



## New SS4 Door Distance sensors



Scanmar has finally started full production of the new SS4 multi-functional door sensors. Additionally to the Distance function, other functions such as Angle, Depth and Temperature can be activated either at the time of purchase or later-by license.

The sensors' battery capacity and new charging technology give a long operating time and short charging time (can be charged while still on the doors).

The feedback we have received from the fishermen testing the sensors show that collective use of all functions yield an overview and benefit far exceeding the users initial expectations.

The first production series are complete sensors for single trawl. Later there will be produced a simplified version and versions for double and triple trawl.

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## Echo sounder – Temperature correction

Echo sounder and sonar are important tools for locating fish. Unfortunately the sound speed under water changes with the temperature, and it's practically impossible to predict the temperature at all depths at sea. The result is therefore that the gear, which has precise depth measurements, is not fishing where the echo sounder shows the fish or the bottom to be.

This is also the cause of many problems with the map systems. Scanmar has developed and patented a system where temperature and depth sensors log the temperature profiles continually during the shooting. By this the measured echo sounder depth and map systems can be corrected while fishing.

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# Perspective

## From catch control to full control

*A simple catch system, 30 years ago consisting mainly of Distance, Angle, Catch and Depth sensors, has over time evolved into a complete catch system.*

Feedback based on thousands of fishermen experiences has given Scanmar an in-depth understanding of fishing, catch conditions and catch technique. This has resulted in Scanmar seeing possibilities where no others have.

Roughly 400 million NOK invested in development of advanced technology and accurate problem-describing has led to many new patents, products and functions. Together they form the foundation of a sophisticated catch system that gives full overview of all

catch phases, showing fishermen in a simple way what should be done to fish as effectively as possible. All while bunkers usage is kept to a minimum.

**What is the difference between a modern catch system and a traditional catch control system?**

For most people who trawl on an advanced level, the catch control system is simply a system consisting of several sensors that show you have a somewhat accurate door distance and correct depth, and an indication from a Catch sensor showing when the trawl is full.

But modern catch system is something much more. On the following pages you will find more in-depth information about different sensors in a catch-system;

here, we have summarized some of the main elements and functions:

- **Logging of all data, including environmental data, position over time so that each field can be reviewed in order to determine factors for each successful haul.**

- **Exact position of the fish entrance, so that towing can happen exactly where the fish are, assuring efficiency and cost control, including lower fuel consumption.**

- **Optimal trawl geometry, where towing speed, wire lengths and door angles all the time simply (automatically) adjust in relation to each other based on depth, underwater currents, towing resistance, filling etc, so that the efficiency is maximized and fuel consumption is minimized.**

**zed and fuel consumption is minimized.**

The fishing convention "Norfishing" was held this August in Trondheim, Norway. Scanmar's booth had many visitors who were particularly interested in the issues mentioned above, as well as the ScanTrack logging system, SuperCatch filling indicator with exact fish entrance, and the new door sensors which give detailed information on the doors "walk" and stability under all conditions.

Many have used Door-Angle sensors for several years, and they have achieved an even greater understanding of how much the trawl doors mean for effective fishing; in addition to experiencing how different conditions affect the trawl

doors during fishing.

Another relation of significance is that many Norwegian shipowners are building new large trawlers and have ordered large systems from Scanmar. Systems which will continually be upgraded as the new functions become available.

We also had visitors from various research institutes. All of them were interested in the significance of Scanmars patented solutions for steerable trawl doors, remote activation of sensors on trawl and trawldoors, automatic correction of eco-data with temperature data etc. We understood that there were some discussions behind closed doors on how the patents could be avoided, while others simply wished to purchase the license.

## Closer contact with the most important users

*Many of the biggest vessels and ship owners have been our customers since the 80's. Just like their fleet has been renewed over time, we at Scanmar have been developing and upgrading our systems and sensors so that we always can deliver state of the art technology in the best product available.*

There is a range of sensors which need to work together for the skipper to get what he pays for. Therefore the skipper is completely reliant on the sensors working as expected.

Scanmar finds itself in a completely new situation with SS4 generation multifunctional easily upgradeable sensors (Distance/Angle/Depth/Temperature and SuperCatch filling indicator /Angle Depth/Temperature) with regards to flexibility and quick service. In practice this means that a sensor body now can be programmed and upgraded via simple functions licenses.

**Our users are our most important source of inspiration, and our most valuable sparring partner.**

Scanmar has always had a close contact with users both in Norway and the rest of the world. Whether it has been research institutes or commercial fishers, this has been completely necessary for many reasons. It has been particularly important for us to know how the equipment is being used, and how the information is being interpreted.

We have also seen real examples of how important it is that the data is precise and reliable.

To come up with innovation in catch

control has been a daunting task. The experiences were few and far between, and we have been completely dependent on receiving feedback to develop prototypes and start development of the final product. Close contact with our most important users has therefore been invaluable. This contact also gave us the possibility to see things which we meant we could improve efficiency of, by reducing fuel, repairs and wear costs.

Some examples of this is the Door Angle Sensor, Filling indicator and temperature correction of echo sounders. We have also observed a number of other things which over time have given us new ideas for products which could be developed on the foundation of technology and experience which we possess.

Some products are already under development while others have patents pending. This means that in the near future we will launch a new range of products, product improvements and functions.

**Development towards double trawl and semi pelagic fishing gear will result in a need for new functions in catch systems. These functions will also be of great significance for development of more efficient trawl doors and trawl design. In addition to the beneficial service arrangements our deals will include, we expect the trade-in and upgrade policies to be of great use to our customers. The policies will be flexible and adapted the individual user to the greatest possible extent to meet their needs and wishes. More information on this will follow in the near future.**

## SS4 Multifunctional sensors – warranty and upgrading

*Scanmars SS4 Door and Net sensors have an unique construction. They are molded in a special extremely impact and wear resistant newly developed plastic. This gives the electronics a very good protection.*

Scanmars experiences through 30 years have shown that the construction solution and the material choice which was made when the first sensors were developed was the right one. Broken sensors comprise only an utterly insignificant part of the 40,000 sensors which were delivered. While the older HC4 Sensors had a warranty of two years, the new SS4 Sensors have proven to be worthy of a 5 year warranty. This is due to the improved construction; "unbreakable" plastic material which gives the sensors an additional technological advantage.

The most important part is to have a product that

allows the user to take comfort in its quality. A product that works, and doesn't require frequent service or repairs. Since SS4 sensors are multifunctional they can be licensed with one or more functions upon delivery, and upgraded at any later time with new functions.

**To give the fisherman further safety in the purchase, we will over time implement a trade-in policy where multifunctional SS4 sensors are traded in to new equal sensors at a trade-in price. For the fisherman this will mean a significant discount on the new sensor. See more about this policy on page 10.**

**Our customers will also have the possibility to buy only the sensor-body for their storage, and activate it at a later time, by downloading function licenses if a main sensor should be damaged or lost.**

**Your eyes under the water  
– Looking ahead**

 **SCANMAR**

# Challenges

Fishermen have never faced as many big challenges as they do today. Quotas, restrictions, fees, explosion of costs, market difficulties, etc. This requires that every detail must be looked at with full attention at all times. The result is therefore often that small problems that have to be solved lead to a loss of focus on what really matters. Even if only for a moment, it can have serious consequences.

Over more than 30 years Scanmar has focused on catch efficiency, which in practice means more than that the gear fishes effectively with the help of sensors like Catch, Depth and Distance, (even if many think those few will be enough for them).

For Scanmar there is something much greater involved. The synergy of gear, environment, underwater currents, towing speed, door angles etc. In practice this means that every fisherman can quickly and simply adapt to what happens, and therefore get the biggest return on his investments, competence and experience.



## Full control during trawling - Is it possible?

To have "full control" is a claim that is used by many, but it is diffuse and with little meaning. If it is to have meaning, it has to relate to specific situations and also be specific towards these situations.

Scanmars definition, when we use it in the context of fishing, is that the fisherman will receive all the information he needs in a simple and detailed overview, so that he can use it to gain "full control" under the pretence that vessel and equipment allow.

A number of small vessels claim to have "full control" with a set of distance sensors and a few catch sensors. That's probably correct. If the fisherman is not able to increase the profit with more or better equipment combined with knowledge and experience, it is wasted money to invest.

The problem, unfortunately, is often that it is difficult, if not impossible for the individual fisherman to imagine what use he would have of new equipment. It's not seldom to hear a fisherman who has bought a new sensor say; "if i only had bought this the first time I thought about it"

We have gotten a lot of interesting feedback from fisherman who have told us what they have made by looking precisely at where the fish are entering with the new Catch/filling indicator, or how important it is with absolute accurate distance sensors, corrected for water temperature when they are fishing deep or on uneven seabed.

It's hard to give advice, especially because fishing is so un-uniform, and fish-

ermen want to fish in different ways. Over 30 years we have listened to the fishermen, been on board, and gotten feedback. The technology we have developed all on our own, but the product ideas are the results of what we have observed and the feedback we have received. Scanmar Info has relayed information and feedback we have received, and an indefinite number of fishermen have thanked us for it, and made a point of noting how much they learned by reading about other people's experiences.

Based on feedback we have gotten, it can be interesting to look closer at what the fishermen believe is important to have "full control". It's changed over time, not just because the fishermen have changed, but also because the requirements for efficiency have increased. As a result of this the demands placed on fishermen are increasing, and to succeed they have to ever increasingly learn more about what they are doing.

It can be difficult to explain the reasons for some things being more important to some fishermen than to other, but we can take a quick run-through and look at individual parts of the gear. Or maybe we should start with the vessel:

### The vessel

**1. The vessel's speed is important in relation to the fish' swimming ability, which can vary depending on water temperature, time of day, etc. The vessel's speed is also important in relation to the trawl's construction and waterflow ability. It's the trawls speed through the**

**water which is of importance, and underwater currents make this often different from the vessels measured GPS speed.**

The Trawl Speed sensor shows the trawl's speed through the water, and it is therefore important for the vessel to adjust her speed so that the trawl fishes effectively. Too low speed results in fish being able to escape, while too fast can lead to a bucket-effect, open masks, and fish escaping that way.

**2. Correct warp length dependent on depth, weight of doors and towing resistance is important for several reasons. The first is that short warp lengths in relation to the depth leads to doors and gears easily losing contact with the bottom.**

**The trawl door angles, especially roll angle is of great significance. Too long warps give poor contact with the gear and can lead to unstable doors.**

Many fishermen believe that it is important that warps should be equally long, but that should only be the case when the trawl is towed directly behind the vessel and is not affected by side currents or uneven bottom conditions. The warps lengths have to be adjusted so that the water flow is 90 degrees to the trawl opening.

Door Distance sensors and especially door angle sensors (both functions now available in the new SS4 sensors) instantly show if the doors can have problems due to tow speed and warp lengths.

The Symmetry sensor is

used to review warp lengths so they are always set to lead the trawl in balance through the water current, to avoid it tensing up on one side and fish escaping through the wide open masks.

### Trawl doors

**3. When trawl speed is correct and warp lengths properly adjusted, trawl doors are one of the most important factors for effective fishing.**

Correct door distance is necessary for completely accurate vertical opening, proper height, and to ensure bottom gear is stretched up so that you avoid losing bottom contact.

The new door distance sensors with temperature correction will correct the measurement for different temperatures, and thereby the right spread is obtained by adjusting warp lengths and towing speed.

Correct door angles are crucial for trawl door spread and stability, (unstable doors have impact on sweep and trawl) and are ensuring that towing resistance does not lead to unnecessary fuel consumption.

Door Angle sensors show even the smallest deviations from what is optimal, and notify immediately when there is a risk of the doors leaving the bottom.

In pelagic fishing it is important that the doors (and trawl) are on the correct depth in relation to the fish aimed for.

The Depth function in the Door sensors is 100% accurate, but the echo sounder reading may vary due to the temperature profile in the sea. However, with Depth and Temperature functions in the sensors adjustments to the echo sounder can easily be done.

### Trawl

**4. With proper towing speed and water flow at 90 degrees in the trawl opening, all the prerequisites for optimal fishing are met.**

To most people fishing with trawl, it is absolutely necessary to see if fish is entering the trawl and where. It's often hard, if not impossible, to see fish close to the bottom on an echo sounder. Scanmar's Trawl Eye has therefore become a very important sensor for bottom trawlers. Since it sits on the trawl-roof, close to the fish entrance, the distance is short and the resolution is good.

### Trawl Speed/Symmetry sensor is mentioned above.

While the catch sensors have previously been irreplaceable to see where fish was entering the trawl, and how the net gradually was filled, SuperCatch with filling indicator has now taken over this role. With this new sensor the information is more precise and accurate, and fishermen reap large benefits on quickly reacting to fish entrance.

**Conclusion: Based on the feedback we have received from fishermen the last years, they are of the opinion that the following sensors are necessary to have full control in the towing phase:**

- Door Distance/ Angle/Depth
- Trawl Eye
- Trawl Speed/Symmetry
- SuperCatch/Filling indicator

**Furthermore, the last version software for ScanBas/ScanMate.**

# Technology and Patents

*When we talk about technology, we immediately think of the technology the fisherman is given through the product, in order to fish more effectively and economically.*

Still there are a few prerequisites which are absolute for the user to get the full benefit he expects, especially with advanced systems where the results are completely dependent on exact measurement, accuracy and reliability. The lack of/incorrect data may paint an incorrect picture of the situation.

- The hydrophones are therefore of great importance, especially when coming to large depths and long distances; many have experienced problems in such cases.

- The receiver unit is even more important. Lots of experience including noise recordings on various vessels is required before one is able to handle the different noise images, as they vary from vessel to vessel, and are on the single vessel dependant of conditions.

- The presentation has to be easily understood and focused on the information the fishermen consider of most importance at any given time, meanwhile all the other data must be easily accessible.

- The sensors have to be robust, the measurements precise and the batteries need to provide a long effective operational time and quick charge, so that they are always ready for use.

Scanmars equipment has been gradually developed for over 30 years, and with around 35-40,000 sensors distributed, we have a guarantee that the new systems meet the demands we put forth.

**If we then go on to the technology (the info) the fisherman receives to make quick and correct decisions, we can take a look at some of the most important:**

Echo sounders and sonars are important tools for finding fish. Unfortunately the sound speed in water changes with the temperature and there is practically no possible way to guess the temperature in every layer of the ocean. The result is therefore that the gear which has accurate depth measurements is in a different depth than where the echo sounder is showing the fish, or sea bed, to be. This is also the reason why many people have problems with chart recorders. Scanmar has obtained a patent temperature and depth sensors log continually during shooting. By this method the correct temperature profile in the sea may be used to make corrections to the echo sounder recordings.

Scanmar is also developing a system where, by the help of measuring the vessels noise frequency and level, will be possible to tell the actual distance different species can hear the noise at. The skipper can then try to adjust the noise in order to get closer to the fish. Hydrophone logs will also tell if there has been caused damage to propellers, or if the noise picture of the vessel has changed over time.

The importance of trawl doors can't possibly be overstated. The Doors Distance and Angle is affected by the vessels movements, towing speed, resistance in the trawl(filling), underwater currents, warp lengths and bottom conditions. To achieve the best possible result, including fuel saving (towing resistance), Scanmar uses Temperature correction and Angle measurements together with Trawl Speed/Symmetry sensor and length/tension in the warps. This results in «perfectly» functioning doors for any given condition. This will only become more effective when the steerable trawl doors are ready for delivery.

Here the patent-pending solution combines pitch/revs winch steering and remote control of doors, a system which will be useful for doors of most brands. In other words; a real «Auto-trawl» system.

There is an ever increasing interest in using pelagic doors on bottom trawls because there is fuel to be saved due to reduced towing resistance. Here we will combine the use of a forward looking sensor combined with the Door Angle sensor so that one can see the obstacles ahead of the trawl doors and the doors height above the sea bed, both below the door as well as ahead of the door.

On the trawl and in the tunnel it is becoming more common to use angle sensors because streams and catch of fish may result in twisting and bucket effects which in turn result in meshes stretched and fish escaping. *ScanTrack* is a patented system for organizing and logging data. It makes it very simple to make the right decisions before problems occur, while giving a complete log of all details in every haul over many years. This gives a great foundation to make decisions and planning, and is maybe extra valuable for companies with multiple vessels or when partners are cooperating.

**There are even more patents pending that will have great significance if the development of the new technology is successful. Either way this lies in the future, so it may be more appropriate to come back to this at a later time.**

# Bridge systems- mode friendly and straightforward

*The bridge system is the «brain» behind the catch control system, and consists of one or several receiver units and one or several display monitors. The receiver unit (must not be mistaken for hydrophone) processes signals received from sensors, removes noise and false signals and prepares these inputs for user-friendly and straightforward presentation.*

Today we have following bridge systems available; *ScanMate*, *ScanBas* and *ScanScreen*. These systems are much more than simple "replacements" for the previous generation of Scanmar systems. Not only have we upgraded the receiver technology and the processing of the hydro-acoustic signals; but we have also improved the appearance of data on the displays, as well as logging and later presentation of historical data. All systems are developed on same technological platform and can be upgraded when needed.

## A reliable wireless link between equipment and vessel

The technology behind the acoustic transmission of signals from sensor to vessel is one of the most important parts of any wireless catch-control system. In brief can the process be described as follows; the sensors mounted on the fishing gear send continuous acoustic signals, which are being received and processed for correct presentation.

Noise from propeller, machines and currents, can influence the signal reception, and lead to the loss or the distortion of the signal. Scanmar's vast experience together with the in-depth reports from over 1000 vessels, have given us possibility to develop a reliable transmission technology for processing of signals from the sensors by filtration of any undesirable noise. Automatic hydrophone-selection (meaning that the receiver unit "listens" to both hydrophones simultaneously, automatically selecting the best signal quality), enhances this further. Our modern systems have a number

of improvements comparing to the older; the processing and filtration of signals is just one of the aspects.

## Software upgrades

We at Scanmar are continuously seeking to develop new and improve existing software, by including new functionality. Recently, we have made several improvements related to user-friendliness, better graphical presentations and more accurate logging. Based on feedback from the users, we have improved the logging functionality even further, granting fishermen the possibility to be updated immediately after taking over their shift; as well as possibility to rewind to see if something of importance might have happened during the period they were away.

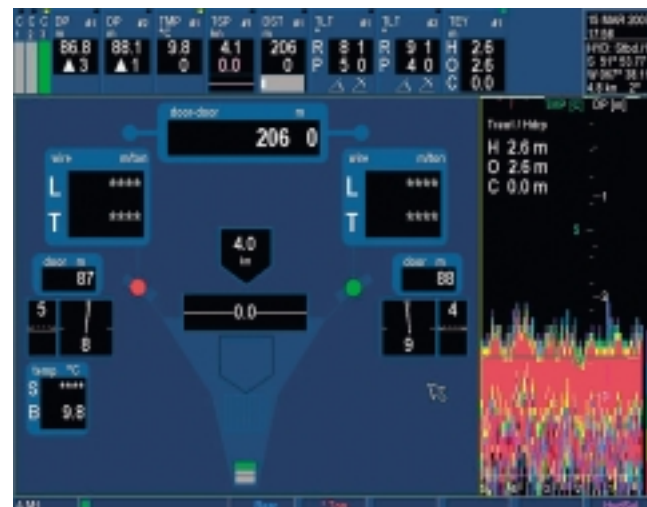
## Present-day system for future fishing needs

*ScanMate 6* is modern equipment on most trawlers that do not use Trawl Eye and do not see the need for expansion beyond six sensor functions. Unlike the traditional systems- Rx-400, 600 and 4000- that *ScanMate* replaced, the system now has a graphical presentation of the trawl, or the depth profile under the seine. *ScanMate 6* can be upgraded to a complete *ScanBas* system, should there come up need to include additional sensors.

*ScanBas* system is used by vessels that need additional functions to the *ScanMate* system. *ScanBas* can handle up to 25 sensor functions, including Trawl Eye. Many large vessels use *ScanBas* today



Geometry and log image, Filling indicator

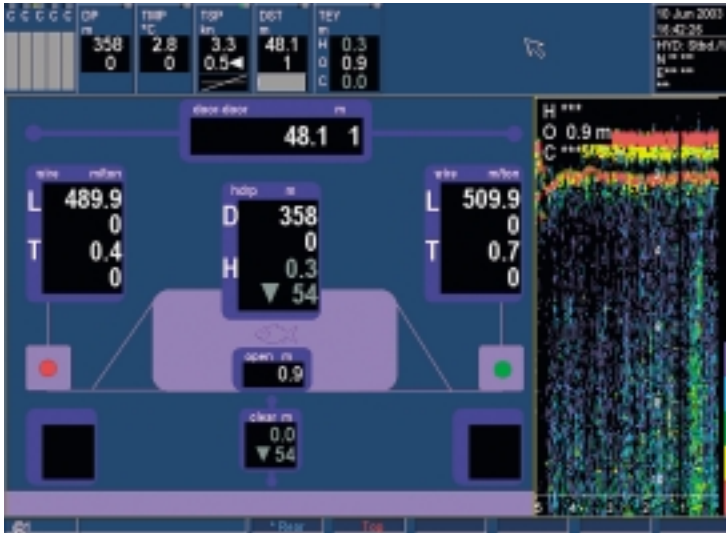


Geometry and Trawl Eye image

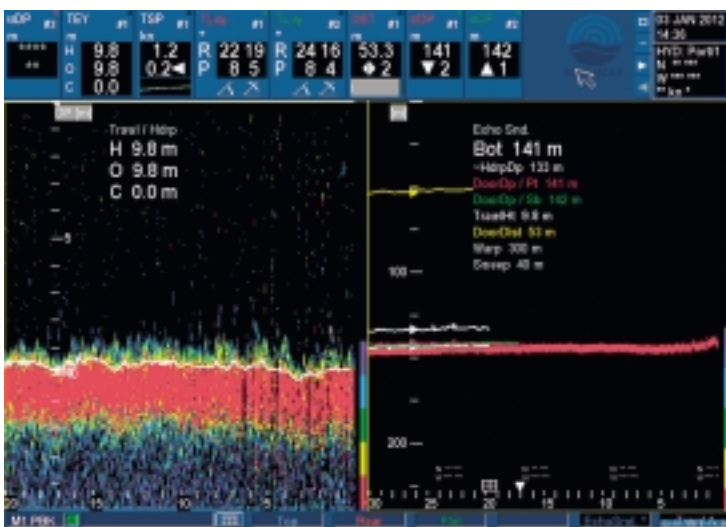
# Modern technology, user-forward presentation



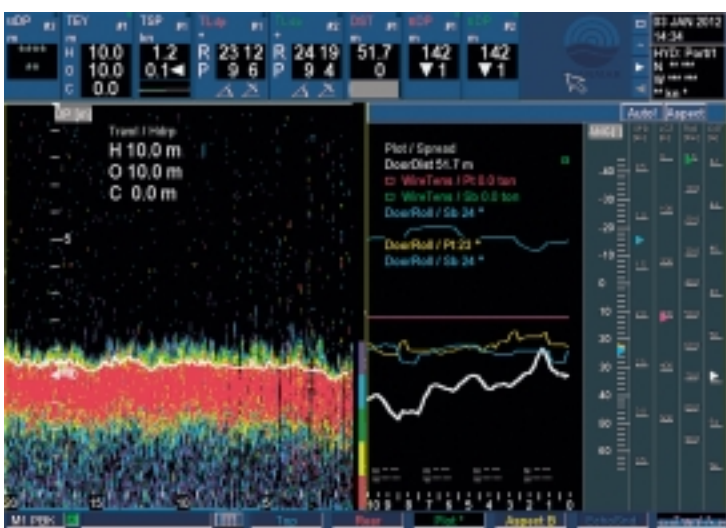
An example of ScanScreen displayed on three screens during cod fishing



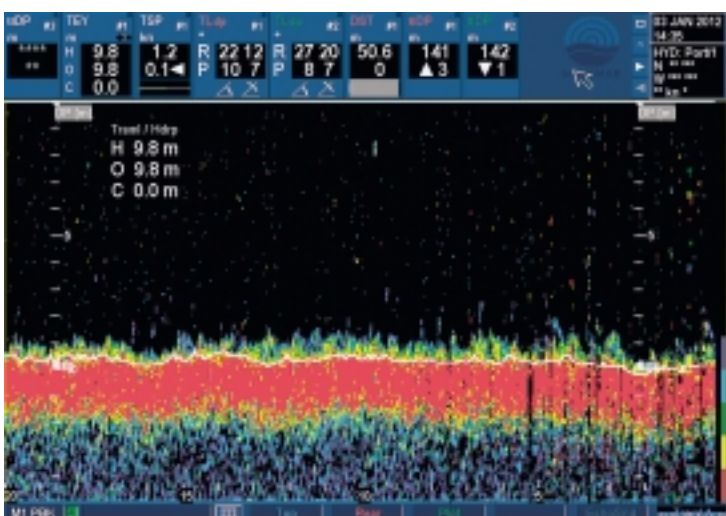
Geometry and Echo Sounder image



Trawl Eye and Echo Sounder image



Trawl Eye and log image



Trawl Eye image

to get a detailed picture of the trawl geometry and the fish intake by the trawl. A modern catch system including Trawl Eye, flow sensors in the opening and the bellows, Door Distance sensors and filling indicator in addition to the traditional sensors, give enormous amount of relevant information for fishermen, which is best presented by using several, connected screens.

*ScanBas* can therefore be upgraded to *ScanScreen*.

*ScanScreen* system is a network-based system, consisting of two or three monitors. While on *ScanBas* you must switch between two different pictures, here you have full overview of the elements you want to have focus on, in all parts of the haul. You can in addition to following the Trawl Eye recordings and the geometric situation, also study situations under development in the different log pictures, for example;

- Door Distance
- Door Angle and stability
- Correct fish entrance in the trawl, including the filling indicator

It is common to use two or three monitors on the bridge desk, and one by the winch desk; however the monitors can also be placed in the mess or other places where fishermen can follow the development.

A number of vessels have used *ScanScreen* over many years, and the feedback we have received has only been positive.

### Future prospects- a new dimension of logging and use of data

Registering and storage of all data under fishing will get even more significance in the future, and there will be many areas of use. It will be important to be able to control all phases of a trawl haul, make fishing more effective by better planning, but also when it concerns information to the shipper and the customer.

In future we will be able to register even more information by using Scan-

mar systems, for ex.

- All relevant data/stages in a trawl haul, to be able to compare with earlier hauls in the same field.

- All data concerning fishing gear and rigging of the gear, for an overview from different fields, or when testing new equipment.

- Weather and environmental data, for increased efficiency as soon as the field has been reached.

- Catch and customer data. The aim here is to get best possible information for the shipper, but also should the vessel be sold (regarding tracking down the catch field and quality).

In addition to the data that are today automatically registered from Scanmar sensors and other connected instrumentation such as GPS, winches, echo sounder etc; it will be possible to include supplementary data automatically or manually, as *ScanBas* can operate several slave displays with keyboards that could be placed in production, the cabin etc.

### Expanded areas of use

Increasingly the focus is being placed on selective fish species and sizes, damage to the bottom fauna and energy consumption in proportion to the catch efficiency. It is possible to expect that all this would lead to further regulations and limits to the catch possibilities. For fishermen this will mean increased demand for efficiency and,

if possible, even greater focus on reducing costs.

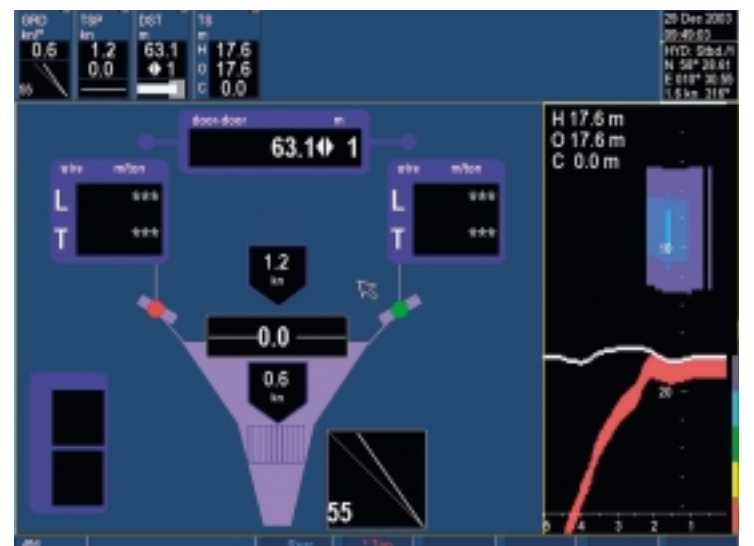
### Use of historical data in planning

Best possible planning will therefore give best results. Planning is mainly about making use of experience and historical data to try to predict how things will develop. Changes to climatic conditions and the great ocean currents, with constant variations to biomass, do not make it easy to predict these developments.

We are at Scanmar looking at possibility to log on all data relevant to the catch environment, and compare them with historical plots. With later hauls at the same GPS position, the historical plots would be displayed on screen together with the ongoing haul. This will make it easy to determine whether to carry on fishing or discontinue and try somewhere else.

Another important element will be to collect data at fishing grounds to be able to understand and predict the cause of fish movement over time as a consequence of changes to temperature, currents, or number of vessels at the grounds.

The *ScanBas* system has the far-reaching use of logging and registration of data as one of its main aims. When Scanmar sensors are used to register all conditions that influence the efficiency of fishing, many of the elements of importance to the fish quality and origin in relation to traceability are also being registered.



Like the other systems, ScanMate 6 includes graphical presentation.

# ScanTrack - New patent pending system for full catch control and simple rigging of trawl

Scanmar's extensive range of sensors and advanced technology for processing of data has now enabled us to develop a new product that allows fishermen to anticipate problems that may arise and simply avoid them. In addition, the system shows how they can easily adjust rigging to get an optimal effect of the equipment.

Scanmars products are based on proprietary molding technology, unique battery- and charging technology and reliable cable-free transmission technology that work in all conditions. Scanmar has also developed technology to ensure accurate and reliable measurement of data, for example temperature compensation for speed of sound in water so that depths and distances measured by echo sounders and Door Distance sensors are correct.

When it is necessary to make correct decisions quickly in critical situations and there are many factors that come into play, it is a requirement that all data is 100% reliable and that data update rate is optimal.

Finally, we possess the required technology and we have therefore chosen to develop a system that gives the fisherman a complete presentation where it is easy to understand what is happening: *ScanTrack*.

*ScanTrack* is an additional unit to the existing Scanmar bridge units that can be connected to most of Scanmar's previously produced systems, limited to how many sensors the bridge system can handle.

In all simplicity, the system records all data from all sensors connected to the system, including data from other sources than Scanmar. The fisherman enters the data he considers to be "correct" from the given situation, and deviations in the actual data will be displayed as deviations from a straight line.



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## Let's have a closer look at the benefits the system provides:

### 1. Fast decisions while fishing to avoid problems

- In a given catch situation, it is natural to focus on the three or even four types of information that have the greatest impact on the trawl efficiency in every situation.

- Trawl geometry is an example of something that concerns most people. Door distance is mainly a result of the doors' pitch angles and towing speed (flow in the trawl opening). When a desired value is selected (done with simple clicks on the screen in terms of sensor selection and setting), the image on the screen will be a thick straight line showing the door distance if real values are the same as the chosen. The other measurement values are hidden.

- If the door distance deviates from the selected value, the thick line points upwards or downwards, depending on whether it is the spread or if you have too little door distance (the deviation is also shown with the digit). At the same time, this or other factors that influence the door distance will show a si-

milar deviation. By correcting these, particularly the greatest deviation, you will easily be able to correct the situation.

- If the door distance changes without any change in the selected parameters, you can check other parameters – those that may have not been displayed in *ScanTrack*, such as warp lengths – to examine other possible causes.

- In *ScanTrack* you put in a filter (simple clicks on the screen) that makes "natural" variations invisible. If you fish in an area where one would expect that the doors are very stable (small *ScanFactor*) you can for example add a filter of  $\pm 2^\circ$ . However, if the seabed is very uneven, it may be natural to select  $\pm 6 - 8^\circ$ .

- For door distance it may be appropriate to select  $\pm 1$  meter on a smooth seabed, while under more difficult conditions it may be natural to select  $\pm 3$  meters. Note: Temperature compensated distance measurements provide a much more accurate reading than usual distance measurements where inaccuracy can be up to  $\pm 3\%$ .

- In the same way as it is often desirable to focus on correct door distance, it may be important to focus

on the height of the trawl, bottom contact, trawl speed, flow in the tunnel, etc. You choose when to observe the factors you believe have the greatest impact on the parameter you want to focus on.

- If you want to change the set parameters while fishing, this can easily be done with simple clicks on the screen. Examples of situations where you wish to change the setting may be that you are fishing at a different depth, that there is a change in the current conditions, filling of the bag, etc.

- Similarly, you can choose to replace the sensors (parameters) you want to keep an eye on, by simple clicks on the screen.

- Since all data is there all the time, you can also click to see the history or retrieve the individual sensors.

### 2. Evaluate a finished haul with regards to if the rigging should be adjusted

- In all logging programs you can go back to study the development of the individual parameters and also discover whether there have been some short-term deviations. With the logging of many sensors, it is not easy to get a com-

plete overview because of the amount of data.

- With *ScanTrack* the advantage is that you can easily study the interplay between the parameters that affect each other. To refer to the example above, there may be other factors than door angles and towing speed that have affected the door distance (and efficiency). These can include warp lengths (depths), side currents (trawl symmetry), filling, etc. It is often useful to make small adjustments that lead to the most efficient rigging throughout the haul.

### 3. Historical data as a basis for future trips

In *ScanTrack* you can store larger amounts of data, making it easy to retrieve any data from earlier hauls in the same place, and see what experiences you have previously made.

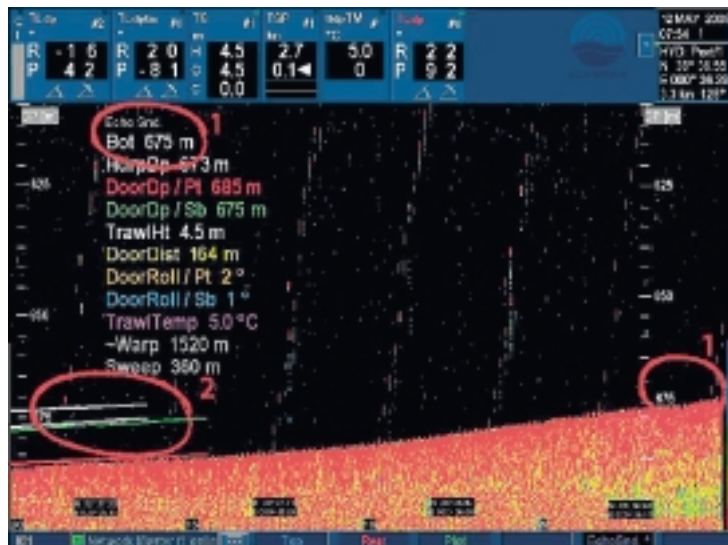
We have shown and discussed *ScanTrack* with many people and without exception they are very positive about how the system will make everything much easier for them.

# Why is it so important to display accurate depth on an echo sounder?

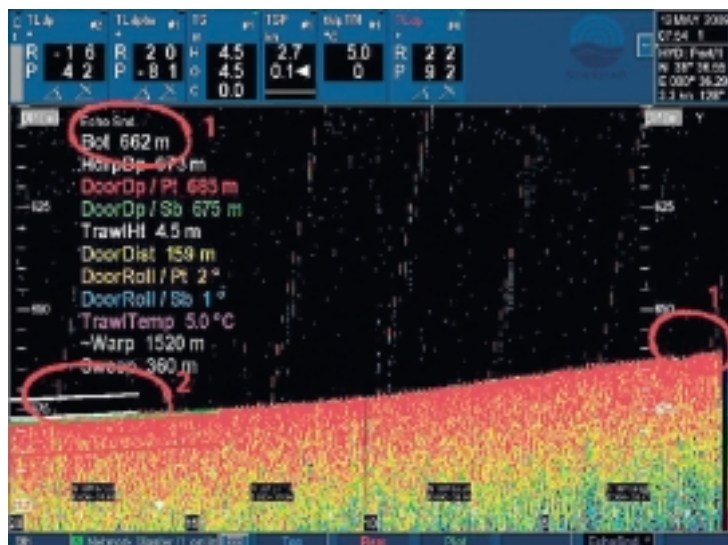
Since Scanmar produced its first graphic displays (CGM and RX-400) more than 20 years ago, fishermen have wondered why it is that the trawl sometimes appears to be above or below the seabed (in the trawl screen image) when the trawl actually is on the seabed.

We have tried to explain it; however many fishermen are accustomed to using and relying 100% on echo sounders so the reason is perhaps not so obvious. The fact is that while a depth gauge is almost 100% accurate, echo sounder readings vary with the temperature in the sea. Sound propagates with different speeds depending on water temperature causing differences of up to 6-7% (i.e. 30-35 meters at 500 meters depth). Just the difference of 10 degrees between summer and winter can cause variations of 12 or 13 meters. When fishing on hillsides and on the bottom with large depth variations, the varying measurements will have a significant effect on the proper positioning of the trawl as well as trawl and trawl door movement in the sea.

When making accurate echo sounder measurements it is not enough to measure the temperature at the surface and at the bottom, split the measurement in two, and then base the sounder on the result. Different temperature layers, with different distributions, make it important to



(1) Without echo sounder correction: shows depth 675 m.  
(2) Trawl height



(1) With echo sounder correction of temperature: depth 662 m

know the temperature profile from the surface to the bottom. In fact, scientists often stop several times a day to record the temperature with a CTD probe with cable.

Scanmar has been granted a patent for a much simpler and convenient system. By logging data from the combined

Depth/Temperature sensor during shooting of the equipment, an accurate temperature profile is generated and a modern echo sounder that has the proper input can adjust automatically or it can be adjusted to the best degree possible by hand.



A screen capture from a ScanBas show's a «perfect» situation. With correct door angles (slightly inward leaning) and optimal towing speed for this bottom trawl, we see that the door distance is completely stable, the trawl is in symmetry, bottom gear has good contact and doors are totally stable. The result is optimal efficiency and lower fuel costs.

# More focus on catch efficiency and fuel saving

Fishermen have never stood before so many big challenges as today. Fishing is not unlimited, cost of fuel is increasing, expenses have skyrocketed and most fishermen only have a minimum of catch days as opposed to what they would like. What can be done? The answer is: Increasing efficiency, but perhaps with a different focus than before.

In fishing that is not regulated, it goes without saying that the larger the catch, the higher the profits. Efficiency is catching the largest amount of fish possible, while there is not as great focus on costs.

In fishing that is regulated, efficiency gets another meaning, especially when the quotas are small. Efficiency is to fish the quota at the lowest possible expense, and preferably at the time of year when the prices are at their lowest.

Throughout more than 30 years Scanmar have focused on catch efficiency, which in practice means more than that the gear fishes effectively with the help of sensors like Catch, Depth and Distance, even if many think those few would be enough for them.

For Scanmar there is something much greater involved. The synergy of gear, environment, underwater currents, towing speed, doorangles etc. In practice this means that every fisherman can quickly and simply adapt to what happens, and therefore get the big-

gest return on his investments, competence and experience.

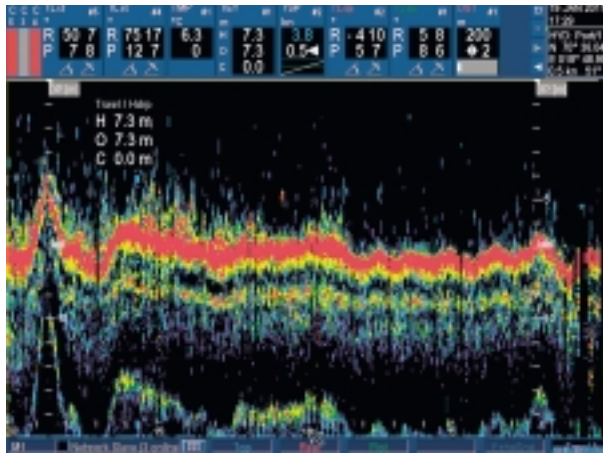
The problem, unfortunately, is often that it is difficult, if not impossible for the individual fisherman to imagine what use he would have of new equipment. It's not rare to hear a fisherman who has bought a new sensor say; "if i only had bought this the first time I thought about it".

We have received a lot of interesting feedback from fisherman who have told us what they have gained by looking precisely at where the fish are entering with the new catch/filling indicator, or how important it is with absolute accurate distance sensors, corrected for water temperature when they are fishing deep or on uneven seabed (see page 12).

Based on the feedback we have received, it's interesting to look closer at what the fishermen think is essential to have full control.



Geometric screen image



Trawl Eye screen image



Log of filling

# Scanmar's screen presentations - unique solutions for full overview when fishing

*A modern Catch System from Scanmar is something completely different and more dynamic than what a Catch Control System was ten years ago and what is otherwise offered in the market today.*

Scanmar is introducing new additional features that not only make old Scanmar systems compatible with modern graphical display, but also allow them to display several of the newest and most advanced features. The new presentation gives, according to fishermen who have tried it, a whole new world.

In the early days of Catch Control it was the simple information such as catch, door distance, depth and temperature that increased efficiency, economic gains and gave substantial cost savings for fishermen worldwide.

Today, developments have taken a major step forward. In more than 30 years, thousands of fishermen have told Scanmar about their experiences and problems. This information, together with the pioneering Scanmar technol-

ogy, has laid the foundation for a completely new understanding of what it takes to fish effectively.

## Now it's the dynamics that are the focus of the best, most innovative fishermen:

- How do the underwater currents affect door distance and door angle when it comes to efficiency and fuel economy?
- What does fish intake and filling of the bag mean for water flow, bucket effects and loss of catch?
- How can new technology show exactly where the fish are so fishermen can minimize towing time and fuel costs?

Most fishermen have begun to ask themselves these or similar questions. It's no wonder: more and more people use Scanmar Flow sensors in one variant or another. Be it the Trawl Speed, Symmetry, or the Grid sensor, they have learned that the towing speed is important. This does not mean GPS speed, but the actual speed of the water passing through the trawl. Everyone who has used one or several of these sensors has seen the importance of proper water velocity in the

trawl. It's not just trawl speed relative to fish swimming ability or even the right speed to get the fish back in the bag, but it also has a significant effect on the doors' angles and distance.

In the mid-1980s Scanmar developed a series of Flow sensors based on a completely new technology, but it took many years before most fishermen understood the importance of water speed and direction (symmetry) relative to effective fishing. Today, more than half of all fishermen who use Catch Control use a Flow sensor. As they become more familiar with the Flow sensor, more and more fishermen are declaring that that it is the main sensor. They also typically recommend Door Angle, Trawl Eye, and Filling Indicator in the process.

This is really no surprise, since these are all closely related. It is this mutual relationship - and the ability to understand the relationship - that makes some fishermen much more efficient than other. It is also the reason why even small vessels no longer buy simple systems.

It is not uncommon for us to re-

ceive calls from fishermen who are angry at themselves because they intended to acquire new equipment for many years and, after finally installing a Scanmar system, they see what they have lost due to postponed investment.

The value of the new advanced sensors, and the dynamics and the relationship between them, can hardly be exaggerated. The point and the challenge, however, are also to present the details in such a way that they are easy to understand and that changes in towing speed, warp lengths and course come easy and clearly, so that appropriate decisions can be taken immediately.

## The main images show:

- Geometric image and development of the most important parameters in the last minute. This is the ideal image to make changes in towing speed, course, or warp lengths, or a combination
  - Trawl Eye or Trawl image
  - Log of fish intake and filling rate

Of course there are many other possibilities to choose from with simple selections on screen.

## Fresh investment, big challenges and exciting opportunities

*After many years of consolidation and reserved attitudes Norwegian ship owners have again taken an important initiative. Ten or so new advanced deep sea trawlers are contracted to be delivered within the next years. The fact that the new trawlers will give big advantages over the competition is indisputable, but large investments also bring large challenges in fishing and innovation.*

Scanmar has had great communication with the ship owners for many years, and we are humble and grateful for the trust that has been given to us. Contracts on deliveries are entered, and we have ta-

ken on new challenges which put big demands on us.

When we previously delivered equipment to new ships, it has been a question of delivering solutions, latest generation of systems which most people had experience with throughout several years.

This is still our foundation, but now the main focus is what possibilities Scanmar equipment can give in the future. After all, there are vessels which unlike most of today's vessels want further advantages over the competition for many decades to come.

Many will maybe think that it's simple to accept large orders, but that is

not the way it is. Since the start, Scanmar has spent 400 Million NOK on research and development and has gained a certain overview on what we think the fishermen will need.

We have a range of projects and plans which build on experiences and work that has been done, and we have significant customer groups which make it possible to develop the systems within financially justifiable frames.

The ship owners know this and while it means a significant commitment to us, it is also a great source of inspiration. In meetings with the fishermen we have therefore informed of what we can help with in

the future, and asked them to give us feedback so that we can explore the solutions which best fit the ship owners' plans.

What we have focus on has convinced ship owners that it is important to expect installing six hydrophones and three bridge systems with 23" screens. That everyone is doing it makes it easier for us to prioritize this is what we and the shipowners think will be the most important things in the future:

**1. Registering of noise with aim to reduce the scaring effect of fish.**

**2. Steering the trawl with automatic synergy**

**of speed, symmetry and course.**

**3. Logging and analyzing data with the focus of giving each individual vessel a database for planning, tracking and the possibility of exchanging data with other vessels.**

At Scanmar we think that it is possible to increase efficiency further (reducing fuel, wear and repair costs), by focusing more on water flow (twist and bucket effect), and fishing according to the fish position and movements.

**We think fishing is moving towards an interesting era.**



# Data logging

## - an important way to improve efficiency and financial result

Ever since the start in 1980, Scanmar has been involved with Fishery Research Institutes (250 vessels are equipped with Scanmar systems) and the interaction between the institutes and Scanmar has proven to be of immense value to both parties. The different institutes have various tasks and aims with their research, but the common factor is that they all use Scanmar sensors to make underwater observations and log the data for further processing.

In the same period Scanmar has collected data from a vast number of commercial fishing vessels all over the world.

In addition to the basic purposes for using data from Scanmar sensors, Scanmar has analyzed the data with the purpose of finding relationships between various factors that may improve the quality of fishery research results and help commercial fishermen improve their economical results.

Based on our experience, sustainable and profitable fisheries have to be based on several different factors, such as realistic quotas, efficient fisheries and profitable fisheries (harvesting the various species when it is efficient, when prices are good, as by-catch, or with minimum fuel consumption and the least possible wear and tear on equipment and fishing gear).

It is worth noting that the last of these, as it relates to commercial fishing based on experience (logged data), is probably well known to experts, but it is only to a very small extent that experience gained from logged data is utilized in commercial fisheries.

Another aspect benefit of logged data is traceability, not only in order to have better information about the resources and biomass, but also to get better information about the catching area and conditions in order to obtain better prices in the market place.

We have seen that in areas with stable weather conditions the surface temperature gives a clear indication of the temperature at various levels in the sea and on the seabed, and consequently fish concentration.

Fish availability is very often directly related to weather conditions and underwater currents, tem-

perature, etc.

- The amount of fish caught is often a result of how the fish is caught; towing direction, fish orientation relative to towing direction, towing speed etc.

This information is all very general, but more information is available in the last ten pages under Catching Technique, as well as on [www.scanmar.no](http://www.scanmar.no).

The main purpose of a Scanmar system for commercial fishing is to optimize the efficiency of fishing operations and thereby reduce unwanted by-catch, fuel consumption and repair and maintenance costs.

However, right from the start we received and logged data from commercial and research vessels. We have then carefully analyzed the data in order to help fishermen increase efficiency by establishing relationships among data that may help improve trip and seasonal planning.

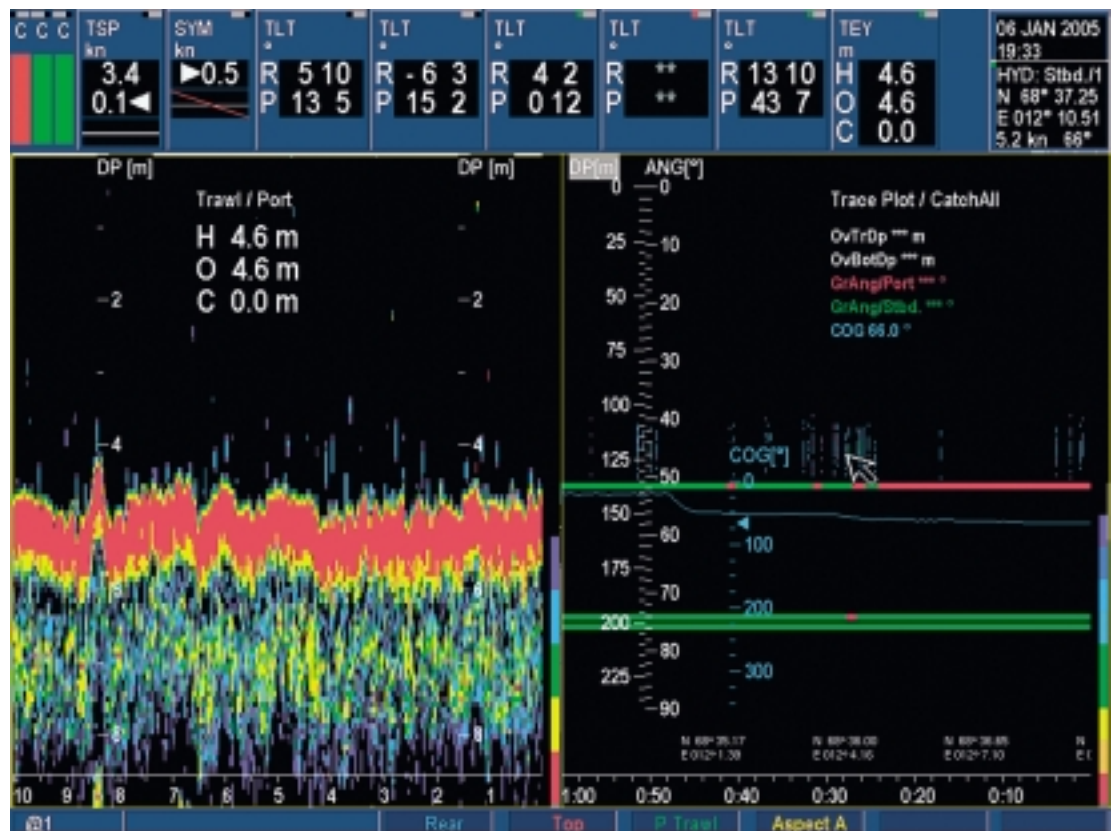
On a micro level, i.e. individual fishing vessels, logged data are of immense importance. We are constantly working on developing screen and log relationships which the fishermen may use, all dependent on their own operations and the area they are fishing.

In addition to observations made with Scanmar sensors, input from GPS (position, course and speed over ground) and other instruments on board the vessel may be incorporated as part of the display and logged on the Scanmar Bridge systems.

Here is a list of data (part of Scanmar system) we think are very relevant for both research programs and sustainable/efficient fisheries:

### Temperature:

Surface (hull mounted receiver), fishing gear and



The log picture shows the activation of the Catch sensor (green/red line) and impact on the combination sensor Catch/Angle when fish pass the sensor on their way into the bag.

water temperature profile (logged during shooting). Patent pending for the latter. The profile of the water temperature is not only important for the fishing operation, but necessary for correct depth measurement for the echo sounder to compensate for different depth measurements in different seasons (speed of sound in water changes approximately 4 m/s per degree centigrade).

### Underwater currents:

Trawl Speed/Direction related to towing direction (GPS).

### Towing speed:

Water flow in the trawl opening related to fish influx.

### Twist and bucket effect:

Huge negative effect on amount of catch (closed/open meshes reduce water flow in trawl; causes fish to escape). May also be used for fish selection.

### Trawl geometry:

Door Distance, Door Angle, Towing speed/Symmetry; the combination important for volume of water entering the trawl opening and have impact on twist and bucket effects, as well as fish behavior in the trawl.

### Trawl position:

Pelagic (related to fish concentration/compensation for echo sounder measurements), and on/off bottom (fish escape). Also used to control how hard the gear goes on the bottom (important for catching certain species).

### Continuous monitoring of filling rate:

Full control of fish influx,

and impact on Towing speed, Door Distance and Door Angles.

The new generation of Bridge units, *ScanMate 6*, *ScanBas* and *ScanScreen*, provides a wide range of options where you can find exactly the combination of data that is most important to you for improving your results and decreasing fuel, repair and maintenance expenses.



The filling indicator shows how the filling grade increases and the registrations show the exact position of fish entry. With the same position for the sensor on the trawl, the filling grade will always have the same gradient. The data is stored and can be used again on future trips.

## Trade-in offer - New SS4 Door sensors

We are pleased to inform you that the new SS4 door sensors with multifunctionality, increased battery capacity, faster charging and stronger plastic material are now in production.

We now offer our customers up to 70.000 NOK in price reduction for a trade-in of older sets of Scanmar Door sensors (sensor and minitransponder) bought in 2011 or earlier.

**The offer is valid until 31.12.12.**

Since the new door sensors can have multiple functions in the same sensor body (Distance, Angle, Depth, Temperature and Stretch) procurement of multiple functions will be more affordable compared to the older sensors that had only one function.

The high quality of the sensor, the new construction and its durable plastic material requires a minimal level of service, and with a battery life up to 700 hours and charging time of only 1.5 hours (can be charged on the door) you get an effective use of the time in the field.

The automatic temperature-based correction of measured door distance also gives a more exact measurement.

**Please contact our sales department today for more information or to order.**

**Telephone: (+47) 33 35 44 00 (Dial 1)  
or e-mail: [contact@scanmar.no](mailto:contact@scanmar.no)**

\* Price reduction depends on the age of the door sensors traded in. Trade-in applies to one set of new SS4 door sensors with the same functions as in the trade-in sensors as a minimum. Trade-in sensors have to be in working order and not repaired by unauthorized personnel.



# Exact measurements with the new SS4 Door Distance sensors

*The great technological lift required a wholesome testing of the sensors under different conditions. The first production series was delivered to a host of vessels in Norway, Sweden, Faroe Islands, Greenland, USA, Argentina, West Africa and Russia.*

The new sensor construction, together with a great battery capacity and simple programming make the new sensors extremely flexible and allow for combination of Depth Angle and Temperature functions in the same body. Still with a very acceptable operation time between each charge.

### The new sensor generation comes in two different versions:

1. All sensors communicate with the vessel, all distances are measured and sensors can easily be upgraded with different functions.

2. Only sensors on port door communicate with the vessel, and can be upgraded. Distance between port door and clump is measured, other distances are estimated (this is only accurate when the door and clump are in line).

### The basic versions of the new SS4 Distance sensor series consist of the following configurations:

- **Single trawl**
  - SS4 Door Distance sensors for both doors
- **Double Trawl**
  - SS4 Door Distance sensors for both doors
  - SS4 Clump sensor
- **Triple trawl**
  - SS4 Door Distance sensors for both doors
  - Two SS4 Clump sensors

### The second version consists of the following configurations:

- **Single trawl:**
  - SS4 Door Distance sensor for port door
  - SS4 Transponder for starboard door
- **Double trawl**
  - SS4 Door Distance sensor for port door
  - SS4 Transponder for

starboard door  
- SS4 Transponder for clump

- **Triple trawl**
  - SS4 Door Distance sensor for port door
  - SS4 Transponder for starboard door
  - Two SS4 Transponders for clump

The new receiver technology in the sensors give more exact measurements and thereby increased reliability. With the temperature function, accuracy is improved even further by correcting the measurements relative to the water temperature. This is due to the sensor signal speed inconsistency depending on the water temperature.

**For more information, see our home page: [www.scanmar.no](http://www.scanmar.no)**



**SCANMAR**

## Your Eyes Under Water

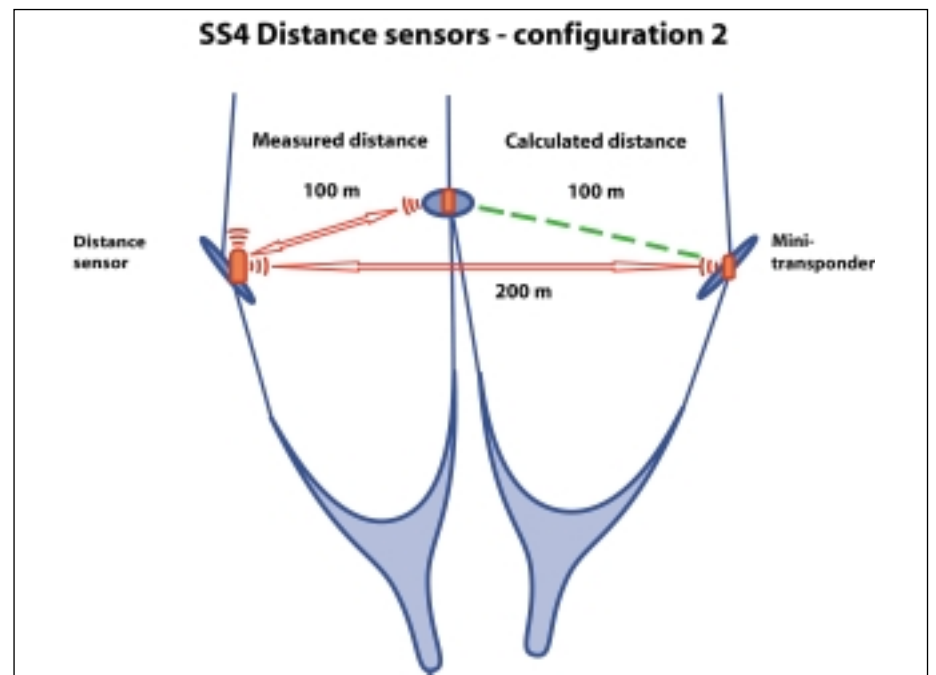
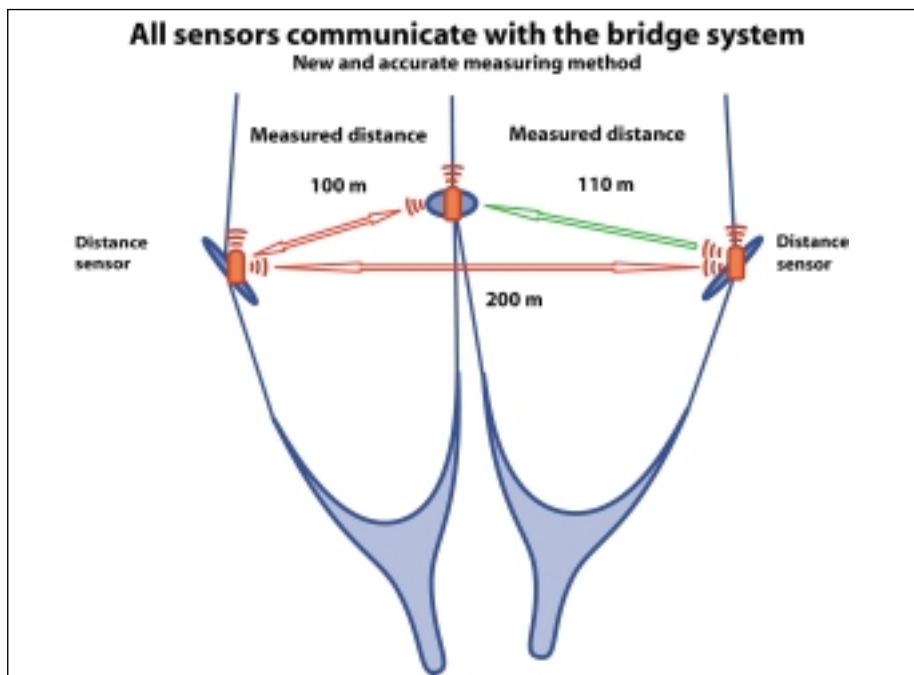
**Advanced Catch Systems for modern fish trawling**

**Knowledge is the basis of all development!**



**SCANMAR**

# Perfect symmetry control with new SS4 Distance sensors



Scanmars distance sensors are overall perhaps the sensors that have meant the most for fishermen, regardless of the type and size of vessel. The sensors have been equally useful for the biggest vessels as for the smaller coast trawlers, and the small double trawlers.

Much of the same can be said about the symmetry sensors. Indeed it took a while before "everyone" understood how much of their catch was being lost by trawling at a crooked angle to the water flow, but now symmetry sensors are a must for most, just like the distance sensors. Dou-

ble trawl has become important for many today, and in the future when a renewal of the fleet takes place it will become even more important. When we developed the new SS4 Scanmar Distance sensors we had this particularly in mind, even if the solutions benefit all types of trawl.

There was a new measuring concept developed, and a new receiving technology which gives even more precise data. In the sensors the data becomes even more precise by the measurements being corrected for water temperature in accordance with Scanmar's patented solution.

In the previous generation of double distance sensors the distance from port door to the clump was measured, while the distance from the starboard to the clump was estimated. The estimated distance was on-

ly accurate when the clump was in a straight line between the doors. All the while minor inconsistencies in the trawl doors walk and minor snagging of the bottom gear could result in some unprecise measurements. Therefore this was by no means an optimal solution. With the new advances SS4 sensors we know that measurement data is always correct, since all distances are measured precisely. It is therefore simple to vary the warp lengths so that clump and doors are in line, and stays to the avera-

ge if the symmetry sensor shows small variations. For a double trawl to fish effectively you need doors and clump to be in line, while the symmetry sensor shows no inconsistencies.

With a side current the trawl must therefore be towed "crookedly" to compensate, so that the water flow is at a 90° angle to the trawl opening. This is even more important in pelagic fishing and semi pelagic fishing where measurements from depth and height sensor are involved in the solution.

## Scanmar's new generation Door sensor is based on new technology with many benefits:

Scanmar's SS4 Door sensors are based on new technology where one of the criteria has been to develop a sensor with improved operation time, multi-functionality and better resistance towards impact and abrasion - with the same high quality and reliability.

- **Multifunctional - several functions built in the same body**
- **Increased battery capacity: up to 700 working hours**
- **Programmable sending effect - multiplies the working time**
- **Reduced charging time; 1.5 hour**
- **Can be charged whilst on the doors**
- **New sensor construction and newly developed plastic material**
- **5 year guarantee**
- **More accurate distance measurement**

### Functions included in the new SS4 Door sensor

The sensors are supplied with one or more functions, and can be upgraded later via license.

#### DISTANCE

This function shows the distance between the trawl doors and at what speed and direction the door distance might change. It also shows if the door sensors have no contact, due to the doors being out of position (if one has settled, for example.) Automatic temperature-based correction in the sensor provides more accurate distance measurement than in previous sensors.

#### ANGLE

How the trawl doors behave in the water is in direct relationship to the spread force and towing resistance. Having control of the doors is therefore essential for efficient and economical fis-

hing. The Angle function's measurement of the doors' roll and pitch angle gives good control of the doors' efficiency. In the landing phase one can immediately see when the doors hit the seabed, so one can begin to tow before the doors lie down. During towing you can quickly discover if the doors lose contact with the seabed, are about to or the doors are at different depths. It's simple to make changes to the towing speed, course or warp lengths.

#### DEPTH

Measurement of the doors' depth in bottom trawling is primarily useful during the landing phase, so one knows when the doors have hit the seabed and towing can begin. During pelagic fishing, it is important to be certain of the exact depth of the trawl, in order to position the trawl where the fish are and for maintaining the

trawl's horizontal symmetry.

#### TEMPERATURE

Temperature measurement is used to determine flow with bait where you find fish that pastures, or a specific kind of fish that one knows from experience is found in certain temperatures. The function can also be used to correct the sonar depth on the bridge system.

#### TENSION

The Tension function measures the tension in the warps or sweep lines. Tension measurements in the warps are used to adjust the winches, as these measurements are more accurate than the measurements done in blocks and winch drums. Measurement of tension in the sweep lines is important to keep the trawl symmetrical relative to the water flow.

# SS4 SuperCatch - much more than a Catch sensor

*The Catch sensor is the sensor that has laid the groundwork for the Catch Control Systems when Scanmar was established more than 30 years ago, and is at the same time a sensor "all" must have. The principle is simple and genius; fish that fill the bag create a bucket effect. This causes an opening of masks cross-ship, and this is detected by a sensor. The signals are sent up to the vessel with different interval; 30 seconds if the sensor is not activated and 20 seconds when it is turned on.*

## **The Catch sensor is very important to bottom trawlers as well as pelagic trawlers.**

- For bottom trawlers that often have difficulty getting good detections on the echo sounder, it is of great importance to get registrations on the Catch sensors so that they know they are getting fish. At the same time it's important to finish the haul at the required amount of fish. Multiple sensors give the fisherman a good idea of the fish influx.

- For pelagic trawlers the fish influx is equally important, because a lot of fish that is registered by the Trawl Eye in the trawl opening often disappear due to bucket effect and twist in the trawl. To many it is often just as important to know when to end the haul. A late termination can lead to overfilling, causing the bag to blow.

Scanmar is very research oriented, and we have always looked at how we can improve our products and increase the user benefit for the fishermen. The developments in the fisheries which have led to larger bags, new constructions and material, have been an important source of inspiration in this work.

In *SS4 SuperCatch*, we have combined the known Catch sensor with quick updating rates and the measurement of pitch and roll angle (Filling indicator). The sensor also has a new construction, extremely long operation time and quick charging time.

When we release new sensors it is exciting to get confirmed whether fishermen get the advantage of the sensor like we intended when we developed it. It is not always we get the answer right away. The Distance sensor that no one had

faith in when it was released was shortly after a bestseller nobody could do without. It took 15 years before the user benefits of the Trawl Speed/Symmetry sensor were discovered, but then it became a big success.

We have received a lot of positive feedback on the *SuperCatch* sensor, but would like to share the experiences three of our customers had recently:

### **Skipper David Gair, MV Aquarius (15 m)**

- *SuperCatch* is awesome. It has paid for itself already. We got £ 20.000 for three hauls in a week. I won't go to sea without it!

### **Skipper Willie Tait, Chris Andra (71 m):**

Chris Andra was fishing mackerel in the North West of Scotland recently and used the opportunity to compare two of the new *SuperCatch* sensors with Catch sensors from two other producers. There is no doubt that *SuperCatch* is the "sharpest" sensor on the market. The instance the Filling indicator kicked in we started to haul, and we had taken in 200 metres of wire before the other sensors responded.

We had a situation where we broke the bag because we didn't know how much we had in it. The Scanmar sensors were not mounted, only those from the other vendors. By the time the sensors kicked in, it was too late. The trawl was on the bottom because of the weight of the fish.

If I have all three types of sensors on the bag, *SuperCatch* is the "sharpest", and by at least two minutes.



Skipper David Gair, MV Aquarius (15 m)

### **Vidar Sigurjonsson, M/TR Thorunn Sveinsdottir (40 m):**

We were looking for Catfish, and as many know it is difficult to detect on the echo sounder - also on the Trawl Eye sensor. We were using three *SuperCatch* sensors and after an hour of towing the first Catch sensor was activated. I was very surprised because I had no indication that there was any catch until I studied the log of the Filling indicator (angle function). There I noticed a small change 30 minutes into the towing. I turned

immediately and towed the same area, and again I saw the same change in the Filling indicator. The result was 2 tons.

Over the next 48 hours we caught 50 tons of Catfish in this small area, after crossing it back and forth many times. Without the *SuperCatch* with Filling indicator we would never have discovered this small area which gave us 50 tons in 48 hours.



Skipper Willie Tait, Chris Andra (71 m):



Vidar Sigurjonsson, M/TR Thorunn Sveinsdottir (40 m):

# Super-Catch:

## Catch sensor, filling indicator – or both

**Scanmar SuperCatch meets all the requirements any fisherman could desire:**

- Correct and precise information
- New robust and reliable design eliminating the need for service and repair
- Labor savings
- Low operating costs and long lifetime providing very profitable investment
- Extremely long operation time

### Uses:

#### • Catch sensor

- Activation of the sensor with the stretch wire in the traditional way.
- Fast activation of stretch wire, important in large fish intake.
- Up / down notifications so that the trawl is not towed with the cod end upside down.

#### • Filling Indicator

- Indicates filling degree using both pitch and roll angle measurements on the bag.
- Pitch measurements show how the bag gradually fills up to the point where the sensor is mounted.
- Shows exactly where the fish intake is so that the vessel can be turned around to fish again in the area where the fish were detected.
- Roll angle (twist) shows how the bag twists when it begins to fill and how it gradually rights itself when it is filled.
- The sensor can be programmed for normal or quick updating.

### Sensor information:

#### • Construction

- New design with double casting of the electronics provides 100% protection.
- Scanmar's newly developed Super Plastic eliminates damage to the sensor due to blows, ten-

sion, or dragging along the bottom with a twisted trawl.

#### • Batteries operation time

- The new batteries have 10 times as much capacity as the old batteries.
- Transmission effect in sensors can be adjusted depending on the depth, something that in most cases will lead to a further increase in operation time.
- The sensor is always ready for use as a quick charge for a haul can be done in minutes.
- The improved battery capacity and increased time between charges means the battery can be used for many years before it must be replaced.

#### • Charging and programming

- Newly developed technology in the charger, the sensor, and the battery cartridge makes charging time a fraction of what is normal for this type of battery.
- Transmission power and frequency are easily programmed with the new charger.
- Choosing fast or normal refresh rate is also done easily via charger.
- The charger has features that can check both battery and sensor condition.



# Grid sensor

*Sorting grids were first used in the shrimp fleet (Pandalus Borealis) in the late 1980's. The purpose was to fish shrimp in areas where there were a lot of small fish, without getting this as bycatch. Since then, the use of grids has become increasingly widespread and they are now being tested in various fisheries.*

Scanmar developed early on a highly sophisticated sensor, Trawl Speed/Symmetry sensor, which very precisely measured water velocity into and across the trawl opening. To obtain absolute accurate measurements the sensor that was developed had an inclinometer (angle measurer) which was used to correct the measurement if the sensor was not lying horizontally.

It was therefore easy to create a variation of the sensor, the Grid sensor, which measures the water flow through the sorting grid and the grid's angle. Shrimp grids (Pandalus Borealis) are most efficient around 450.

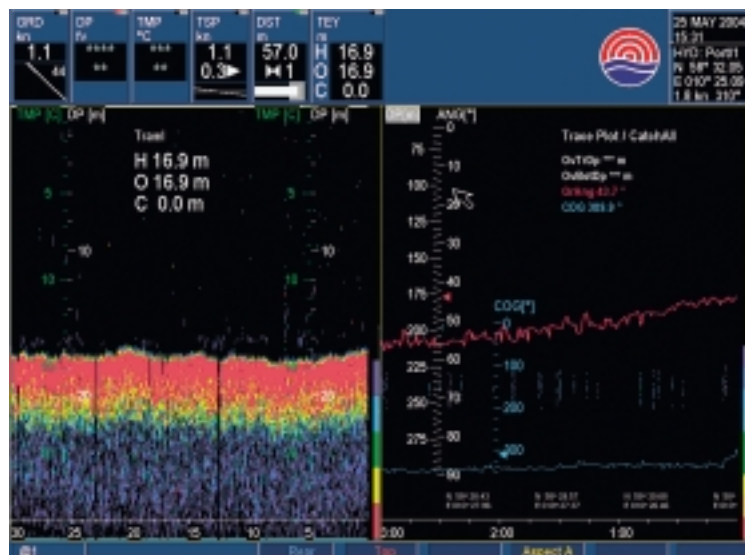
- Water flow through the sorting grid is the most important observation.

- It is not rare for the grid to be blocked by the skate, seals, sharks, rocks, etc.

- In some seasons there are large numbers of jellyfish that clog the mesh in the bag, so that water doesn't flow through. When this is the case it's time to end the haul.

- With shrimp (and fish with no swim bladder) the bag sinks as it fills. It is common to start the haul with an angle above 500 and end it when the angle approaches 37-380.

- Changes in the angle give a good indication of the catch at any time, and the log curve also shows where the influx was greatest.



Trawl Eye and Grid sensor used on a shrimp trawler. The shrimp influx is visible on the left side of the screen which displays the Trawl Eye's detection. It can also be seen as blue markings in the log image of the Grid sensor to the right. The grid angle has fallen (ascending curve) from about 550 to 440. Impact in the angle is corresponding to the influx of shrimp.

# Noise hydrophones

Fish are frightened by sounds, and various species are frightened by different sound frequencies. For a long time now, it has been the wish of many fishermen, especially in pelagic fishing, to get as close to the fish as possible.

Scanmar is developing a system which by means of measuring vessel noise frequency and level, can estimate the dis-

tance at which different kinds of fish are frightened. With this information it is possible to change the noise image and use the frequency and noise that scare the fish the least.

Hydrophones could also by logging noise levels over time tell if there is damage to the propellers or the vessel's noise picture is changing over time.

Great benefits with the SuperCatch technology:

- \* Quick Charging \*
- \* Long operation time \*
- \* Solid construction \*
- \* 5 year guarantee \*

# What does it take to fish as effectively as possible in all conditions?

*It can be hard to explain the reason for some things being more important to some fishermen than other, but we can look at the vessel and the different parts of the equipment:*

## The Vessel

The vessel's speed is important relative to the swimming ability of the fish, which varies depending on water temperature, time of day, etc. Vessel speed is also important with concerns to the trawl construction and water flow. It is the trawl speed through the water which is crucial, and underwater currents can result in a difference between the trawl speed and measured GPS speed.

The Trawl Speed sensor which shows the trawl speed through the water is therefore important, so that the vessel speed can be properly adjusted for the trawl to fish optimally. If the speed is too slow, it can result in fish escaping, and if it is too fast, it can result in a bucket effect in the trawl, expanded masks, and escaping fish.

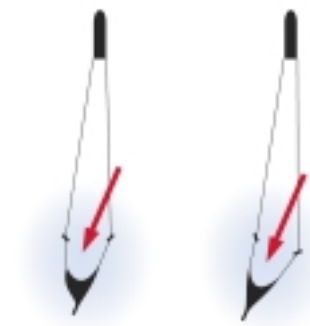
The Symmetry sensor is used for making sure that the warp lengths are adjusted to keep the trawl in balance around the water flow and to see that it is not tight on one side, while loose on the other, allowing fish to escape through the wide open masks.

The warp lengths which are adjusted to varying depth, weight of the doors, and tow resistance, is important for several reasons. Too short warp lengths relative to the depth result in gear and doors losing bottom contact. Also the trawl door's angles, especially the gradient is of great importance. Too long warp lengths result in poor contact with the equipment and can lead to unstable doors. The new SS4 Door sensor with Distance and Angle functions immediately shows if the doors are experiencing problems due to towing speed and warp lengths. Many fishermen believe that it is only important that the warp lengths are equally long, but that is only the case when the trawl is being towed perfectly behind the vessel without the impact of any underwater currents or uneven bottom conditions, so that the

water flow is at a 90 degree angle to the trawl opening.

## The Trawl

With proper towing speed and a water flow of 90 degrees into the trawl all the requirements for optimal fishing are met. Most people who trawl are completely dependent on seeing



Side current results in expanded masks and loss of catch.

Starboard warp is adjusted so that the trawl is in symmetry around the side current.

if there is fish where they are towing. It is often hard or impossible to see fish close to the bottom on an echo sounder. Scanmar's trawl eye has therefore been a very useful sensor. Because it sits on the trawl roof close to the fish entrance, the distance is short and the resolution is very good. While catch sensors previously have been irreplaceable for seeing where there was fish entering the trawl, and filling, SuperCatch with filling indicator has now taken over this role. With this new sensor the information is much more precise and exact, and fishermen benefit from being able to quickly react to fish entering.

## The trawl doors

When the trawl speed is correct and the warp lengths are properly adjusted, the trawl doors are the

most important part of effective fishing. Correct door distance is crucial for an accurate vertical opening, proper height, and that the bottom gear is stretched upward. This way you avoid adhesion and losing contact with the bottom.

The new door sensor with distance function and temperature correction (sound speed varies in water depending on temperature), secures exact measurements. The settle is adjusted with the towing speed and/or warp lengths.

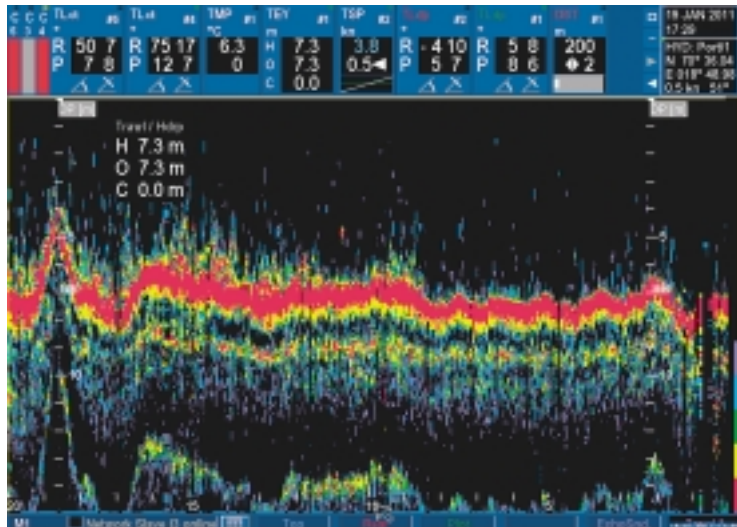
Having proper door angles is vital for having stable trawl doors. Unstable doors propagate to sweep and trawl, and towing resistance results in unnecessary wasteful fuel use.

The door sensor with angle function registers even the smallest deviation and notifies immediately when ever there is a risk that the doors could lose bottom contact. With pelagic fishing it is important that the doors and trawl are at the right depth relative to the fish. The depth function which is one hundred percent accurate secures this. Combined with temperature function this gives an accurate temperature profile, which can be used to correct the echo sounder.

## Conclusion:

Based on the feedback we have gotten from fishermen over the years, the following sensors are needed to have full control:

- Door sensor with Distance and Angle function
- Trawl Eye
- Trawl Speed / Symmetry sensor
- SuperCatch with filling indicator.



The trawl Eye picture clearly shows fish near the bottom.

# Flow sensors; a new family of current meters

*Through use of Scanmar sensors on fishing and research vessels it has been determined that wind, currents, towing direction and towing speed have crucial importance for the trawl's ability to catch.*



It has been 25 years since Scanmar launched the combined Trawl Speed/Symmetry sensor. It was obvious at that time that the fishermen were not familiar enough with underwater currents and the effect these had on efficient fishing. Fishermen towed according to GPS-speed and trusted the winch producers' statements that the trawl was correctly towed as long as the warps were equal and pressure on the winch was the same.

The new family Flow sensors consist of combined Trawl Speed/Symmetry sensor, pure Symmetry sensor and Tunnelflow sensor, and a half-brother: the Grid sensor.

## Trawl speed

All trawls have an optimal water flow. This varies with construction, mesh size, thickness of net material, knots, whether the material is new or old, etc. It is therefore important to tow at a speed that makes the trawl move through the ocean at the speed it was constructed for.

If the trawl moves too fast through the water a type of "bucket effect" is created in the trawl so that a pressure is formed in front of the trawl. If towing too slowly, fish (especially larger fish because of their swimming strength and endurance), are given a chance to escape.

Underwater currents, whether they are with the towing direction, against, or from the side, will lead to the water flow into the trawl deviating from what is optimal unless the GPS-spe-

ed is changed and the trawl is pulled so that the water current is 90 degrees in relation to the trawl opening.

The Trawl Speed/Symmetry sensor gives fishermen an opportunity to continuously adapt to changes in the water current so they always have the "correct" towing speed and symmetry.

## Tunnelflow or Trawl Speed sensor in the belly

Because the trawl's circumference is smaller and the mesh is smaller further back in the trawl, a lot of the water has to get out through the side panels. This is when a "Bucket effect" occurs, which makes the mesh stretch. If this happens in an area with large mesh the fish escape or the trawl will be "coated".

When the trawl bag fills, the "bucket effect" will increase and move forwards in the trawl. Therefore we see that it often takes a very long time to fill the front part of the bag. Usually it will pay off to haul in and shoot again.

The Tunnelflow sensor shows the water flow and angle changes caused by bucket effects, while the Trawl Speed sensor shows the water flow and skewed position. Both show how the water flow is affected by the bucket effect and/or that the trawl is stretched out when the fish get to the back of the belly.

## Symmetry

If the trawl does not move symmetrically through the water current the direction of the water flow (the water flow given from the direction the vessel is moving in and side current) will come at a skewed angle at the opening. In this situation the whole trawl will be asymmetrical, the mesh on the opposite side of the current will stretch, the water flows through the mesh, and fish/shrimp escape. The Symmetry sensor has twice the working time as the combined sensor and can be used alternately by changing the battery.

# Trawl Eye – an advanced "echo sounder" placed on the trawl

More than a thousand Trawl Eyes have been sold since their introduction in 1990. The Trawl Eye is suitable for use in bottom trawling as well as pelagic trawling in most fisheries around the world. Many of the species are in fact impossible to see on an echo sounder or sonar, and trawling without a Trawl Eye is like fishing blindfolded.



Amongst the twin rig trawlers there are currently many that use a Trawl Eye on each trawl to compare the trawl openings, seabed contact and not to mention the catch entrance. When they have more entrance in one trawl they move sideways so that they achieve maximal entrance in both trawls.

Because the Trawl Eye, when placed on the headline, is close to where the fish are, it has much better detecting ability than anything correspondingly mounted on the vessel. A skipper with experience will therefore easily determine whether it is fish or bait, and if he is fishing for the "right species" and not wasting time and resources unnecessarily.

More and more of those who do pelagic trawling have begun to use an extra Trawl Eye in the belly, often together with a Flow sensor or an Angle sensor, in order to ensure that what they see in the trawl opening ends up in the back of the bag.

## Two different types of Trawl Eye

With the many areas of application and different fisheries, Scanmar was quick to see the need for two variations of the Trawl Eye. The broad beam Trawl Eye was first introduced to the market intended for trawls with low opening and is today largely used for catching white fish. In fishing for shrimp or species that keep close to the seabed, the narrow beam Trawl Eye usually offers the best detection abilities.

Narrow beam Trawl Eye is usually used in pelagic trawling as well.

## Bottom trawling

The Trawl Eye gives precise information of the trawl opening and contact with or clearing from the seabed. For bottom trawling you can therefore keep the trawl down on the seabed and avoid that it lifts in areas where essentially all the fish enters, i.e. in the center of the trawl.

To achieve the best possible results it is important that the Trawl Eye is mounted securely tight and directly over the bottom gear. Many trawls have to a greater or lesser extent an overhanging ceiling. With a Trawl Eye on the headline one will in this case not be able to determine whether the trawl presses on or lifts from the seabed. In these cases it would therefore be correct to move the Trawl Eye back onto the top of the trawl so that it will be as close as possible to being right above the bottom gear. By sowing in a suitable bag into the net line with a safety rope up to the headline, the Trawl Eye will be placed precisely and securely every time.

## Pelagic fishing

In pelagic trawling, a narrow beam Trawl Eye is most commonly used both in the trawl opening and in the belly. The application areas are more varied in comparison to bottom trawling. Many use the Trawl Eye as a headline sensor instead of trawl sonar or when the trawl sonar is not working because of broken cables or other faults. This allows the fishing to continue. Some skip the trawl sonar in certain types of trawling and only use Trawl Eye.

In pelagic fishing when it is important to be as close to the seabed as possible while avoiding landing on the seabed and snagging, the Trawl Eye's resolution is vital and trawl sonar does not give sufficient accuracy.

In Iceland we see that skippers use the Trawl Eye on the ground rope when fishing closely to the seabed. They use low range, which provides

further increased precision. Additionally the Trawl Eye is programmed with upward view to see the fish that enters.

The skipper, Gisli Runolfsson, on the trawl Bjarni Olafsson, explains it this way:

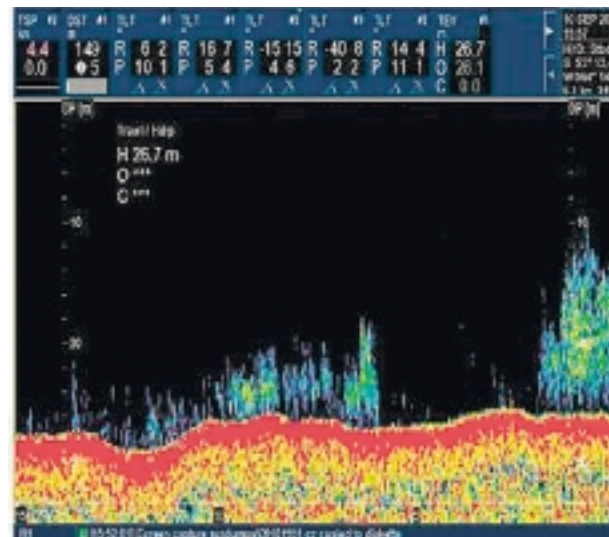
- When fishing close to the seabed I always use Trawl Eye on the ground rope in order to get as close as possible. I program the Trawl Eye to seeing 15 meters up and 15 meters down. On the cable sonar the ground rope is so wide it gives too strong an echo to provide precise information of the distance from the ground rope to the seabed. At the same time the upward view is important in order to see when the herring comes over the ground rope and begins to enter the trawl.

## Trawl Eye in the belly

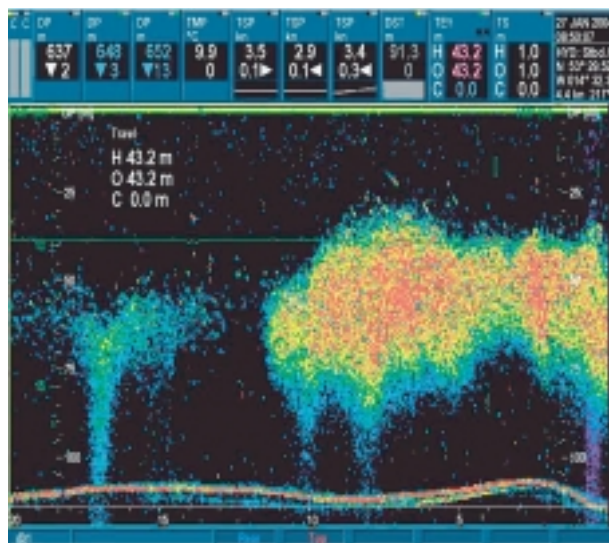
Trawl Eye in the belly is also an important area of use in pelagic trawling. Placed in a net bag stitched into the center of the net ceiling in the required area of the belly, it shows height, entrance, and where appropriate, distance to the seabed. You can also see if any of the fish escape outside or under, or, by programming the Trawl Eye to look upwards, over the trawl caused by the fish escaping through the mesh further ahead.

If you do not have the expected opening in the belly, this may be due to poor water flow or simply if the trawl is tangled further ahead (even though everything looks ok on the trawl sonar). As the cod end fills, the opening (and water flow) will reduce. In many cases it will be sensible to haul before the bag is completely full and shoot again instead of continuing to tow for a long period of time for the bag to fill completely.

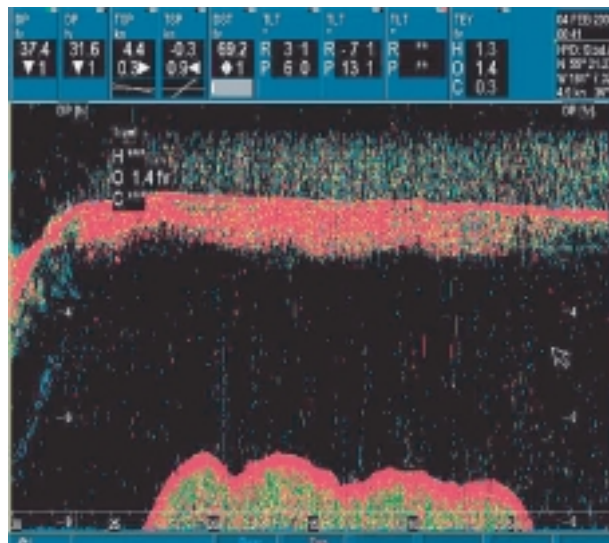
The entrance into the belly also shows if your trawl is correctly positioned vertically in relation to the fish. In many cases the entrance on the trawl sonar turns out to be bait that does not end up in the back of the trawl. Many also use this sensor to register the size of the fish. Large and small fish can use different time from the opening until appearing in the tunnel.



Clear detection of "Hoki" close to the seabed.



Pelagic fishing



Trawl Eye in the belly

Scanmar – Your eyes under water



# Trawl Speed/Symmetry and Door Angle sensor – alpha and Omega

*More and more fishermen are starting to realise how unbelievably important this combination is for efficient fishing. With the help of these sensors you can have full control over the trawl geometry while simultaneously assuring optimal towing speed.*

Fishing along a slope, seabed conditions, underwater currents etc. have a great impact on the trawl doors and they are often significantly less efficient than they should be. Underwater currents create in addition big problems for the trawl's ability to catch, either because bucket effects form in the trawl opening and in the trawl or because the trawl is not symmetrical in relation to the water current. Which again leads to fish escaping through the side panels in the front of the trawl where the mesh is bigger.

It is not only the trawl's horizontal and vertical opening that is important for trawl geometry, but also the trawl's symmetry around the water current. This is a more and more widespread perception. We see an array of even quite small vessels, both single and twin trawlers that use the Symmetry sensor, often together with the Distance sensor, as their most important information source for efficient fishing.

This is not very surprising because it immediately affects the amount of catch if the trawl is skewed when towed through the water current.

Seeing so many use combined Trawl Speed/Symmetry sensors they have realized the importance

of correct towing speed. Then the question arises: what do the door angles mean for symmetry and towing speed and fuel consumption?

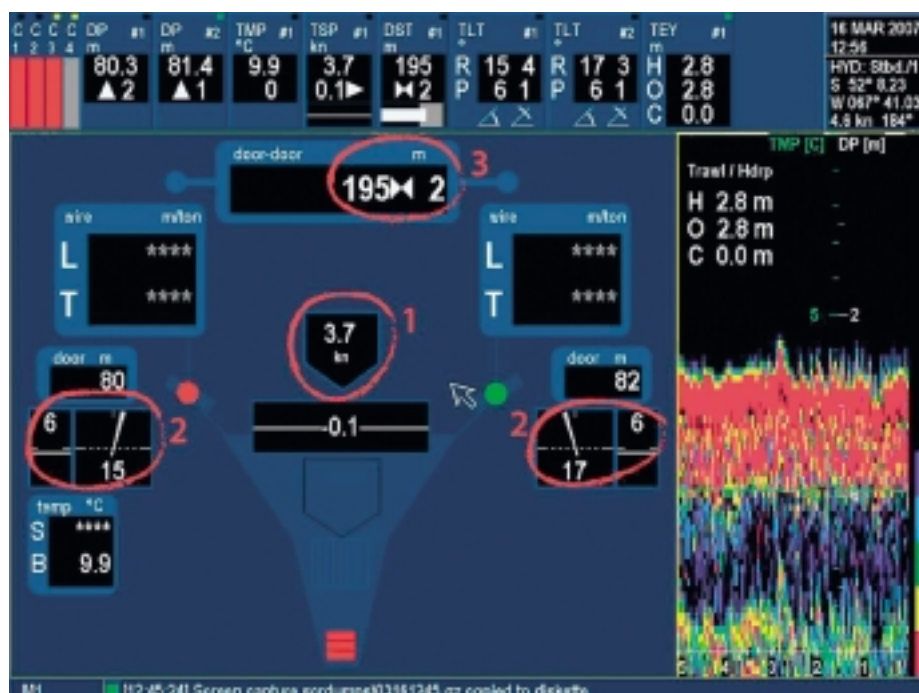
Most people understand that when the doors are not vertical they are not as efficient as they should be, but how important is that? On the basis of what one learns by using the Trawl Speed and Symmetry sensors one really begins to understand the importance of Door Angles, and especially the roll angle, for efficient fishing.

Many have therefore bought or tried the Door Angle sensor, and the truth is that most, even though they are aware of the sensor's importance, experience that the significance is much greater than expected.

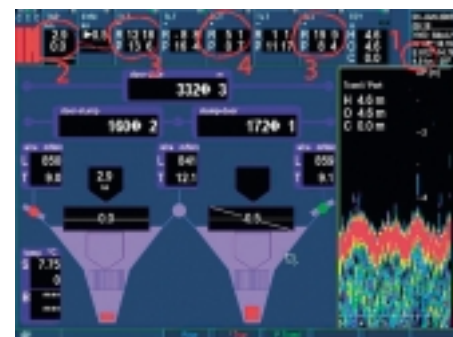
What perhaps baffles most people, us included, is how sensitive the doors are under towing. The accuracy of the sensor readings is therefore crucial for a good result. The measuring head on the Trawl Speed/Symmetry sensor is made from special components and the sensors are put through extensive calibrating tests in a special flume tank before they enter the market.

Likewise the accuracy is extremely important for the Door Angle sensors; Scanmar has constructed them so that they can be mounted directly on the door blade, parallel to the shoe, and calibrating is done in a hand turn with an instrument that is included.

The interaction between the Towing speed (water current into the trawl), the trawl doors' roll angle and the warp length makes it possible to adjust the gear much more accurately than one would think. Especially when a side current comes into picture, it could otherwise present problems. Uneven sea-



(1) Reduced Trawl Speed leads to (2) the doors laying down inwards and (3) reduced door distance.



The haul is going on during a strong current with the towing direction. (1) GPS 4.9 knots, (2) TS 2.9 knots. This results in unstable doors (3) but double trawl and the gear hard in the bottom results in sustained contact with the bottom.

bed, in slope and poor weather also make it difficult.

We see that more and more are aware of the combination of Trawl Speed/Symmetry sensor and Door

Angle sensor, and we receive feedback that is very encouraging to us.

## Full control at a glance; – solve problems before they occur

**During towing there are only two things you can do to affect the trawl geometry and fishing ability (apart from changing course):**

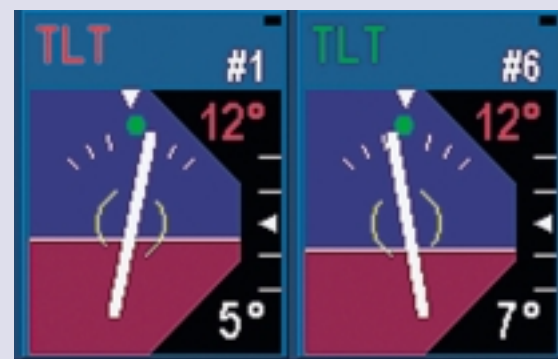
- Change the towing speed (water flow into the trawl)
- Change warp lengths

**On the other hand there are many factors over which you have no control that influence trawl geometry:**

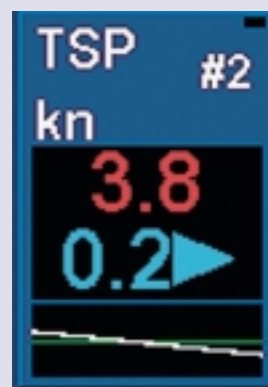
- Bottom conditions
- Depth variations
- Underwater currents
- Fish influx and filling

Although you cannot control these conditions you can immediately

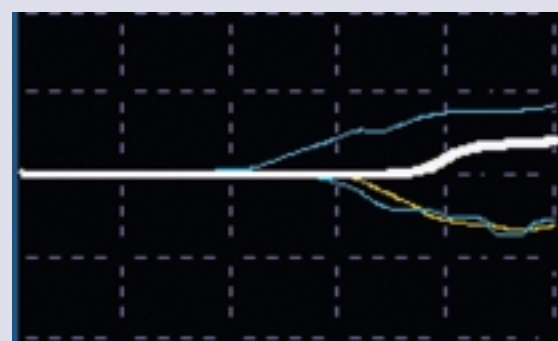
detect them through changes in door distance, towing speed or door angles. You must therefore focus on door angles and towing speed in order to obtain the correct door distance. If you have rigged the doors correctly, you can focus entirely on ensuring that the doors have the correct tilt angle. This you correct easily by adjusting the towing speed and in some cases by a small adjustment of the winches (Scanmar has patents for steerable trawl doors). Scanmar has developed the program *ScanTrack* that processes and displays information so you instantly see if everything is on line or if you must take action to prevent problems from occurring.



Door Distance



Trawl Speed



Follow the thick line:  
Above: Increase speed  
Under: Reduce speed