainty (0,05 confidence level) that the difference between the sample and the total population is less than x%. It is important to bear in mind that these calculations are valid for all methods used to sample data, whether they are based on manual sampling, the use of biomass counters or other methods.

Large samples are needed for high accuracy

According to statistical theory, for a population (all the fish in a cage) with an average weight of 3.0 kg and a standard deviation of 1.2, a sample of at least 9,600 fish will be needed to be able to say that, given these premises, the difference is not more than 1%, i.e. that the measurement is 99% accurate.

If 97% accuracy is required; a sample of 1,100 fish will be needed. For 95% accuracy, 400 fish are needed, and if the sample consists of only 100 fish, then only 90% accuracy can be expected.

Normal probability curve and Standard deviations



Rule of thumb (if $w = 3$ kg and $sd = 1.2$)

For 99% accuracy you need 9600 fish in a sample
 For 97% accuracy you need 1100 fish in a sample
 For 95% accuracy you need 400 fish in a sample
 For 90% accuracy you need 100 fish in a sample

Effects of fish behavior on the weight results

It is well known that salmon (and other species) have tendencies to gather in groups, which can be unevenly located in the pen, especially if the pen is large. If such situation occur it's recommend that measurements should be taken from two or more location in the pen and that a larger sample should be taken, in order to get a sample that represents the population. Sometimes fish stratifies into layers depending on size, it therefore necessary to observe fish behaviour carefully in order to get the more accurate weighing samples. NB, in the autumn when light and temperature begins to change, salmon has grater tendency to stratify.

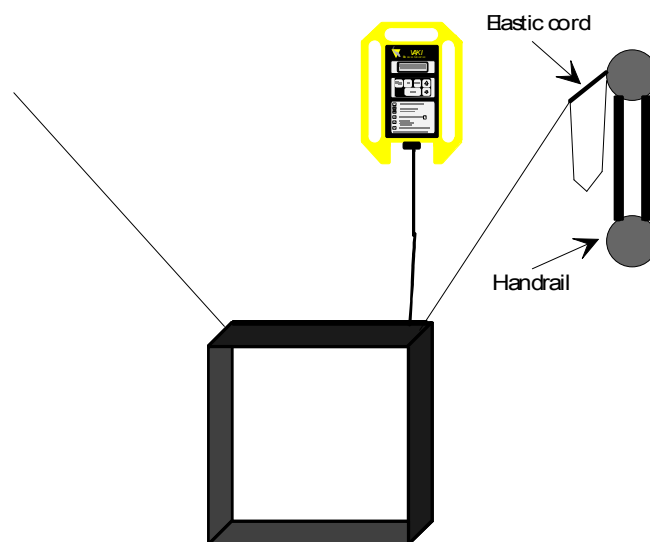
2.4. PRACTICAL TIPS

To speed up measurements (measure more fish in a shorter time):

- * Raise the net
- * Feed the fish near the Scanner Frame
- * Move the frame to where the fish are grouped closer together or are moving around more
- * Place the frame at right-angles to the direction of the tide.

We do not recommend using the Biomass Counter in really bad weather when there is a heavy sea and the pen is moving around a lot, as it may result in unreliable measuring data.

If however it is necessary to make measurements in marginal conditions, there are ways of reducing the movements of the frame. For example, use an elastic cord to fasten the cord from the frame to the handrail, making sure that it is sufficiently elastic to offset the movement of the frame. (See the figure below.) Another method is to have an elastic cord about 10 cm long connecting the two top corners of the frame to the supporting ropes.

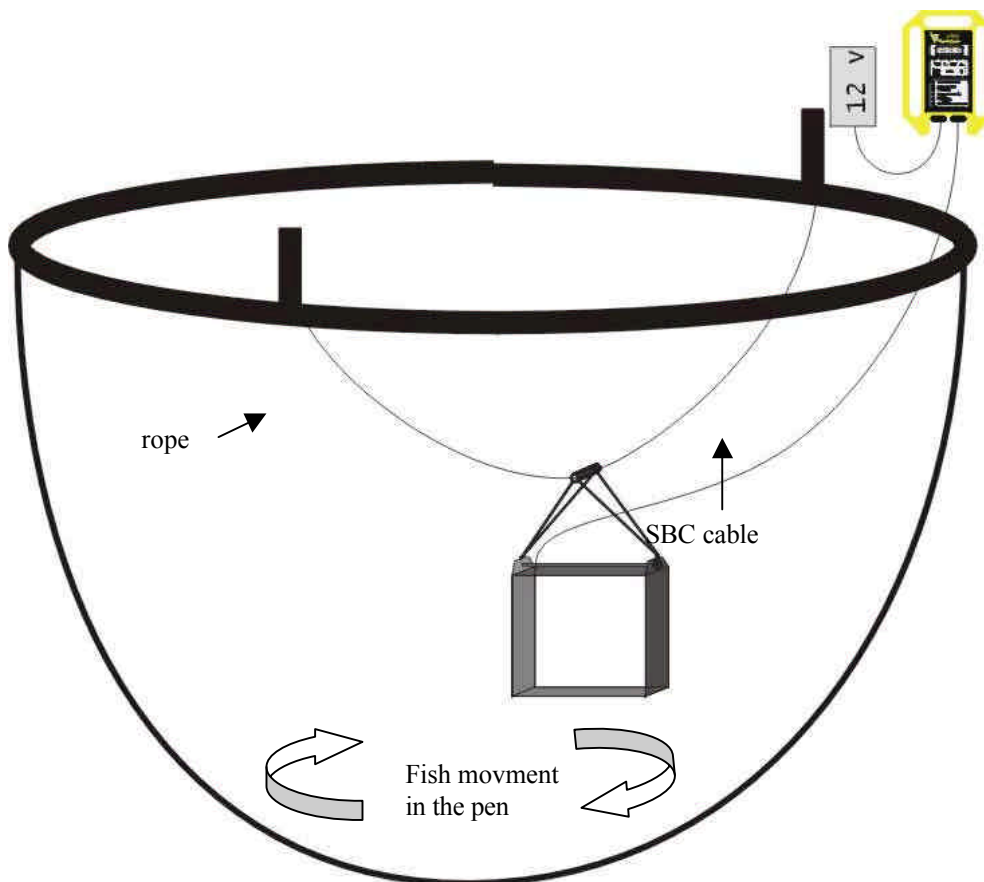


3. USING THE SBC

Note!! Check battery charge before leaving shore.

Before submersing the Scanner Frame, fasten the cable protection cord on the unconnected end of the cable to the handrail of the cage to prevent the connector plug on the cable from falling into the sea.

The Scanner Frame should be positioned in the "normal" swimming pattern of the fish in the cage, with the frame opening into the tide current. For a 12m x 12m square cage, the Scanner Frame should be positioned about 5-8 metres deep, 2-3 meters from the side, in the middle of one of the sides of the cage. (See picture below).



Use knots, or other marks, on the supporting ropes to measure the depth of the Scanner Frame. It is also possible to put a float on top of the frame to make it easier to check the depth.



3.1. WEIGHING PROGRAM



When the yellow Display Unit is turned on and connected to the frame, the last measurement will be shown:

W	AV:	3751	3296
#		358	1.32

The numbers are an example

In this case the numbers indicate the following:

W	The DU is on Weighing mode
AV: 3751	Average weight of the sample
3296	Weight of the last fish measured
358	Number of fish in the current sample
1.32	Condition factor (Cf) of last fish measured
■	Signal is transmitting from the frame (flashing sign). Level of battery
### ##	The # pattern changes, indicating a fish has swam through the Frame

The DU will display individual measurements for the first 100 fish accepted through the scanner. Average weight and number of fish is not displayed until 100 fish or more have been accepted.

With the Display Unit **connected to the frame**, it is possible to choose between 5 functions. This is done by pressing FN on the Display Unit, after which you can scroll through the menu by using the arrows. The menu consists of:

- 1)

PRESS ENTER TO: ! CHECK SYSTEM
--

To check that all infra-red light diodes are functioning properly
 ↑ ↓
- 2)

PRESS ENTER TO: ! MARK NEW PEN
--

To separate two measurements done after each other
 ↑ ↓
- 3)

PRESS ENTER TO: ! SET CLOCK

Sets the internal clock in the frame the same as the clock in DU
 ↑ ↓
- 4)

PRESS ENTER TO: ! GET DATA

Manual back up method to upload data from frame



3.1.1.

PRESS ENTER TO:
! CHECK SYSTEM

This function is used to check whether all light diodes in the frame are functioning properly. With the frame on land and no obstructions in front of the diodes inside the frame, press **FN**. The following will be displayed:

!

If some of the boxes shown are black ■, there may be something wrong with the frame. Make sure the windows are clean and nothing is blocking the diodes inside the frame. If problem persists then please contact Vaki or your local distributor.

3.1.2.

PRESS ENTER TO:
! MARK NEW PEN

When sample weighing in one cage is finished and you wish to sample from another cage without downloading current data to a PC, press the **FN** button and ↵ once, and the following message will appear:

PRESS ENTER TO:
! MARK NEW PEN

When **ENTER** is pressed, your previous measurements disappear from the display and you can start sample weighing in a new pen. The old measurements are stored in the memory.

PEN ID: A00

To change the pen id, press the arrows to change the first digit then press **ENTER**. Continue to the next until the right id is displayed. The new pen id is displayed on the screen

W A03
! □□□□□

3.1.3.

PRESS ENTER TO:
! SET CLOCK

To set the clock in the frame to the same time as in the DU then press **FN** and ↵ twice, the following will be displayed

PRESS ENTER TO:
! SET CLOCK

Press **ENTER** to set the clock in the frame.



3.1.4.

PRESS ENTER TO:
! GET DATA

To manually upload all data from the frame to the Display Unit, if for example the data from DU has been lost while disconnected from the frame.

PRESS ENTER TO:
! GET DATA

Press **ENTER** and the data

LOADING....
GET DATA

3.1.5.

RESET

To reset all data in the DU and Frame memory: Press **RESET** and the display will show:

PRESS ENTER TO:
! CONFIRM RESET

Press **ENTER** to confirm that you want to reset all data in the memory; if not, press any other button.

3.2. STORAGE

Always store the Display Unit in a clean, dry place, where temperature fluctuations are not great.

- * Keep the cable connected to the frame at all times.
- * Keep the protective connector cap on the other end of the cable.
- * Clean the windows, inside the frame, with a soft cloth and some warm soapy water. If the windows are very dirty you can clean them with ethanol or some disinfectant. You must bear in mind that the seawater scatters and absorbs a part of the scanning beam in the Scanner Frame and therefore it is necessary to keep the frame windows clean.

NEVER CLEAN THE WINDOWS WITH ACETONE, AS IT WILL RUIN THEM COMPLETELY.



4. PROCESSING SAMPLED DATA

When the Display Unit is **disconnected** from the frame and turned on, the following message will appear:

CONNECT FRAME

Or

CONNECT EXT BAT
04 04 29 12 :13

The following menu is available on the Display Unit by pressing **FN**.
Scroll through the menu by using the arrows and select by pressing **ENTER**

PRESS ENTER TO:
EVALUATE DATA

To view the number of fish and the av. weight of the sample.

↑↓

PRESS ENTER TO:
PROG. VERS.

View program version and voltage to the DU. Button test

↑↓

PRESS ENTER TO:
VIEW REJECTS

Number of fish rejected by the frame, and the reason.

4.1.

PRESS ENTER TO:
EVALUATE DATA

To view the average weight, press **FN** on the Display Unit and then **ENTER**. The Display Unit will show the averages of weight and Cf. only if over 100 fish have been measured. If more than one pen has been marked, the number of the measurement (PEN#1, PEN#2...) is shown. By using the arrows you can scroll through the measured pens on the Display Unit.

PEN# 1	A01	683
Wgt.	4471	1.21

PEN#1 indicates that it is the first measured pen that is being viewed on the Display Unit

A01: indicates the pen identification given when marking new pen

683: indicates the numbers of fish in the sample

4471: indicates the average weight in the sample

1.21: indicates the average condition factor in the sample

4.2.

PRESS ENTER TO:
PROG. VERS.

To check program version running in the Display Unit and display the voltage, press **FN** and ↓ and **ENTER**. The following will be displayed on the screen:

Program Version	→	A: 8.00	←	Voltage
				8.9



To check that all the buttons are operating on the DU by press any key to change a digit which appears in the top left hand corner of screen. **To exit this function you must turn the Display Unit off.**

4.3.

PRESS ENTER TO:
VIEW REJECTS

To look at the reasons why fish are rejected from the measurements, press **FN**, then press \hat{u} once and **ENTER**. The following will appear on the display:

PEN# 1	683	68	1
12	15	22	9 4

683: The number of accepted fish = 683

68: The % of accepted fish against the total number of fish accepted and rejected. Therefore 68% = 683 fish, Total number of fish = 1000, Total number of rejects = 317 fish

1: Indicates screen 1 reject reasons 1-5

12: 12% of rejects for reason 1

15: 15% of rejects for reason 2

22: 22% rejects for reason 3

9: 9% rejects for reason 4

4: 4% rejects for reason 5

Press ENTER to enter screen 2 for rejects reasons 6-10.

PEN# 1	683	68	2
8	15	22	9 4

Reasons for Rejects

1 = The fish stays too long inside the frame

2 = Uneven speed

3 = Two fish or more side by side

4 = The fish turns round in the frame

5 = Image of fish distorted

6 = Rejected because of too high / low condition factor, i.e. two fish together or the fish do not swim straight through the frame

7 = Two fish together, top view

8 = Two fish together, side view

9 = Fish too low inside the frame, not a complete image

10 = Uneven speed

The reject rate is usually 50 - 60%.



5. TROUBLESHOOTING

If the SBC seems to be out of order, please answer the questions on the "SBC DIAGNOSTIC SCHEME" and send it to Vaki or our agent. This is necessary to be able to solve the problem by telephone if this is possible.

1. If no fish are registered after a long sample time, take the frame out of the water and put some fish-like objects through the frame and check to see if the pattern on the display changes. If it changes, the frame is operative. You may have to try this a few times to evaluate the operation.
2. Also, make sure the inner surfaces of the frame are clean. (Use a soft brush or a cloth and water to clean).
3. **CHECK SYSTEM** (see Chapter 3.1.3.)

With this function you can check whether any of the scanning hardware functions of the Scanner Frame are blocked, i.e. due to dirt on the frame windows or malfunctions in the system.

With the Scanner Frame connected, press **FN** and then press \Downarrow on the display until following message appears:

```
PRESS ENTER TO:
! CHECK SYSTEM
```

When **ENTER** is pressed, the screen displays:

```
<ENTER>: TO
! TEST
```

Then press **ENTER**.

If the scanners are blocked, numbers will appear indicating where the blockage is. The numbers change every few seconds, giving readings from different units of the Scanner Frame.

```
W0      45      78
!       21      25
```

Then clean the windows inside the frame with a soft cloth and some detergent. You must bear in mind that the sea water scatters and absorbs a part of the scanning beam in the Scanner Frame and therefore it is necessary to keep the frame windows (inside the frame) clean. Press **ENTER** to exit.



6. TECHNICAL SPECIFICATIONS

Display Unit:

12 V DC internal battery.

- The fully charged battery suffices for 16-hours' operation.

Weight: 4,5 kg.

Index of protection. IP 65.

Scanner frame:

Dimensions: 595 x 655 x 215 mm.

Weight: 17 kg.

Power supply from the Display Unit.

Water resistant to a depth of 30 metres.

Specifications:

Weighing mode: (Sample weighing)

Sample time: 1-8 hours.

Sample size: 300 fish or more are recommended

Average weight with less than 5% error.

Minimum fish size for accurate operating results: 50 gr.

Sample capacity: ~ 4.800 fish

Operating environment:

Outside (air-) temperature: 0° - 40 °C

Sea temperature: 2° - 30 °C

