STABILIZED

MAQ SONAR COMPANY
DIVISION OF HELO ENTERPRISES INC.

Operator Manual
Applies to Software Version V10
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It is important you read this page and its warnings

1. Never turn on the sonar when the boat is not in the water.
2. The transducer is designed to operate immersed in water only. The unit can be damaged if the system is forced to transmit when exposed to open air.
3. The system must NOT be powered up while the vessel is in dry dock unless the Transceiver unit HIGH VOLTAGE switch is in the OFF position.
4. When the Sonar unit is turned on, it is critical to ensure there is enough water depth under the boat before lowering the transducer.
5. We recommend any repairs be carried out by an authorized MAQ technician.
6. Please perform regular maintenance on the hoist to ensure trouble free hoist operation.
7. Zinc Anodes must be inspected and/or replaced yearly.
INTRODUCTION

- Basic principles of how sonar works
- What will affect Sonar detection and what can be done to maximize fishing detection
- Depth of the water
- Terrain and features of the bottom of the sea
- Impact of salinity
- Rough Seas
- Interference from Sonar and sounders nearby
- Temperature of the water and thermocline
Basic principles

Sonar is the transmission of sound waves in beam form from the transducer. Targets reflect the sound and are detected when the beams return to the transducer which is displayed on the monitor. Speed of sound through water is about 1500 m per second. MAQ has been told how the fish school can be seen moving on the display at 250 m range. At this range the screen is updating 3 times a second which can explain how the targets actually appear to be moving on a display. The shorter the range scale, the quicker the updates.

Fishermen are now upgrading from searchlight Sonar to Omni sonar systems. It was explained to MAQ the difference is like going from watching a slide show to the whole cartoon.

A periscope on a submarine can only look in one direction at a time and must see what is in the other directions, sector by sector. Searchlight Sonar works in the same way. To find fish, a set of elements move around a center core and shows the fisherman the sea one sector at a time. Since the vessel is not stationary, it is possible for a fisherman to sail by a school of fish without ever seeing it because the fish are out of Sonar range by the time the “searchlight” moves to that side of the vessel. With conventional searchlight Sonar it would take 32 seconds to train full circle for 400 m range at 6° steps.

Instead of having one row of Sonar elements facing in one direction and moving around 360° over a period of time such as searchlight Sonar, Omni Sonar has 256 Sonar elements on a cylindrical core sending continuously in a full circle of 360°. There are no moving parts. It takes about half a second to complete a full circle scan for a 400 m range.
What will affect Sonar detection and what can be done to maximize fishing detection

Many conditions can affect how the Sonar works. Water conditions, different terrain, temperature are the major ones.

Depth of the water

- With the 5° narrow vertical beam the operator has a much better chance for success especially in shallow water fishing. The 5° beam height is 1/10 of the range that is selected. As an example at 1000 m the beam will be 100 m in height. A 10° beam doubles the number or 200m height. The doubling of the beam can mean echoes from the surface or the bottom resulting in shorter detection distance.

Terrain and features of the bottom of the sea

- There are two types of bottoms which affect detection distance: “Rock Bottoms” and “Sand/Silt Bottoms”.
• Using a 5° vertical beam the following observations are noted:

<table>
<thead>
<tr>
<th>Bottom Type</th>
<th>Detection Distance</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand/Silt</td>
<td>20 m per 1 m depth</td>
<td>On sand or silt bottom a MAQ Sonar will achieve 20 m detection distance for every 1 m of depth in worst conditions. This means when fishing in an area with a sand/silt bottom at 30 m depth, maximum detection distance will be about 600 m. This will increase depending on water conditions.</td>
</tr>
<tr>
<td>Rock</td>
<td>10 m per 1 m depth</td>
<td>On rock bottoms a MAQ Sonar may achieve 10 m detection distance for every 1 m of depth. This means when fishing in rocky bottom water at 30 m depth, maximum detection distance may be as little as 300 m. This will increase depending on water conditions.</td>
</tr>
</tbody>
</table>

Impact of salinity

• The concentration of salt directly affects the performance of the Sonar. The lower the salinity the better the performance. As an example the Baltic Sea has a salinity of 12 ppt. (parts per thousand) while the Red Sea is at 40 ppt. It would be normal that Sonar performance in the Baltic Sea would be superior to the Red Sea.

• When fishing where the mouth of a major river enters the ocean, it would be normal to expect lower salinity numbers due to the mixing of considerable fresh water with the salt water.

• This is where the adjustment of the gains will be important depending on the conditions.

Rough Seas

• It is recommended the operator use the Stabilized modes in these. See the chapter on Operator Panel for more details.

Interference from Sonar and sounders nearby

• This cannot be avoided; the operator can make adjustments to ensure the effect from nearby devices is minimized.

• Within the MAQ menu there are selections which can be used to minimize these effects such as IR- Interference Rejecter and PC-Picture Correlation which are found on the STP Setup Panel.
Temperature of the water and thermocline

- Air temperature and sunlight can heat and cool the surface water to varying depths of the ocean which can affect performance.
- As cold water meets warm water a thermocline layer is in evidence. A thermocline can have the effect of refracting the Sonar beam and reducing the detection distance. Thermocline is a condition which needs to be considered depending on the region of the world.
QUICK START

- Turning on the Power
- Lowering and Raising the Transducer
- What will be seen on the Display
- Operation of the Joystick
- Menu Panel
- Default Settings
- Optional Keypad Control
Now the system is on, the transducer is lowered and Sonar operations can commence.

What will be seen on the display?

Below is a typical Sonar screen which has a brief explanation of the various items which might be seen on a sonar screen.

On the right hand side is the Main Menu and in this particular screen shot the Operator OPR panel is on the display. This is the panel the operator will use the majority of the time for fishing operations.

Items which are highlighted are:

Water temperature, cursor position, GPS coordinates, wake trail, true north indicator, range rings, compass rings, vessel heading and speed relative to true north, depth at cursor, cursor range and bearing (from vessel) and display cursor.
Keypad Control (Optional)

The Keypad Control allows operators to change various settings with the push of a button. Controls available on the keypad are listed below. Keypad is backlit for night operations.

<table>
<thead>
<tr>
<th>PST (Pre-sets)</th>
<th>BR (Monitor Brightness)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM (Auto Mark)</td>
<td>MM (Manual Mark)</td>
</tr>
<tr>
<td>GN (Gain)</td>
<td>Cursor Movement Direction</td>
</tr>
<tr>
<td>NG (Near Gain)</td>
<td>RG (Range)</td>
</tr>
<tr>
<td>FG (Far Gain)</td>
<td>TL (Tilt)</td>
</tr>
<tr>
<td>NET</td>
<td>FL (Filter)</td>
</tr>
</tbody>
</table>

![Keypad Control Diagram]
OPERATION PANEL

- Mode of Operation
  - Stabilized Mode
  - Auto Track
  - Event Marker

- Operator Panel
  - Range
  - Tilt
  - Gain
  - Near Gain
  - Far Gain
  - Receive Vertical Beamwidth
  - Transmit Vertical Beamwidth
  - Filter
  - Pre-sets
EM: Event Marker

This feature requires that latitude, longitude, speed and bearing information are available through the GPS port.

There are three selections for Event Marker:

**AM Auto Mark**
The system will automatically place a mark on the target under the cursor each time the external navigation information is updated. The position of the target is tracked until the cursor position is altered by moving the joystick.

The initial mark is then used as a reference for calculating the speed and heading of a school of fish (*this data shown in the Menu Item Description area of the Operate Panel when subsequent event marks are performed*).

When the selection is set back to the OFF position, all event marks are erased.

**MM Manual Mark**

There are two types of Manual Mark: Event Marks and Vessel Position Marks. 10 marks are available for each type of marker. When this limit has been reached, the oldest marker is removed to be replaced by the current mark. The range and bearing to the latest mark of each type are displayed at the bottom/right corner of the Sonar display.

**Entering an Event Mark**

The cursor must be away from the vessel position (center of the display).

Marks the position at the cursor with an X and links back to the vessel with a gray line. Relevant data is then sent to the plotter device (*if connected to the system*).

Subsequent marks are numbered and linked with a gray line. After the target has been marked, the system will switch back to the OFF position and the event mark will remain in storage.
On the following page are the range scales which are currently available for use. Each range scale selection is farthest ring from the center and the range is then divided by the number of rings (4) and each ring is \( \frac{3}{4} \) of the distance of the range selection.

### 22 kHz Feet

<table>
<thead>
<tr>
<th>300</th>
<th>450</th>
<th>600</th>
<th>1000</th>
<th>1250</th>
<th>1500</th>
<th>2000</th>
<th>2500</th>
<th>3000</th>
<th>4000</th>
<th>5000</th>
<th>6000</th>
<th>7000</th>
<th>8500</th>
<th>10K</th>
<th>12K</th>
<th>13.5K</th>
<th>15K</th>
<th>16.5K</th>
<th>18K</th>
</tr>
</thead>
</table>

### 22 kHz Meters

| 100 | 150 | 200 | 300 | 450 | 600 | 800 | 1000 | 1250 | 1500 | 1750 | 2000 | 2500 | 3000 | 3500 | 4000 | 4500 | 5000 | 5500 | 6000 |
|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|

### 22 kHz Fathoms

| 40  | 80  | 100 | 150 | 200 | 300 | 400 | 500 | 650 | 750 | 850 | 1000 | 1250 | 1500 | 1750 | 2000 | 2250 | 2500 | 2750 | 3000 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|

### 22 kHz Yards

| 100 | 150 | 200 | 300 | 450 | 600 | 800 | 1000 | 1250 | 1500 | 1750 | 2000 | 2500 | 3000 | 3500 | 4000 | 4500 | 5000 | 5500 | 6000 |
|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|

### 60 kHz Feet

| 150 | 240 | 300 | 360 | 450 | 600 | 900 | 1200 | 1500 | 1800 | 2100 | 2550 | 3000 | 3750 | 4500 | 5250 | 6000 | 6750 | 7500 | 8000 |
|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|

### 60 kHz Meters

| 50  | 70  | 100 | 120 | 150 | 200 | 300 | 400 | 500 | 600 | 700 | 850 | 1000 | 1250 | 1500 | 1750 | 2000 | 2250 | 2500 | 2700 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|

### 60 kHz Fathoms

| 30  | 40  | 60  | 80  | 100 | 130 | 160 | 200 | 250 | 300 | 350 | 400 | 500 | 650 | 750 | 850 | 1000 | 1100 | 1250 | 1350 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|

### 60 kHz Yards

| 50  | 70  | 100 | 120 | 150 | 200 | 300 | 400 | 500 | 600 | 700 | 850 | 1000 | 1250 | 1500 | 1750 | 2000 | 2250 | 2500 | 2700 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|

### 90 kHz Feet

| 100 | 120 | 150 | 180 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 1000 | 1200 | 1400 | 1600 | 1900 | 2200 | 2600 | 3200 | 4000 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|

### 90 kHz Meters

| 30  | 40  | 50  | 70  | 100 | 130 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 550 | 600 | 700 | 800 | 1000 | 1200 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|

### 90 kHz Fathoms

| 20  | 30  | 40  | 50  | 60  | 80  | 100 | 120 | 140 | 160 | 180 | 200 | 220 | 240 | 260 | 280 | 300 | 350 | 450 | 600 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|

### 90 kHz Yards

| 30  | 40  | 50  | 70  | 100 | 130 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 550 | 600 | 700 | 800 | 1000 | 1200 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|

**TL: Tilt**

The Tilt control sets the tilt angle of the Sonar beam. The range of selection is 10° to -46°.

If the tilt angle is too severe upwards surface echoes near to the vessel may be received. To correct this issue reduce tilt angle and surface echoes will recede.

Alternately if the tilt angle is too severe downwards and especially in shallow waters, bottom echoes near to the vessel may be evident. To correct this issue adjust tilt angle towards zero and bottom echoes will recede farther from the vessel. Additionally if tilt angle is too severe downwards grating lobes can become stronger creating false echoes near the boat.
A good thing to think about when tilt angles are being considered is with a 5° beam there is a beam height of 1/10 the range selected. As an example at 400 m the beam would be 40 m high.

**GN: Gain**

The Gain control sets the overall receive sensitivity of the Sonar display. The range of selection is 0 to 28 in increments of 0.5.

If the screen has too many echoes, which are neither surface nor bottom, then the gains can be adjusted to achieve a cleaner picture. The Gain setting adjusts the overall receive sensitivity of the Sonar.

Note, if Gain is turned down too low, small schools and skimmers will not be detected. The risk is that as the Gain is turned up, unwanted echoes may be received. It is a balancing act based on distance and the species of fish involved.

**NG: Near Gain**

This setting adjusts the gain curve for targets close to the transducer to compensate for target size. The range of selection is 0 to 14.

Near Gain adjustments are used to reduce surface and bottom clutter as the target approaches the vessel. It is effective on ranges below 1000 m. After 1000 m Near Gain has reached its limit of effectiveness and no longer affects the display Gain.

**FG: Far Gain**

The Far Gain control adjusts the gain curve to compensate for signal attenuation at long ranges due to water temperature and salinity effect.

If a target of a given size and density changes strength as it approaches the vessel from the outer regions of the display the Far Gain setting must be corrected:

- Reduce the setting if the target strength decreases as it moves in.
- Increase the setting if the target strength builds as it moves in.

Slight alteration of the Gain (GN) control may be required after making this adjustment. The range of selection is 0 to 60.
FL: Filter

The Filter control sets the overall receive bandwidth of the Sonar display. The range of selection is 0 to 20 (20 being the maximum filter level). The system will override the Filter setting (the FL lettering will turn the color of an unselected menu item - in this example red) when the Range (RG) setting or the Pulse Length (PL) selection is sufficiently short to require less filtering.

This feature will smooth the picture. To remove unwanted echoes on the screen and allow the target to be seen more clearly increasing the filter setting can sometimes be the solution. This is particularly true with large schools.

The opposite applies to dispersed schools, like tuna and skimmers as many times these will appear as blips on the screen and with the filter set high these targets may disappear from the screen.

PL: Pulse Length

PL sets the length of the transmit pulse. Three selections are available:

- **S** Short pulse for maximum echo resolution
- **M** Medium pulse
- **L** Long pulse for long distance detection

On fast moving fish and small targets use the shorter the pulse lengths. This will result in better discrimination. For instance on tuna, use of short and medium pulse is recommended for the best chance for detection of small tuna. For larger schooling fish it may be better with long pulse on long range targets and short/medium pulse as targets move in closer. For dispersed schools, tuna and/or skimmers, the shorter the pulse length chosen the better the chance of success.

PST: Pre-set Panel

*Please see the Preset panel chapter for further details.
PRE-SET PANEL

• Enabling PST Function
• Sorting Pre-sets
• Edit a Pre-set
• Using Pre-sets
SETUP PANEL

- Trawl Mode
- Range Units
- Operating Language
- Audio Select
- Picture Correlation
- Interface Rejecter
- Echo Decay
- Transmit
- Transmit Pulse
- Auto Range
- Filter Bandwidth
- Noise Rejecter
- Reverberation Controlled Gain
- Vessel Speed
- Fish Speed
**TRL: Trawl Mode**

Trawl Mode allows the operator to simultaneously operate the Sonar at two separate ranges, tilt angle, gain and filter settings using a single transducer. Each Sonar presentation is renewed on alternating transmissions. See Chapter 6 for full details.

**RU: Range Units**

RU sets the unit of measurement for range and depth. Selections are:
- feet
- m
- fm
- yd

**OL Operating Language**

Sets the language displayed in the menu item description. There are 12 languages presently available *(standard)*.

Eng 	 English
Fra 	 French
Esp 	 Spanish
Sve 	 Swedish
Pt 	 Portuguese
Tür 	 Turkish
Ita 	 Italian
Russ 	 Russian
Nor 	 Norwegian
Dan 	 Danish
CH 	 Chinese
VNM 	 Vietnamese
A-Scan

This feature is disabled when the system is in Trawl Mode or in Simulator Mode.

The A-Scan feature displays the information stored by the audio channel in the direction of the cursor. This feature provides an effective method of detecting weak echoes in a noisy environment such as bait or reverberation.

The cursor position in relation to the waveform is indicated by a dotted yellow line while the range ring positions are shown as light blue lines in the background of the window.

The window position will shift to the upper section of the Sonar display when the cursor is moved to the lower half of the display.
A-Sweep
This feature is disabled when the system is in Trawl Mode or in Simulator Mode.

The A-Sweep feature is identical to the A-Scan feature with an expanded sweep window to view the waveform area highlighted on either side of the cursor position.

The window position will shift to the upper section of the Sonar display when the cursor is moved to the lower half of the display.
FS: Fish Speed

This control determines the highest amount of Doppler (frequency shift due to movement) the sonar will accept from fish echoes.

FS allows for a wider Bandwidth (frequency) response of the sonar relating to the fish. This control will also affect targets which are up or not solid. These targets tend to have a broader bandwidth response.

FS will have the greatest effect when using Long Pulse as long pulse response is in a much narrower band than short pulse.

So while it makes sense for FS to be used on fast moving fish such as tuna it is also very effective on large schools for better discrimination and detection on long pulse.

The system will automatically adjust the Fish Speed setting (*the FS lettering will turn the color of an unselected menu item - in this example red*) when the Range (RG) setting or the Pulse Length (PL) selection is sufficiently short to require less Fish Speed filtering.

Use the selector to set the expected speed of the target fish in knots.
TRAWL PANEL

- Enabling the Trawl Panel
- Trawl Panel (Dual Beam Control)
- Trawl Depth Trace
Trawl Mode allows the operator to simultaneously operate the sonar at two separate Range, Tilt, Gain and Near Gain settings using a single transducer. Each sonar presentation is renewed on alternating transmissions.

Enabling the Trawl Panel

The Trawl Panel is only present when the Trawl Mode (TRL) is engaged and is inserted between the Operate Panel and the Setup Panel in the Panel Select area.

Go to STP Panel and go to the first selection TRL and select ON to enable Trawl Panel. Notice in the second panel that TRL has been added to the main menu line. Select TRL.
Trawl Panel (Dual Beam Control)

The Trawl Panel presents two sets of distinct display controls for operation of the sonar. Range (RG), Tilt (TL), Gain (GN) and Near Gain (NG) settings are adjusted independently for the upper and lower displays.

Auto Operations (AO), Event Marker (EM) and Reverberation Controlled Gain (RCG) selections are duplicated here from the Operate Panel for easy access while in Trawl Mode.

When the cursor is operated in the upper display, all cursor related information on screen is based on the information obtained during processing of the upper display (range, bearing and depth at cursor as well as navigation information).

While the lower display remains in basic Omni Mode, many of the standard system features (Picture Correlation, Vertical Profile, etc.) are available for the upper Trawl Mode.

In Trawl Mode the displays refresh alternatively. The speed of refresh is determined by the time it takes the longest range display to refresh.

In Trawl Mode there are two display options. The Operator may select either:

- One front facing display and one rear facing display or
- Two front facing displays.

Front-Rear Display

Front-Front Display
Trawl Depth Trace

When in Trawl Mode changes in depth at the cursor, between transmissions, will be reflected on screen as seen in the picture on the next page. The green line indicates the distance between the points while the change in depth is shown in yellow text at the vessel position of the upper display.

The display will be shown for one transmission and only if there has been a change in depth.
DISPLAY PANEL

- Clutter level
- Display Brightness Level
- Peak Discrimination
- Color Resolution
- Background Color
- Control Side
- Range Rings
- Display Enhancement
- Text Colors
- Text Brightness Level
CL: Clutter Level

The Clutter Level control features two modes of operation:

**Color Elimination** *(Settings 1 - 6)*
Adjust to eliminate the lower strength signal display colors.
A setting of 0 disables the elimination whereas 6 is the maximum elimination level.

**Clutter Reduction** *(Settings 1a - 6a)*
Alters the response curve of the system colors to reduce the display reaction to lower strength signals.
A setting of 1a provides the minimum reduction and increases to the maximum setting of 6a *(does not eliminate colors).*

*Note: CL may reduce the detection capability of hard to detect species such as individual Tuna.*

Sonar Display Brightness Level

Adjust the brightness level of the sonar display.

PD: Peak Discrimination

Extends the color range of the system to indicate the dense regions of a strong echo. If using 8 color resolution, the dense region will fall from red to darkness.

When using the 64 color resolution, the dense region will climb from red to pink *(a dark line will also be introduced to further highlight the target peaks).*

Selections available:

<table>
<thead>
<tr>
<th>1</th>
<th>Normal color palette</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>The dense region will fall from red to darkness</td>
</tr>
<tr>
<td>1</td>
<td>The dense region will climb from red to pink <em>(a dark line will also be introduced to further highlight the target peaks—available in Lo-RES only at this time)</em></td>
</tr>
</tbody>
</table>
**TtT: Text Colors**

Adjusts the color scheme used by the system for menu text.

**Selections (Highlight color/Secondary color):**

- **A** Yellow/Red
- **B** White/Gray
- **C** Green/Dark Green
- **D** Cyan/Blue
- **E** Blue/Magenta
- **F** Red/Dark Red

**Aop → Fop**

Uses the same color scheme as matching parameters above but reduces brightness of all other controls on Operate Panel except Range, Tilt and Gain for night operation of the sonar *(only when Range, Tilt or Gain are the selected menu item)*.

**Text Brightness Level**

Adjust the brightness level of the text.
TONNAGE PANEL

- Using the Tonnage Estimator
- Reset Estimation
NET PANEL