USER MANUAL

The CM2 SIDESCAN SONAR SYSTEM

CONTENTS

Please note that this manual does not describe systems using MaxPro software, nor those using the C-Case deck units. For those systems please refer to earlier versions of the manual. In case of difficulty contact C-MAX Ltd or their local representative.

continued ...

continued ...

(This page intentionally blank)

1. SUMMARY OF WARNINGS

The warnings summarised here are intended to prevent injury to personnel and damage to equipment in what can be a hazardous environment.

OPERATORS OF THIS EQUIPMENT ARE RESPONSIBLE FOR THEIR OWN SAFETY

THE SUPPLIER ACCEPTS NO LIABILITY FOR THE CONSEQUENCES OF EQUIPMENT USE OVER WHICH IT HAS NO CONTROL

DO NOT ALLOW THE TOWFISH TO STRIKE THE BOTTOM OR OBSTRUCTIONS; THE TOWFISH SINKS WHEN THE BOAT TURNS OR SLOWS

USE GLOVES TO HANDLE ALL STEEL-ARMOURED TOW CABLES

NEVER ALLOW SLACK IN THE CABLE WHILST THE TOWFISH IS DEPLOYED

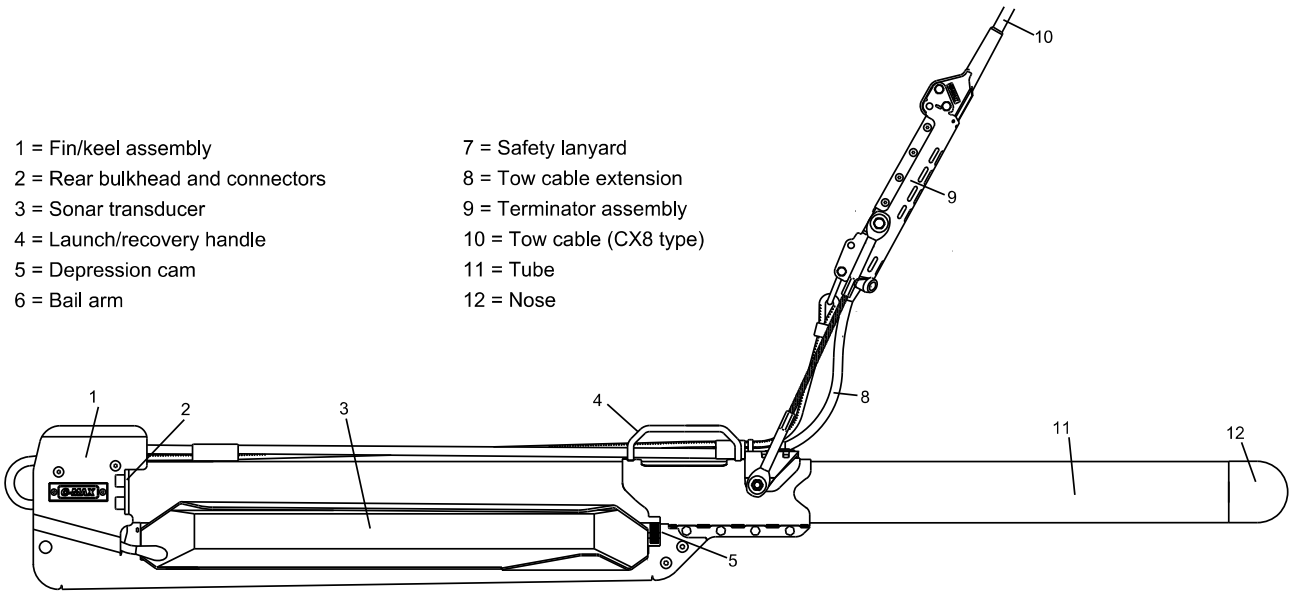
DO NOT EXPOSE THE TRANSDUCERS TO HEAT FROM STRONG SUNLIGHT

ENSURE THAT ALL ELECTRONIC UNITS ARE DRY BEFORE STORAGE

2. SYSTEM COMPONENTS

Towfish

The towfish is the acoustic sensor head. It transmits a very high frequency acoustic pulse (“ping”) at regular intervals and receives the series of echoes that result from each ping.



Standard Towfish and Tow Cable Terminator

Two types of CM2 standard towfish are available, namely EDF (325/780kHz) and DF (325/100kHz). Both are identical externally. These are digital towfish, communicating with the surface electronics via the tow cable.

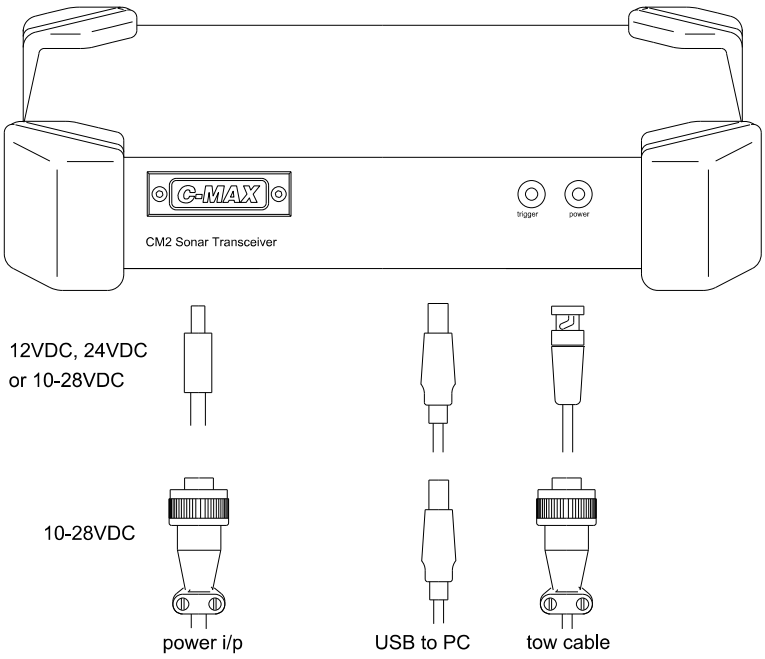
The optional wing depressor for the standard towfish is described in Section 19.

The alternative DeepTow towfish and its cable terminator are described in Section 16.

Optional additional sensors for both standard and DeepTow towfish are described in Section 23.

Sonar Transceiver (STR)

The “top end” (i.e. surface electronics) unit provides power for the towfish via the tow cable, receives the echo data and other information such as the towfish altitude, and sends commands to the towfish. The primary type of top end unit for the CM2 system is the Sonar Transceiver (or STR). As well as communicating with the towfish, the STR communicates with the PC that acquires, records and displays the sonar image. Communication with the PC is via the STR’s USB interface.



Sonar Transceiver (STR) Versions

There are two types of connectors used on STR's, either BNC or MIL-C-5015 connectors. Early units fitted with a BNC connectors accept supply voltages in the range 10-18VDC; 24VDC was an ordering option. All units fitted with MIL-C-5015 connectors and all later BNC units accept 10-28VDC as standard.

Early STR units also featured an analog output, generated from the internal digital signal, for driving “legacy” acquisition systems and thermal printers.

Tow Cables

The CM2 tow cables use a single pair of electrical conductors to carry both data and power. There are two types of tow cable offered as standard with the CM2. “Soft” cable (CX8) is intended for shallow work, where the cable can be hauled and veered manually. The alternative standard cable (SS5) is 4.7mm diameter stainless-steel-armoured cable intended to be handled by a winch. Various other diameters of steel-armoured cable are available to special order.

Accessories

Optional accessories including the C-Shell, winches, towfish wing depressor, counting pulleys, polemount bracket and USBL bracket, are described in Sections 17-24.

Specifications

Specifications for the major components and certain accessories are listed in Section 15.

3. INSTALLING THE SYSTEM

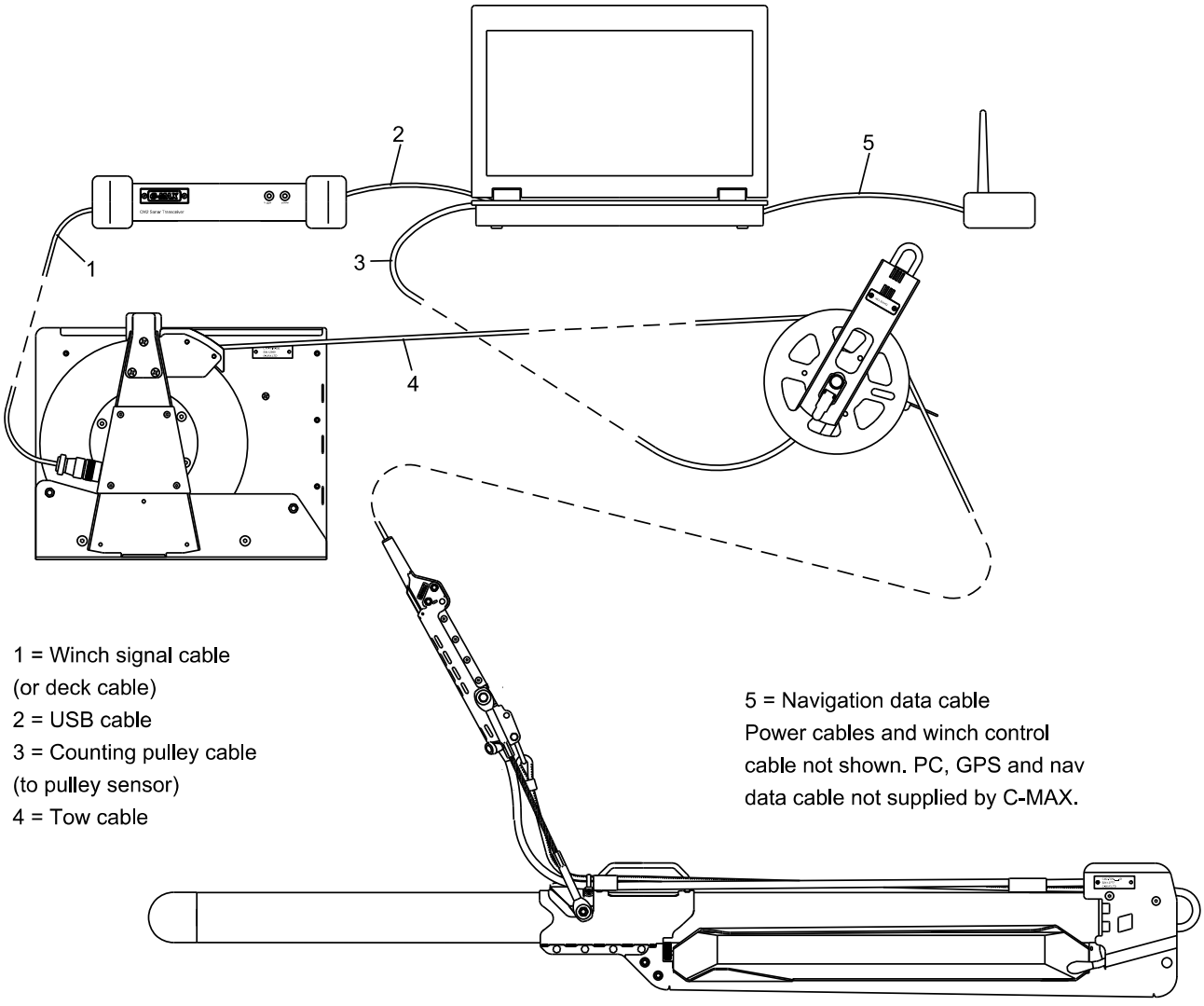
Data Acquisition Subsystem

The CM2 system uses a PC, running Microsoft Windows, to acquire and display the sonar records. The user normally supplies this PC. To install the acquisition software on this PC please refer to the MaxView Installation Guide available from C-MAX or the local supplier. For third-party acquisition software refer to the supplier's manual.

Link the Sonar Transceiver (STR), or C-Shell with its internal STR, to the acquisition PC via the USB cable supplied.

Prepare to apply dc power to the STR. If powering from an AC supply, use the 60W power brick supplied with the STR.

CAUTION: DO NOT SUPPLY THE STR FROM THE SAME DC SOURCE AS IS USED TO SUPPLY THE WINCH. The voltage spikes generated when the winch is switched on and off can exceed allowed upper voltage limit of the supply to the STR.



System with Optional Winch and Counting Pulley

Connect the tow cable or winch signal cable (or “deck” cable) to the STR.

Connect a navigation data cable to the PC if required. As GPS and other sources of navigation data often output via an RS232 serial connection, and as serial ports are becoming less common on PCs, this connection may require the use of a serial-to-USB converter. Note that if a CM2 C-Shell (fitted with an STR) is being used, the GPS data from the C-Shell’s optional internal GPS receiver is already mixed with the sonar data on the C-Shell’s USB output.

If a counting pulley is to be used, connect its cable to the PC. This may also require a serial-to-USB converter.

Tow Cable

Tut adhesive tape markers on the tow cable, a few metres above the terminator, to warn when the towfish is close to the vessel.

Installing a Winch and Pulley (if used)

The tow cable should run directly from the top of the winch drum to a suitable pulley or fairlead.

Any pulley or fairlead must be no smaller than the cable’s recommended minimum radius, preferably considerably larger. A pulley is better than a rigid fairlead.

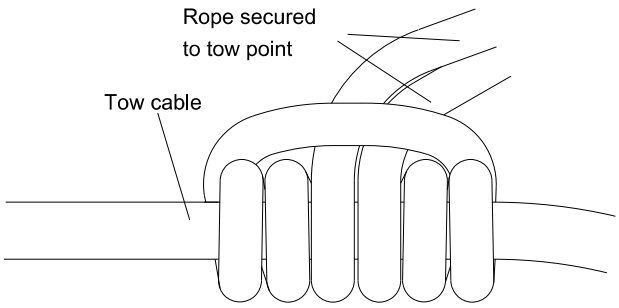
The pulley should normally be suspended above the stern or stern quarter, able to move freely in any direction, and positioned so that neither the towfish nor the tow cable is in danger of fouling the vessel's propeller or rudder or any other structure. A central position minimises tow cable heave caused by the vessel's roll, but may be too close to the propeller wash.

The winch should be mounted as far forward (away from the pulley) as practical, to reduce the maximum off-axis angle of the cable. The path the cable from the pulley to the centre of the winch drum should be parallel to the centreline of the vessel so as to minimize the tilting of the pulley and side force on the pulley rim when the towfish is astern. The winch mounting must be able to withstand the shock of the towfish striking the bottom.

The mounting “footprint” of the CM2-WIN-300 winch is shown in Section 19.

Securing a “soft” Tow Cable (if used)

Make sure that enough cable is flaked out on the deck so that the towfish can reach its operating depth without the need to disconnect the inboard end of the tow cable. Provide a method of securing the tow cable. A recommended method is to use a loop of 5-6mm diameter rope, one end secured to the deck and the other terminated in a “prusik” knot with 2 or 3 turns around the tow cable. The cable will slip through the hitch until the operator starts to tighten its grip.



Securing a Soft Tow Cable with a Prusik Knot

To prolong the life of the cable, avoid sharp bends, twisted loops, and shock loads.

Attaching the Towfish

Straighten out the end of the tow cable and, if it is a steel-armoured cable, ensure that there is no more than a half-turn of inherent twist in it.

The following description applies to the standard CM2 towfish. The attachment of the DeepTow towfish is described in Section 16.

First remove the drop-nose pin from the rear of the keel, feed the loop of the safety lanyard into the end of the keel, and replace the pin to secure the loop. Drop the nose of the pin, to 90 degrees, to ensure that the pin cannot fall out.

Remove the dust cap from the tow cable underwater connector.

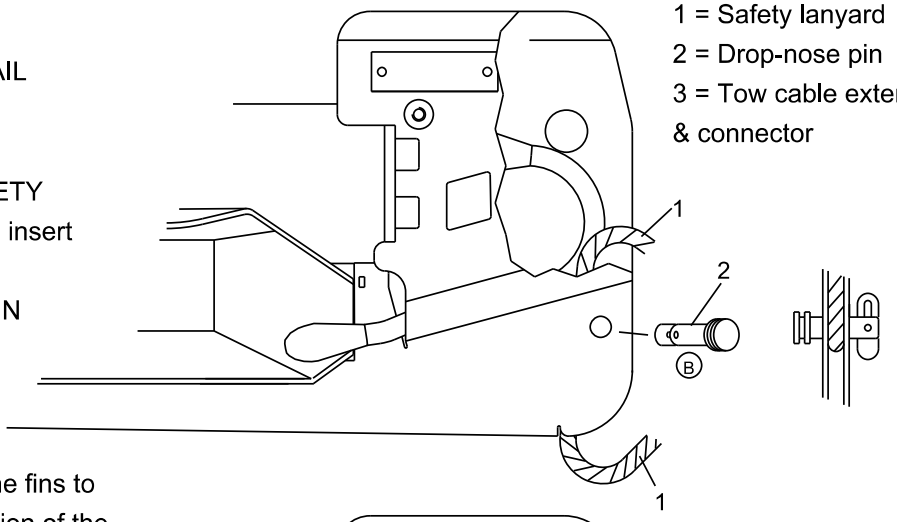
Engage the tow cable socket on to the plug on the rear of the towfish, being careful to align the connector correctly. It is good practice to keep this plug clean and occasionally apply silicone spray to the pins. Note that if silicone grease (as provided with earlier spares kits) is used it must be applied very sparingly. Excessive grease can stop the towfish working.

Attach the towing bail using the breakaway “safety” washer, and the M6 cap screw with captive washer. Use the 5mm hex key provided to tighten this screw. The breakaway washer is designed to fracture under excessive load.

BEFORE fitting the TOWING BAIL to the towfish

First fit the SAFETY LANYARD, then insert and secure the DROP-NOSE PIN

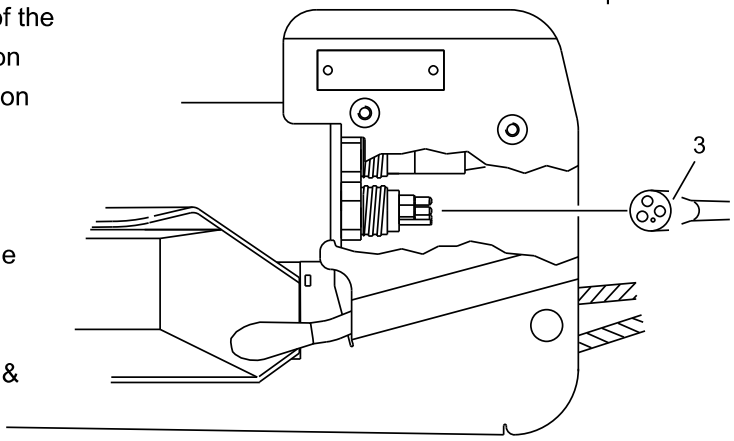
1 = Safety lanyard
2 = Drop-nose pin
3 = Tow cable extension & connector



Look between the fins to identify the position of the steel orientation pin on the 3-way connector on the bulkhead.

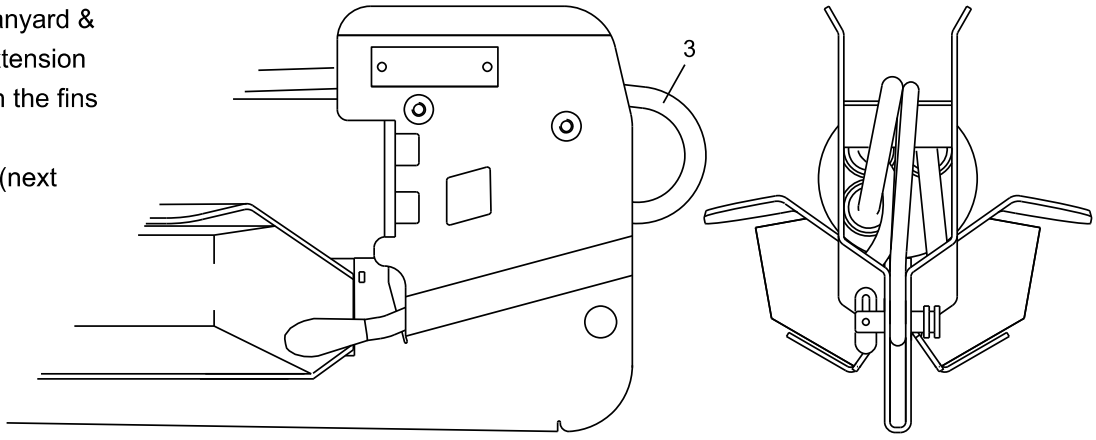
Align the tow cable connector at the same orientation

Mate the connectors & push fully home

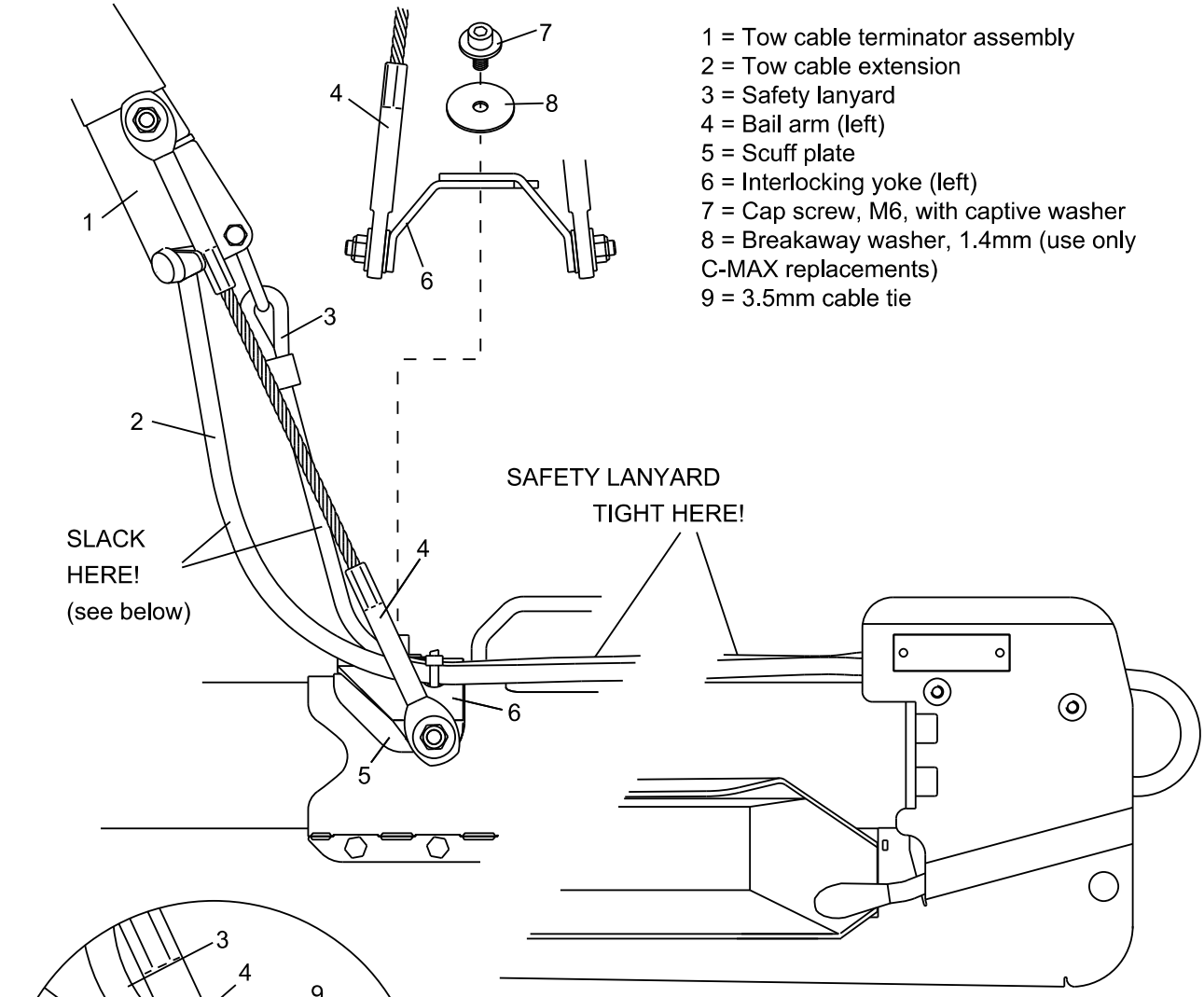


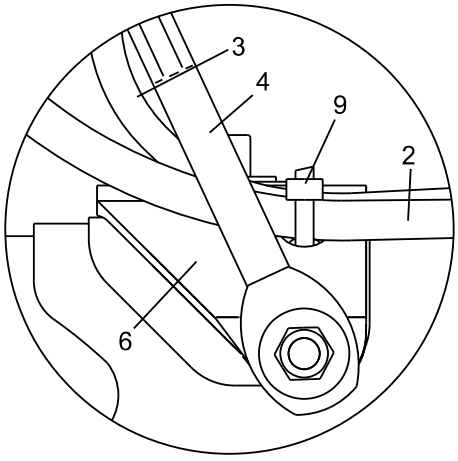
Pull the safety lanyard & the tow cable extension forward between the fins

Then fit the bail (next illustrations)



Attaching the Safety Lanyard and Tow Cable Extension





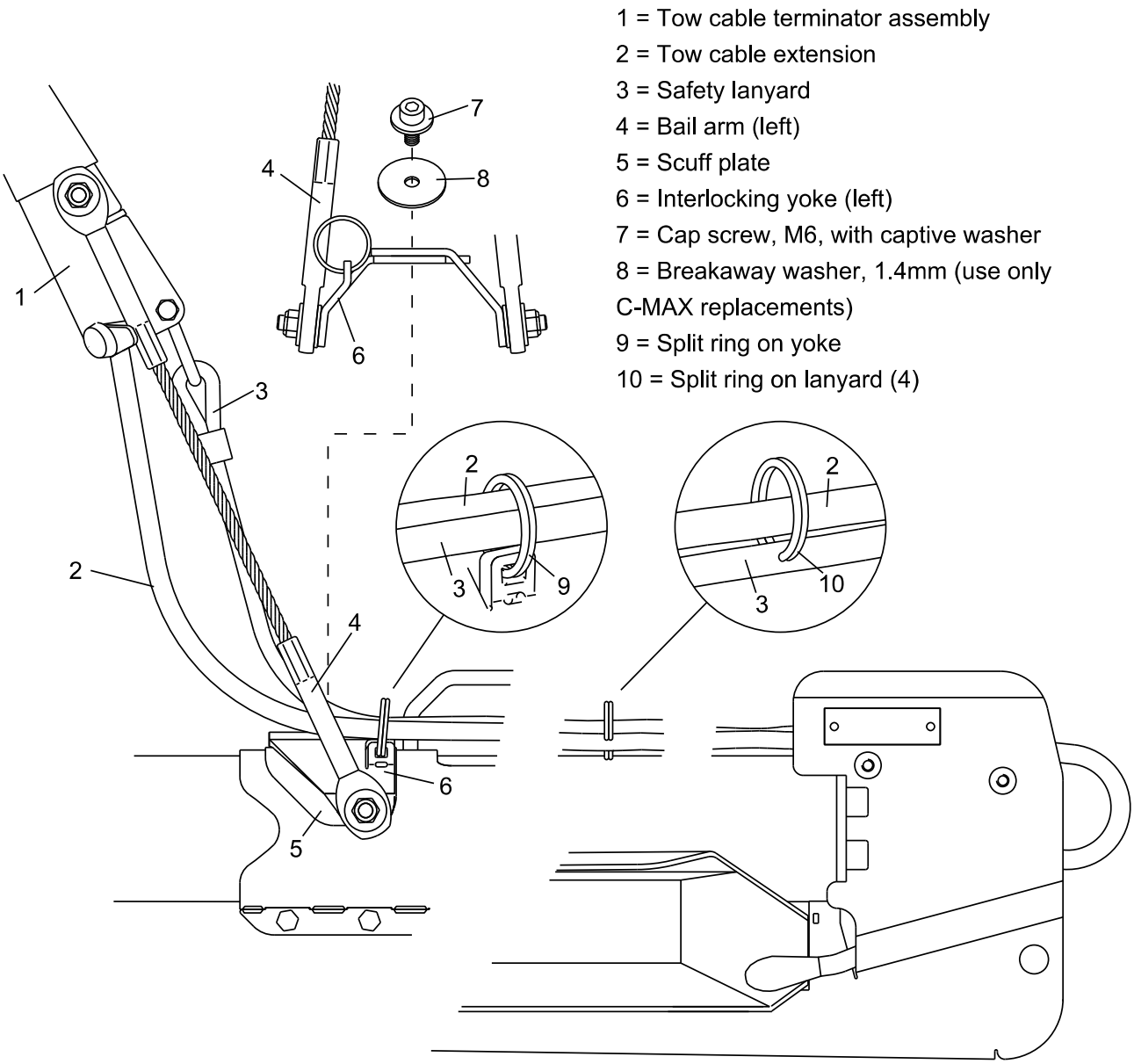
Cable extension 2 and lanyard 3 should be PERMANENTLY attached to yoke 6 using cable tie 9.

The lock of cable tie 9 must be positioned on top so that it does not interfere with the movement of the bail arm 4.

The cable extension 2 should have just sufficient excess length between the terminator 1 and the yoke 6 so that, if the breakable washer 8 breaks under load, the safety lanyard 3 takes all the towing stress, NOT the cable extension 2.

Attaching the Towing Bail (Earlier Tow Cables)

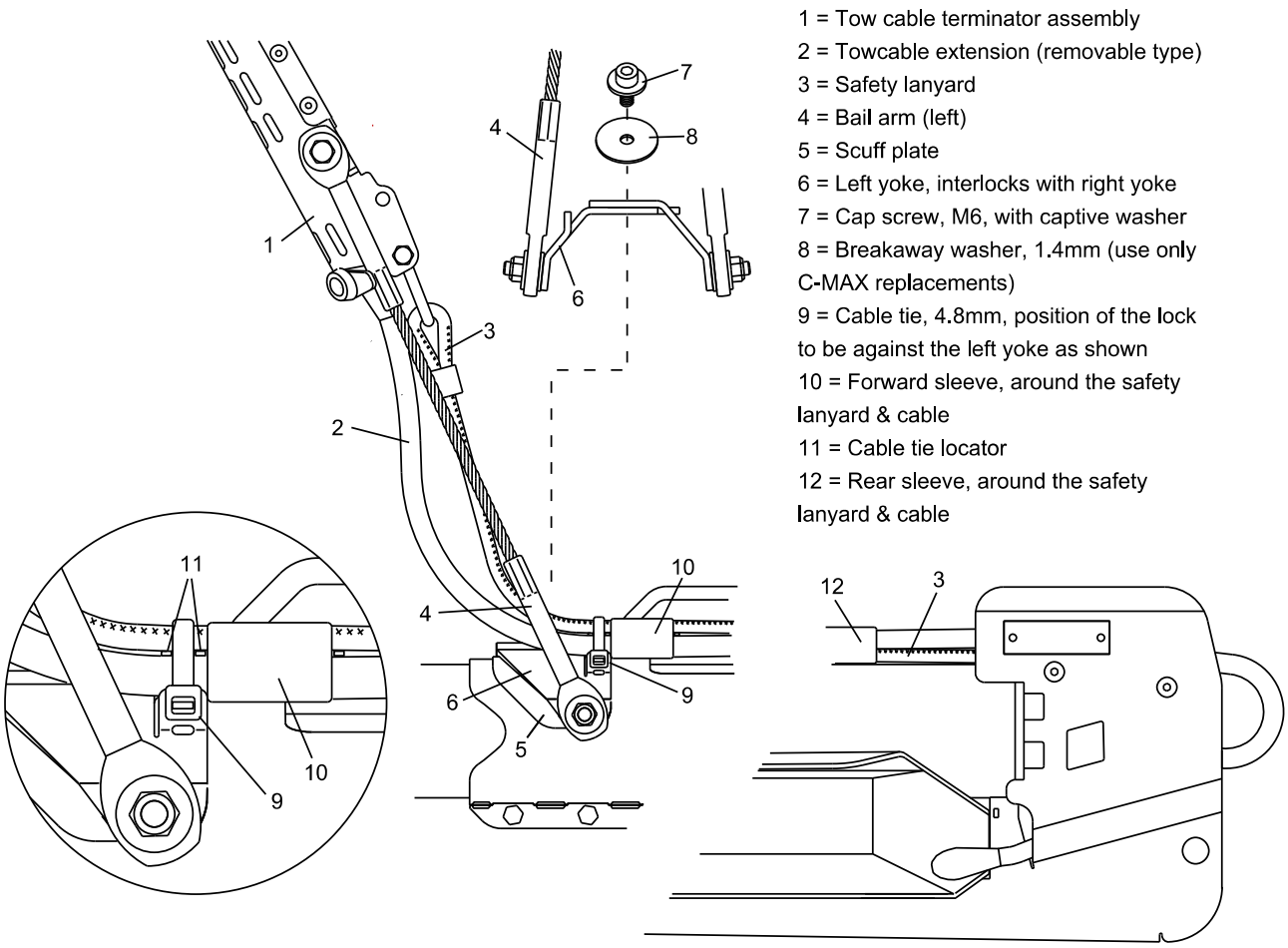
On earlier tow cables the lefthand yoke has two holes through which a cable tie can be passed. On these earlier tow cables the safety lanyard and the tow cable extension should be secured to yoke with a 3.5mm cable tie so that there is no slack in the lanyard and in the tow cable extension between the yoke and the rear fin.



Attaching the Towing Bail (Interim Version Tow Cables)

On later tow cables the lefthand yoke has a raised hoop, as shown in the illustration. In an interim version of the tow cable a stainless steel split ring was fitted to this hoop. On these tow cables both the safety lanyard and the tow cable extension should be passed through this split ring. (Some cables were originally supplied with the later type of yoke but with a cable tie rather than split ring.)

The current, upgraded version of the tow cable features a separately removable tow cable extension, to which the safety lanyard is permanently secured. This configuration has several advantages, the most important being that if the tow cable extension or its 3-way connector is damaged it can be easily replaced without the main tow cable needing to be re-terminated. The terminator now includes a 2-way connector from which the tow cable extension is only disconnected when, or if, a new extension needs to be fitted.



Attaching the Towing Bail (Later Version Tow Cables)

Checking system operation

With the whole system now connected as described earlier in this Section, apply power to the STR or C-Shell. The red Power indicator should light.

If MaxView has been installed, open it and select **Start...** from the **Towfish** menu. Alternatively press the spacebar then select **Start Towfish** from the **Quick Select** menu. If some other acquisition software is installed instead of MaxView, the towfish can be started using that software.

When the towfish is commanded to start, the green Trigger indicator on the STR should light continuously whilst the Start Towfish dialog displays the **Energizing…** message. This message should be automatically replaced after a short period by **Connecting…**

The **Energizing…** message indicates that a voltage of approximately 40VDC* is being supplied to the tow cable connector. This voltage is passed to the towfish to charge its internal capacitors and start its operation.

The **Connecting…** message indicates that the towfish has started its initialisation and that the tow cable telemetry is being set up. This message should disappear when the telemetry link has been established and the towfish has started running.

Note that initially the towfish runs silently, i.e. in the muted mode. This is to allow the telemetry link to complete its optimisation without any interference from the transducer drive voltage. The muted period lasts for the first 80 pings.

As soon as the towfish runs the STR Trigger LED indicator flashes, once per ping.

Wait for the gain, the amplification of the echo image, to rise to a point where the “waterfall” display on the screen has filled in to show “noise” from the environment. At this point the operation of the towfish can be given a basic bench check known as a “rub test”. Without touching the metal of the towfish with either hand, place one hand briefly on the face of one of the transducers. This should result in an increase in signal on the appropriate side of the waterfall display for the time that the hand is that position; at least until the automatic gain control reduces the signal. Then test the other side in the same way.

The **Quick Select** menu, accessed by pressing the spacebar, can be used to change the sonar range and frequency or to stop the towfish. The spacebar can also be used to clear the **Quick Select** menu.

(*This voltage level depends on whether a towfish is connected at the time that it is measured. Also, after the towfish has started pinging, if the tow cable is higher in resistance than a certain value, the towfish will detect that its internal voltage has dropped below nominal. In this case it will command the STR to increase its supply to the tow cable by a further 24V.)

Spares and Tools

Always carry spare breakaway washers. Note that two types are available, the original 1.4mm thick type for the standard towfish and the 2.2mm thick type specifically for the DeepTow.

The stainless steel 5mm hex key provided with the system spares is the only tool required in normal operation. Every towfish is supplied with a kit (CM2-TSK) containing minor spares and consumables.

4. PLANNING THE SURVEY

Survey Plan

Every survey or search needs to be planned in advance. Survey planning and post-processing are topics that are wider than can be covered here. Most sonar acquisition software packages, including MaxView, include the facility to plan survey lines for guiding the helmsman.

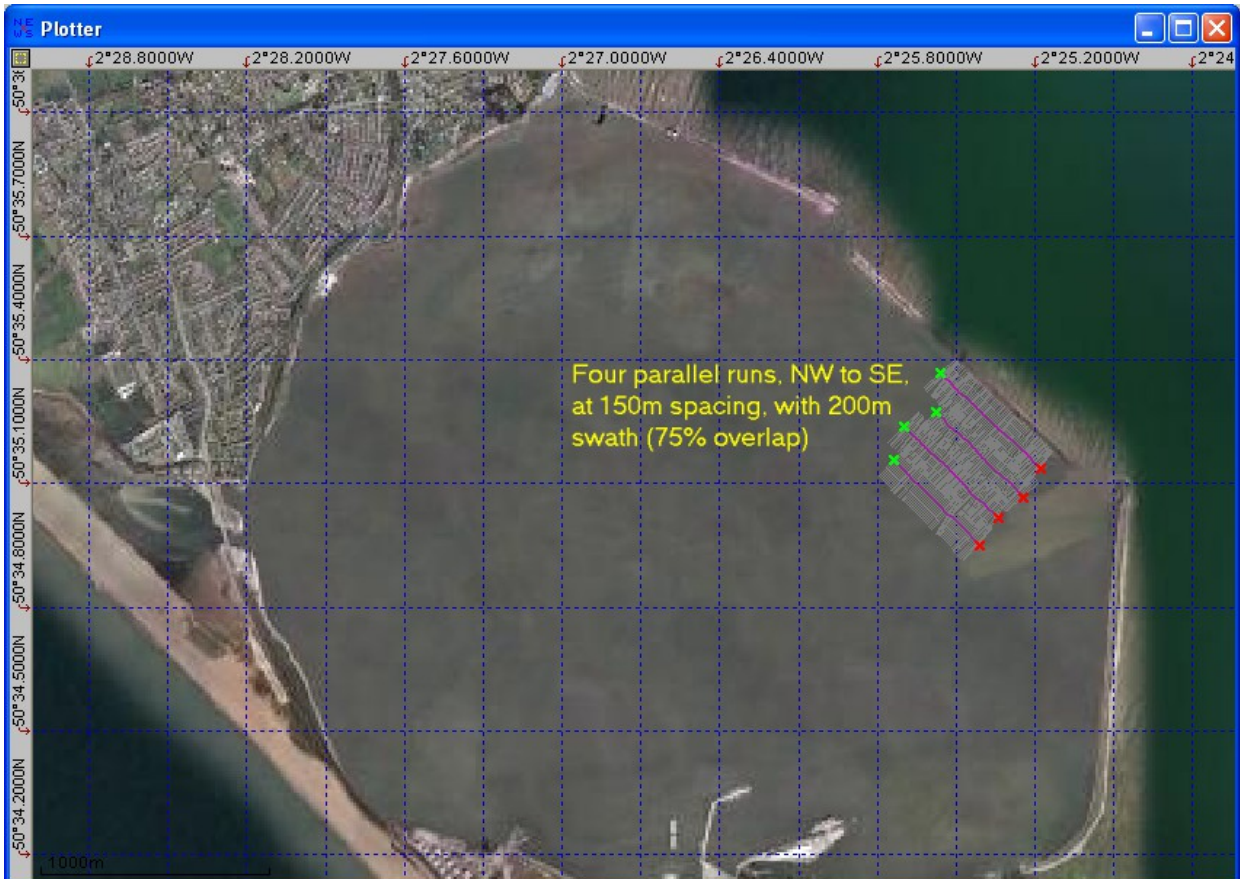
Line Spacing

The frequency and range settings should be defined for the type of task being planned, whether it is a search for a wreck or lost anchor, or a post-dredge clearance check, for example.

The image quality is reduced in the region below the towfish because the geometry results in a compressed image in this zone; also the steep angle results in poorer shadow information. The quality is also reduced at the extremity of the range primarily because of beam spreading. Survey lines should therefore be spaced with sufficient overlap (e.g. 75m when working with 100m range setting) to ensure complete coverage. Overlap is also necessary to compensate for course deviations.

Line Direction

It is normally preferable to run survey lines in the same direction as any current. Where currents are very strong the lines may need to be run in only one direction, against the stream, as running with the stream would give too high a speed over the ground thereby reducing the number of pings on any target.



Typical Small Survey; Area Sweep inside a Harbour

In order to identify a target, or to provide extra assurance of coverage, it may also be necessary to follow the along-current lines with a set of perpendicular, cross-current, lines.

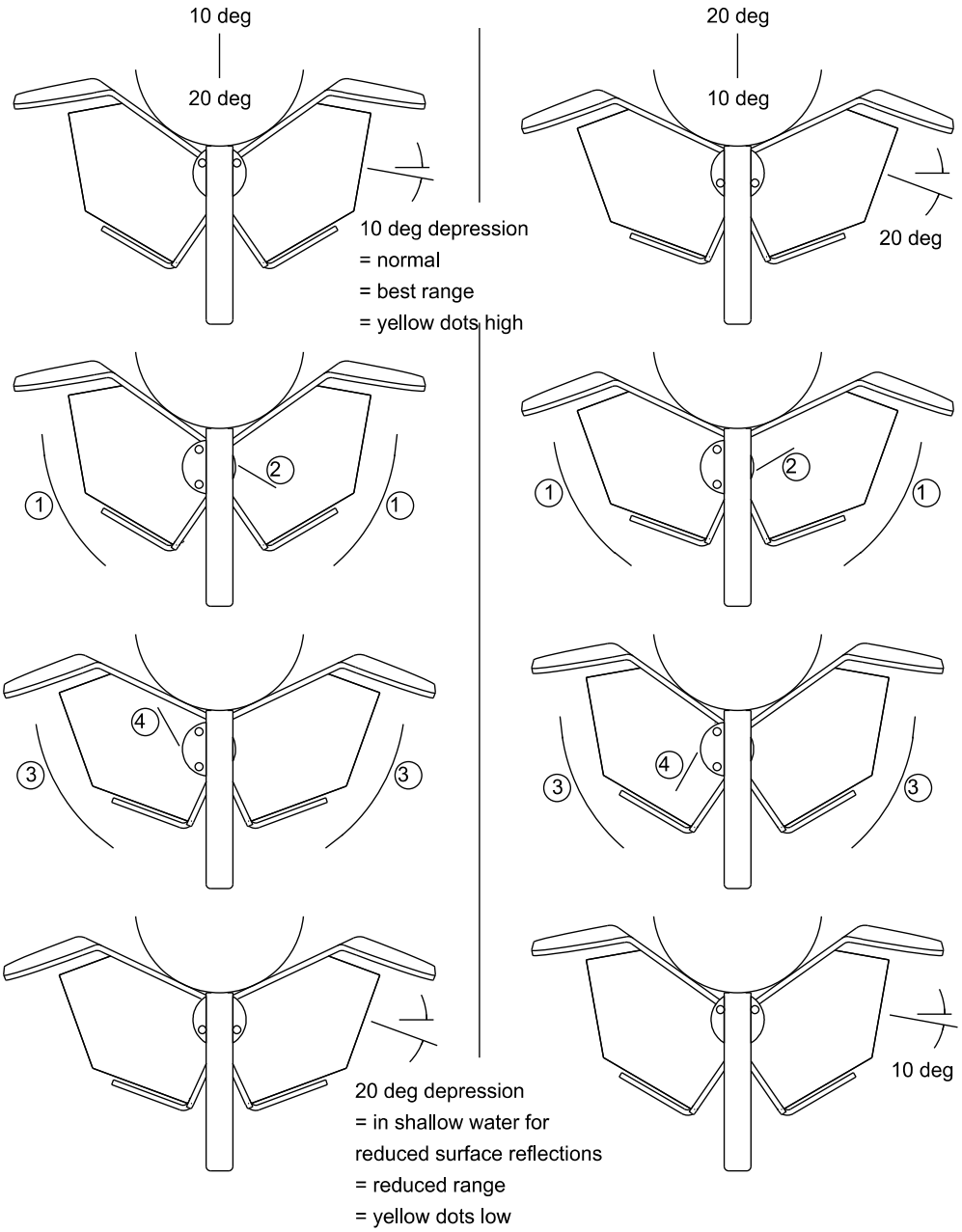
Sometimes the major consideration in planning lines is not the direction of the current but the bathymetry. It is easier to survey along lines of approximately constant depth rather than to be constantly heaving and veering tow cable to keep the towfish at a suitable altitude.

Finally, the wind direction may be the controlling factor. Waves running across, rather than in the same direction as, the survey line will cause a spiralling movement of the tow cable and oscillation of the towfish track. This will have more of an effect on the image than the simple pitching motion if the ship is running into, or directly away from, the waves.

5. OPERATING THE TOWFISH

Pre-launch Check

Check that the towfish transducers are angled high or low, as required, as indicated by the yellow dots on the depression adjuster cam.



Move the cam rearward. Then rotate the cam and transducers as shown by the arrows in the sequence 1 - 2 - 3 - 4. Finally move the cam forward to the locking position.

Adjusting the Transducer Depression Angle (Standard Towfish)

Check that the tow cable connector is firmly home, and that the bail is correctly attached to the towfish.

Check that the tow cable is clear and free from twists, and that the winch, if present, is powered and ready to run.

Note that the automatic gain adjustment starts as soon as the towfish is switched on.

Launch

Set the display to show the water column (i.e not slant-range-corrected). Launch the towfish astern with the vessel preferably at slow speed, then lower it to an altitude above the bottom within 5-15m initially

CAUTION: DO NOT ALLOW ANY SLACK IN A WINCHED TOW CABLE - a slack cable can start to wind outside the winch drum and can also form loops that can pull tight and seriously damage the cable.

The "soft" tow cable can be handled without gloves but is still capable of giving friction burns if allowed to slip.

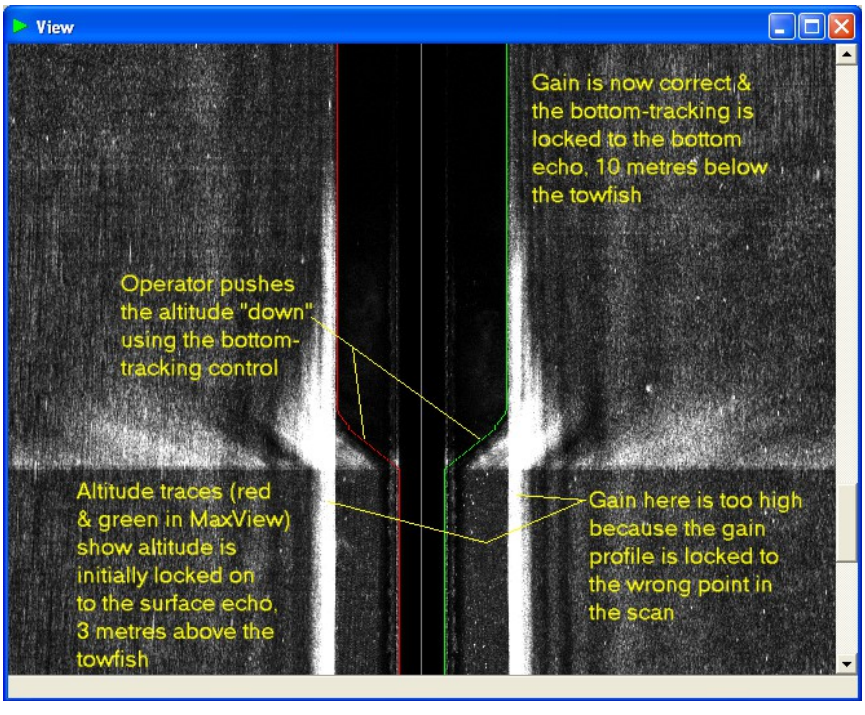
If the optional wing depressor is used, refer to Section 20 for advice and important warnings.

Bottom Tracking

The indicated altitude is shown in MaxView's sonar parameters, or the equivalent in other versions of acquisition software.

The indicated altitude may be marked on the display by a pair of lines overlying the initial bottom echoes. In MaxView these lines are red and green; see the illustration below.

CAUTION: VERY IMPORTANT: IF THE INDICATED ALTITUDE DIFFERS FROM THE TRUE ALTITUDE THE OPERATOR **MUST** TAKE ACTION TO PUSH THE BOTTOM-TRACKING INTO LOCK.



Locking the Bottom-Tracking after Launch

With earlier versions of the towfish, when the towfish is first launched the bottom-tracking may lock on to the surface echo or may stay in a "neutral" position. This will give the wrong indicated altitude.

An example of the bottom-tracking initially locking on to the surface echo is shown in the illustration above, in the lower section of the image. The operator can see from the image that the towfish is actually deeper and uses the bottom-tracking controls to push the bottom-tracking into lock.

Bottom Tracking Controls

If the bottom tracking initially fails to lock on to the bottom correctly then use the bottom tracking control to push it into lock.

In MaxView the hotkeys Ctrl + Up Arrow and Ctrl + Down Arrow can be used, or **Bottom Tracking** in the **Towfish** menu.

All third-party acquisition software for the CM2 has equivalent bottom-tracking controls.

Flying the Towfish

As soon as the altimeter has locked to the bottom and the image is normal, wind the cable in or out, or adjust speed, until the towfish flies at an altitude equivalent to 8-10% of the range limit.

Note that the indicated altitude cannot exceed 20m for 780kHz operation, 40m for 325kHz, and 60m for 100kHz. If the towfish is operated above these maximum altitudes, the image may be degraded; also the altimeter may try to lock on to surface echo instead of the bottom.

Minimum indicated altitude is 1.4m. MaxView and other acquisition programs may sound an alarm if the altitude falls below a preset value.

The towfish must be flown high enough to clear any obstacles. Over uneven ground, flying high increases safety and prevents excessive shadowing. Over flat and featureless ground, flying low enhances the shadows of any object that may be present. In shallow water it may be necessary to fly lower to stay below the wake.

In very shallow water it may be better to deploy the towfish alongside, or at the bow, rather than astern, but keep the towfish and cable away from the propeller!

Depending on speed and depth expect to pay out about 3 metres of tow cable for every metre of towfish depth (not altitude). Always keep a reserve of at least 3 turns of cable on the winch drum.

See Notes for the Helmsman.

Tow in the range 2.5 to 6kt (speed through the water; this may differ from speed over the ground or GPS-indicated speed). Low over-the-ground speeds give more scans per metre of travel and a correspondingly better image resolution. Sometimes, however, a higher speed will give a steadier course.

CAUTION: THE TOWFISH WILL SINK CLOSER TO THE BOTTOM DURING TURNS AND WHENEVER TOWING SPEED REDUCES

Action if the Towfish Fouls

If the towfish hits the bottom or other obstruction, the increased towing force will usually break the breakaway washer. The safety lanyard will then apply tension to the rear of the towfish. This will normally cause it to tumble and to free itself of the obstruction. In the meantime the towing vessel should, of course, slow down but without going astern into the cable!

Recover the towfish and replace the breakaway washer. Inspect the towfish and tow cable for any damage.

Recovering the Towfish

Slow to 2 to 4 knots before the towfish hits the wake. Watch for the tape marker warning that the towfish is close.

Wash the towfish, cable and winch with fresh water immediately after use in seawater. When the tow cable is disconnected from the towfish, cap the cable connector to keep it clean.

CAUTION: DO NOT EXPOSE THE TRANSDUCERS TO HEAT FROM STRONG SUNLIGHT

6. OPERATING GUIDELINES

Do not allow the towfish to hit the bottom – be aware towfish sinks when turning!

Fly the towfish on as straight a course as possible, to prevent distortion and smearing of the image

Fly the towfish lower (but safely clear of the bottom) to give best image shadows, e.g. 5m altitude; fly it higher to give longest effective range, e.g. 10m altitude or more, except in shallow water

Use the higher frequency for best image resolution, and for small targets; use the lower frequency for longest effective range, and for big targets

Use 10deg transducer depression in normal circumstances; use 20deg depression if the bottom image is being obscured by reflections from the sea surface

Higher tow speeds are OK for 100kHz operations, e.g. up to 6 knots

Use lower tow speed for 325kHz operations, e.g. 4 knots

Use lowest tow speed for 780kHz short-range operations, e.g. 3 knots

Low speed gives more “pings” on each target and gives greater towfish depth for any particular tow cable length

High speed makes it easier to keep the towfish on a straight course

Overlap survey tracks to give best target detection probability; overlap by at least 2x altitude (approximate rule), ideally 100%

Orthogonal survey tracks (e.g. E-W then N-S) may give more information on target shape

During the survey always watch the image in NORMAL geometry to check that the bottom-tracking (automatic altitude measurement) is locked on to the bottom echo

If the bottom-tracking is not in lock then use the altimeter forcing buttons (up-down) to restore the correct indicated altitude

Check the incoming nav data and don’t forget to RECORD the sonar data!

7. NOTES FOR THE HELMSMAN

Navigation

Use the sonar's plotter window to show waypoints, the track and the swept ground.

Steering

The quality of the sonar images depends on the skill of the helmsman. This applies especially to the 780kHz and 325kHz operation.

The helmsman is so important because the towfish can only collect good images if it flies straight. Because of this, steering a sidescan sonar survey is not the same as steering a conventional sounding line.

A turning towfish stretches the image on one side and compresses the other, wasting the high resolution of which the system is capable. (A high power telescope can only be effective if it is held steady!) As well as corrupting the outer areas of the image, a turning towfish also upsets the matching between the gain (image amplification) profile and the beam shape, causing alternate light and dark patches in the inner areas of the image.

Use small, slow wheel movements even if this means that the vessel temporarily leaves the planned survey line. If an autopilot is available it will, under most conditions, steer a better sonar course than a human helmsman, even though the heading may need to be trimmed occasionally.

Remember that the towfish follows the stern, particularly when the tow cable is short, and is therefore affected by rudder movements as well as by course deviations.

At the end of the survey line, the helmsman must warn the sonar operator before turning and must not turn sharply, or the towfish could strike the bottom.

Emergency Actions

Emergency actions should be discussed in advance of the survey, between the sonar operator and the helmsman. The planned actions will depend on the water depth and depth variation, bottom type and the danger from obstacles.

If sharply rising ground or an obstacle is detected on the ship’s echo sounder it may be too late to raise the towfish by hauling in the tow cable, particularly if the cable is several hundred metres long. Here the quickest way to raise the towfish may be to increase the ship’s speed as quickly as possible. Of course if, despite this manoeuvre, the towfish still strikes the obstacle or bottom the impact will be at higher speed.

Slowing to avoid an impact with an obstacle will almost certainly drop the towfish on to the bottom, but may reduce the risk of losing the towfish.

If the towfish gets entangled, and the ship is manoeuvring above, beware of catching the tow cable in the propeller.

8. TOWFISH COMMANDS

Towfish Command Set

The CM2 towfish uses the same set of commands regardless of what acquisition software is being used.

Towfish start, stop, range selection and bottom-tracking control must be supported by all acquisition software; other commands may or may not be supported. MaxView offers short-cut keys for range selection and bottom-tracking control, as well as for towfish start and stop.

Bottom-tracking, Up and Down

These allow the operator to force the indicated altitude to the correct value so that the altimeter can resume lock on to the bottom.

Mute, Off or On

Mute allows the towfish to run as normal but with no acoustic transmissions. This is useful for diagnostic purposes where an echo sounder or other acoustic source may be interfering with the image. When muted, indicated altitude is zero.

Shallow Mode, Off or On

Shallow mode is intended for use only in very shallow water where the user needs to use the towfish at less than the normal altitude limit of 1.4m. In shallow mode the gain profile is started at the towfish position itself instead of at the first bottom echo and the indicated altitude is zero.

Gain Hold, Off or On

Gain Hold allow the automatic gain to be inhibited, fixing the profile of image amplification across the range as it was when Gain Hold was selected.

Normally the only reason to disable the automatic gain is if the image of a certain target, such as a wreck, needs to be observed without the gain slowly changing. If the gain profile is held whilst the target is in view, the reflectivity of any part of the target can be directly compared. Also if the target has a significant dark area, holding the gain constant avoids the “gain shadow” as the scan moves back on to the relatively light background again.

CAUTION: On versions of the towfish up to and including V6, if the gain profile is held constant this automatically disables the towfish from measuring its altitude. The reason for this is that changes in bottom reflectivity together with the fixed gain may mean that the altimeter would have difficulty in bottom-tracking. However the altitude can still be adjusted by the operator using the bottom-tracking, up and down controls. Also note that the correction for the shape of the acoustic beams may be wrong if the altitude changes whilst the gain is held.

9. INTERPRETING THE SONAR IMAGE

(This topic may be covered in additional detail in help text associated with MaxView or with third-party acquisition software.)

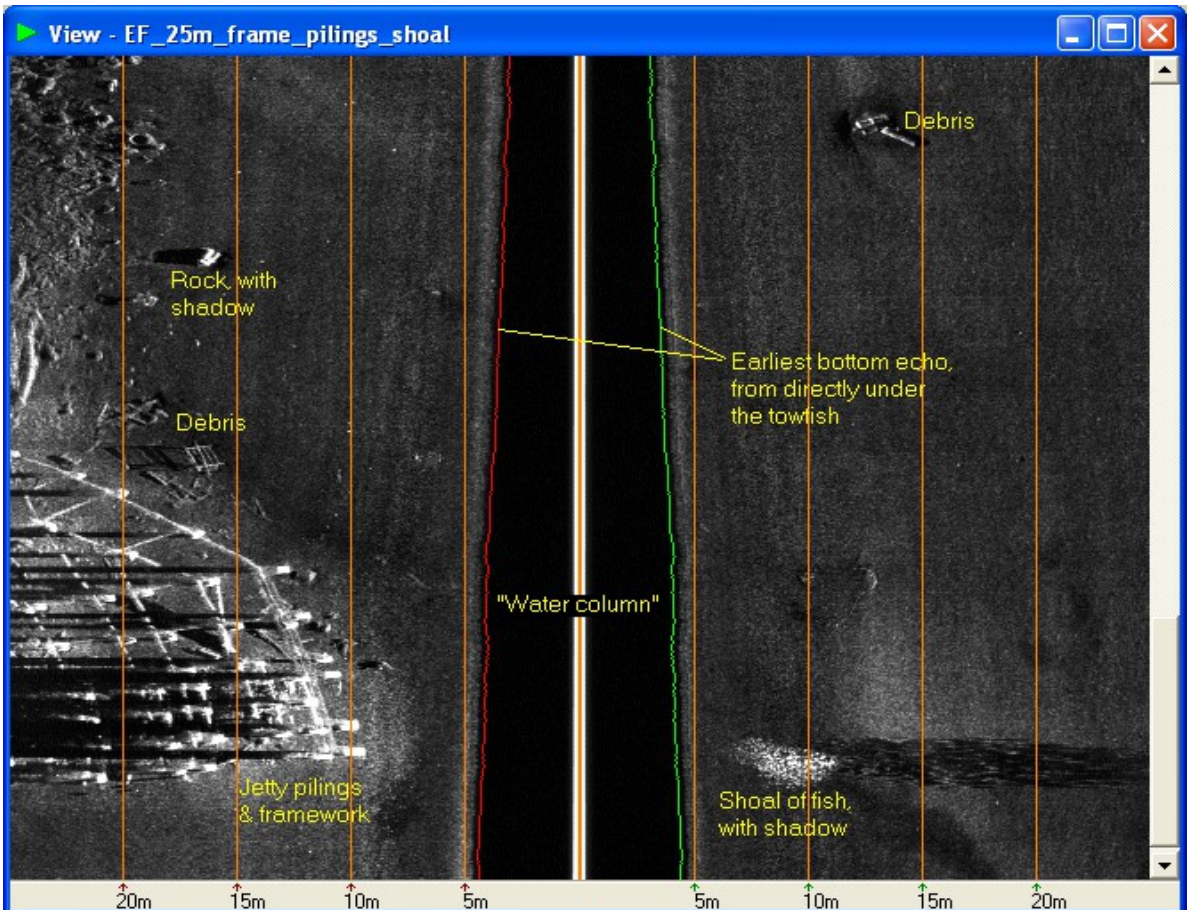
Checking Imaging Performance

CAUTION: INCORRECT SETTINGS WHEN USING THIRD-PARTY ACQUISITION SOFTWARE AR ALMOST CERTAIN TO RESULT IN A DEGRADED IMAGE. IT IS ADVISABLE TO USE MAXVIEW TO CHECK PERFORMACE.

Note that MaxView is free to download and to use to check that an optimum image is being obtained. The paid-for acquisition dongle is only needed if the acquired data is to be recorded.

Water Column and Bottom Image

At the very centre of the image is a line that corresponds to the track of the towfish.



Example Image

On both sides of the central line, the (normal geometry) picture is occupied by what is called the 'water column'. This represents the time before the echo first returns from the bottom directly below the towfish. The water column normally shows up as a white area. Occasionally, if the towfish is close to the water surface, faint echoes of the surface may show up in the water column. Wake bubbles, fish shoals, and other mid-water objects, may appear in the water column on one or both sides, depending on whether they are to one side of the towfish (but still nearer to the towfish than to the bottom) or are directly below the towfish.

Note that this water column image does not represent a gap in coverage. The bottom echoes on either side of the water column are DIRECTLY BELOW the towfish, as can be seen when slant-range correction is applied.

Highlights and Shadows

Highlights, shown as darker points or smudges, indicate that the beam has struck a stronger echo reflector. Hard surfaces reflect more strongly; so do surfaces that face the beam direction. The air-filled swim bladders of fish can also act as good reflectors.

The towfish sees most of the bottom in its view at quite a low angle, as little as 5º at the outer regions. This means that the sonar picture normally includes shadows as well as highlights.

Shadows show up as lighter areas usually lying beyond a highlight or line of highlights. They can indicate the presence of an object and can also provide clues about its height and shape. If there are no associated highlights, the shadow may just indicate a depression in the bottom.

If an object casts a shadow on a flat bottom the height of the object is given by simple geometry, using the shadow length, the towfish altitude, and the true (slant) distance of the object from the centreline. Some acquisition software, including MaxView, includes the ability to calculate the object height by running the cursor along the length of the shadow.

Image Corrections

For safety when gathering sonar records use the uncorrected, normal geometry image, not the slant-range corrected image. When reviewing the records, or when taking measurements, corrected geometry may be useful.

Selecting slant-range corrected geometry (SRC) corrects for the 'slant range' distortion, by differentially stretching the image, and removing the water column.

Over rocky or very uneven ground the closure at the centre of the SRC image may not be perfect. If the ground is uneven it cannot be assumed that the whole bottom is varying in unison, so a smoothed altitude value is used. The SRC process exaggerates any mis-closure.

Although SRC geometry corrects for slant range distortion, it does not correct the display 'aspect ratio', i.e. ensure that a square area of the bottom is represented by a square on the display. To do this requires replicating or suppressing ping lines and is not generally desirable.

Causes of Image Defects

It is important that the towfish is towed on a steady track and without excessive heave motion transmitted down the tow cable. Any erratic motion of the towfish will transfer to the image. Roll oscillations may produce light and dark banding, alternating between left and right sides. Turning stretches the image on one side and compresses the other.

If the towfish is near the surface it may pick up reflections from the surface waves. This can reduce the maximum range at which a good bottom image is obtained. Also in calm conditions, particularly in shallow water, the echoes can reflect off the surface as well as returning directly. This 'multi-path' effect shows up in the image as ghosting. The CM2 325kHz towfish has a sharper surface cut-off than most sidescan sonars and is inherently more resistant to both the above effects.

The CM2 towfish transducers are adjustable in angle. In the normal position they are depressed nominally 10º from the horizontal. This angle gives maximum range. In the other position they are depressed approximately 20º from the horizontal. This gives greater immunity from spurious echoes from the surface, which may be useful in shallow water, but sometimes reduces effective range.

The wakes of motor vessels contain a vast number of microscopic bubbles, which may take ten minutes or more to dissolve. Wakes left by other vessels can show up prominently on the sonar image and should not be confused with permanent features.

Note that a large object, such as a wreck or a piling structure for example, may appear to be distorted if it tilts towards the direction from which it is being viewed or extends above the altitude of the towfish.

10. ROUTINE MAINTENANCE

Routine Maintenance

Maintenance is simple and is normally limited to the following tasks: -

(a) Immediately after use, thoroughly wash the towfish with fresh water if it has been exposed to seawater: also wash the tow cable and winch

b) Daily, or whenever it is suspected that the breakaway washer attaching the bail to the towfish has been stressed in use, inspect the washer; refer to the replacement procedure below

c) Periodically inspect the whole system, particularly the cable, for accidental or corrosion damage that might otherwise go unnoticed

d) Clean the exterior of all items, when appropriate; for the STR or C-Shell use a cloth lightly damped with fresh water, no solvents

e) Follow the winch maintenance instructions.

Replacing the Towfish Breakaway Washer

The breakaway washers supplied with CM2 towfish are manufactured from phenolic resin bonded fine-weave fabric. They are designed to yield with consistent characteristics and should be replaced only with approved spares.

The breakaway washers used by the standard and DeepTow towfish are nominally 1.4mm thick and 2.2mm respectively. They should not be interchanged although two 1.4mm washers can be used in place of one 2.2mm washer in emergency.

The breakaway washer secures the tow cable bail assembly to the spigot on the towfish. It should be replaced if the bail has pulled free or the washer shows signs of stress. Breakaway washers should be inspected regularly.

11. STORAGE AND TRANSIT

CAUTION: KEEP THE TOWFISH TRANSDUCERS OUT OF DIECT SUNLIGHT TO PREVENT THEM FROM BECOMING EXCESSIVELY HOT

The system should preferably be stored and transported in purpose-designed containers. Internally padded shipping/storage cases can be supplied for all the system components.

On the optional CM2 or SK172 winches, tape or strap the tow cable to prevent it unreeling from the winch drum.

Ensure that all equipment, particularly the STR, is dry before packing.

Keep the empty cases closed whilst the system is in use so that they do not accumulate condensation.

12. REPAIR AND REPLACEMENT

Replacing the Towfish PCB

The following description applies primarily to the standard towfish although some applies also to the DeepTow towfish as described in Section 16.

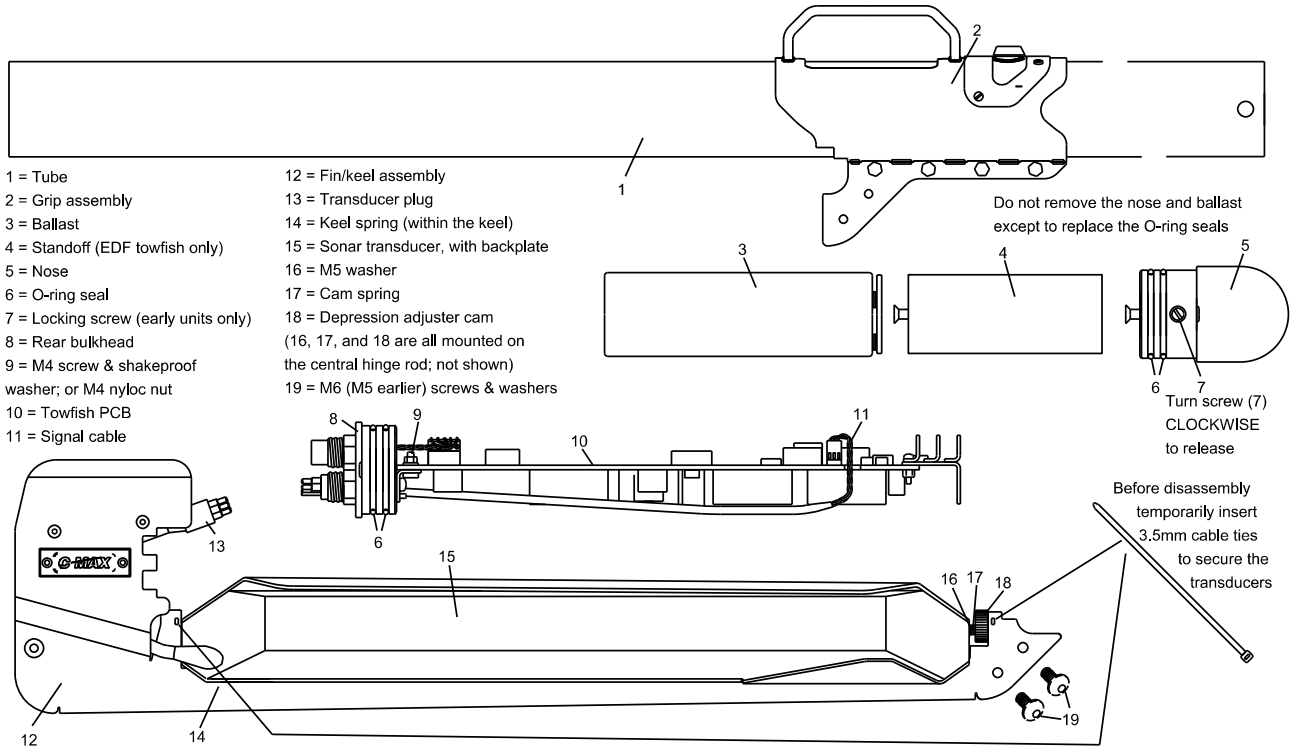
The towfish internally contains only lead ballast and a single main printed circuit board (PCB). This PCB can be replaced as a unit by the user. Note that this PCB is complex and is not user-serviceable. Any attempted repair of this PCB by the user will invalidate the warranty and may cause permanent damage.

The towfish should be opened and resealed only in low or moderate humidity conditions to avoid the possibility of condensation forming internally when the towfish is immersed in cold water.

It is assumed that the tow cable and safety lanyard have been disconnected.

Dismantling the towfish is easier if someone is available to hold it in position, resting with its nose and keel on a bench, with the keel held upright.

Set the transducer depression angle to 10º and temporarily put cable ties through the slots shown on the illustration. This secures the transducers to the keel.



Disassembled Towfish

Remove the two M6 button head screws, or M5 socket cap head screws on earlier units, at the forward end of the keel. This is easier if the towfish tube is pressed down on the keel to keep pressure off the screws.

Push the tube forward and then disconnect the two transducer connectors. Completely separate the tube assembly from the keel/transducer assembly. The rear bulkhead is now free to be extracted from the tube, but it will be retained by the grip of the O-rings. Rotate the rear bulkhead to loosen this grip, pulling outwards at the same time. If necessary use two large screwdrivers, with their blades in the recesses each side of the

rear bulkhead, to start the extraction process.Note that in cold conditions the rear bulkhead may be released more easily from the grip of the O-rings if the tube is heated near the joint, for example by pouring hot water over this area. Note also that if the rear bulkhead and the tube become misaligned (i.e. off axis) they may tend to jam together.

CAUTION: WHEN SLIDING THE PCB AND BULKHEAD IN AND OUT OF THE TUBE DO NOT ALLOW THE BLACK HEATSINK TO SCRATCH THE SEALING SURFACE OF THE TUBE

Whenever the rear bulkhead (or the nose) has been removed the end of the tube is vulnerable to damage. Even a short drop on to a hard surface may distort the bore.

To remove the PCB, first disconnect all attached connectors. Then remove the locknut from the M4 stud in the rear bulkhead bracket that retains the PCB. On earlier units an M4 screw is used instead of a stud and locknut.

CAUTION: WHEN REMOVING OR RE-ATTACHING THE PCB FROM THE REAR BULKHEAD BE CAREFUL NOT TO DAMAGE THE SMALL THERMOMETER CHIP ON THE UNDERSIDE OF THE PCB BY CATCHING IT ON THE BULKHEAD BRACKET

Reassembly requires care. The two O-ring seals on the rear bulkhead may be renewed using standard nitrile rubber seals of 49.5mm inside diameter, section diameter 3.0mm, medium hardness (Shore Hardness A70).

All the sealing surfaces must of course be clean and dry, and they should be very lightly lubricated with the silicone grease provided or with silicone spray. The replacement of the rear bulkhead O-rings, and cleaning, should be done with the PCB removed.

Reassemble the tube assembly to the keel/transducer assembly by the reverse process. Finally rotate the transducers to the 10º depression angle (cam dots high) then remove both cable ties from the slots.

There is normally no need remove the nose of the towfish but, if there is, proceed as follows. Unscrew the single M5 cap head screw at the base of the nose. Alternatively, on earlier units, the nose is retained by two screws, one each side of the nose; these should not be unscrewed but should be screwed clockwise fully inwards.

This will release the nose but it will be retained by the grip of the O-rings. Rotate the nose to loosen this grip, pulling outwards at the same time. If necessary use two screwdrivers, with their blades in the recesses each side of the nose, to start the extraction process. Putting a rubber band round the nose may enable it to be gripped more easily.

As the nose is replaced, rotate it to align the locking screws. Replace the M5 locking screw on the underside or, alternatively, on earlier units, wind each locking screw counter-clockwise outwards just enough to lock the nose in position. Use MINIMUM torque.

Replacing a Transducer

To replace one or both of the acoustic transducers, do not open the towfish tube, i.e. do not separate the rear bulkhead from the towfish tube.

Remove the tube assembly as described in the previous section. Remove the two temporary cable ties and then lift out the pair of transducers, still hinged together with the hinge rod. Slide out the hinge rod.

Be careful to retain the adjuster components on the rod. They must be grouped at the front (screw) end, with the screw head on the cam pointing forwards. The assembly order on the rod is the adjuster components (cam, coil spring, M5 washer) then the transducers..

Never remove the angled backplates from the transducers.

Replace the transducers by the reverse procedure, and refit the tube assembly as described earlier.

Repairing the Tow Cable

In the event that the “wet” end of the cable requires re-termination, this may be performed by the Factory.

Alternatively the cable may be re-terminated in the field using the termination kit, available as a standard accessory.

Steel-armoured cables cannot normally be repaired mid-way along their length by splicing because the size of such a splice would prevent the cable from layering properly. Manually handled “soft” tow cables can, in an emergency, be spliced but it is difficult to ensure that the splice retains sufficient strength and such a repair is not recommended.

If a steel-armoured cable is damaged close to the winch end and the damage is such that the cable is unserviceable, then this damaged inboard section will need to be cut out. The shortened cable will then need to be re-terminated on to the winch. In these circumstances, or if the cable is to be completely replaced, consult Section 18 or 19 for guidance on removing and replacing a tow cable on the CM2-WIN-300 or SK172 winches. The guidance for these winches may also be applied, where appropriate, to larger winches.

On newer tow cables of either type, steel-armoured or soft, the tow cable extension is a separate item which, if damaged, can be replaced without re-terminating the main cable. To replace this type of tow cable extension first unscrew the locking collar around the tow cable extension where it attaches to the terminator. When this collar is released remove the extension to reveal a 2-pole female waterproof connector. Fit the new tow cable extension by the reverse process and tighten the collar.

Repairing the Safety Lanyard

In the latest design of tow cable the safety lanyard is permanently attached to the tow cable extension. Replacement of either the extension or the lanyard should therefore normally be done by replacing the complete unit.

For the earlier design of tow cable a damaged or worn lanyard can be replaced individually and should normally be replaced with a factory-produced item to ensure that the dimensions are correct.

If a lanyard for a standard towfish must be constructed locally in emergency, it should have an internal length, measured over 8mm pins, of 98.5cm.

Servicing the Surface Electronics

Some items are SENSITIVE TO ELECTROSTATIC DAMAGE and must be handled accordingly.

Be careful not to stress cables or connectors when disassembling equipment.

Before removing any component or internal cable, record carefully how it is secured, preferably using photograhs, and replace it exactly as found.

Consult the local C-MAX representative or the factory for advice.

Servicing the STR

To gain access to the internal parts of the STR remove the three M3 screws at the lower rear of the unit and carefully slide the chassis out.

Take care when replacing the chassis not to trap the LED leads between the chassis and the top of the enclosure.

13. TROUBLESHOOTING

STR will not power up

Check the supply voltage.

Towfish will not start

Wait 30 seconds before trying again.

Check all connectors.

Use a DC voltmeter on pins 1 and 2 of the underwater tow cable connector (disconnected from the towfish) to check that approximately 42V appears for a period when the towfish is commanded to start.

If an SK172 winch is present, inspect the slip rings within the winch and, if necessary, clean them.

Towfish altimeter locks on to the surface echo

This can only occur if the towfish is nearer to the surface (or the wake bubbles) than to the bottom while, at the same time, the signal gain has not yet reduced to the correct value for the bottom echo.

Use the towfish bottom-tracking commands to force the indicated altitude to the correct value.

Image contrast poor at the longer ranges

Check that the transducer depression angle is set high (10º).

Check that the transducer faces are clean and free from oil or grease. Clean with mild detergent.

Try greater towfish altitude.

Check system performance in a known environment.

Image shows unexpected patterns on outer zones

If the sea surface is rough and the bottom is smooth then suspect interference from surface echoes. Try setting the transducer depression angle to low (20º).

Image shows spots or other interference

Temporarily mute the towfish to aid diagnosis, and then try switching off echo sounders, pingers or other sonars. Also try throttling back any outboard motors, particularly those with underwater exhaust.

Reduce tow speed.

Ensure that the towfish is below the wake.

Try reducing the towfish altitude.

Image shows alternating dark and light bands

If these bands are at 90º to the towfish track, it indicates that the towfish is not flying steadily.

Try to reduce the heave motion being transmitted down the tow cable. Hold a steady course and heading.

Try increasing towing speed so that the vessel holds a straighter course.

Image suddenly goes very erratic

The towfish has probably struck the bottom, or a mid-water obstacle such as an anchor chain, and broken the breakaway washer. Recover the towfish carefully.

Winch does not operate

Check the supply voltage and polarity.

Check the operation of the remote control pendant using an ohmmeter between the COMMON and IN and OUT contacts.

Other troubleshooting advice

If further advice is required, consult your local representative or the Factory.

14. INTERFACES

Towfish/Tow Cable Interface

Wet end interface

Mechanical: CM2 terminator, bail arm assembly and tow cable extension
Electrical: SubConn Micro 3 female (or equivalent); Micro 2 female upper connector on extension
Data = pins 2 and 3, polarity not significant; balancing signal (in tow cable extension only) = pin 1

STR Interface

Tow cable or winch deck cable

BNC or MIL-C-5015, size 10, threaded, 2-way bulkhead connector, polarity not significant

PC link

USB type B socket; USB1.1 or 2.0

Power input

2.5mm DC jack socket, central pin = +ve, or MIL-C-5015 size 14, threaded, 4-way bulkhead connector, Pin A = +ve, pin B = gnd; refer to STR Specifications for power requirements

C-Shell, Winch and Counting Pulley Interfaces

Consult Sections 16, 17 or 19 for interface information on these optional accessories.

15. SPECIFICATIONS

Standard Towfish

Operating depth
0-2000m
Acoustic frequencies
100kHz/325kHz, CHIRP -DF type,
325kHz/780kHz, CHIRP -EDF type
Ranges (port and starboard)
100m,150m, 200m,300m,400m,500m –100kHz;
25m, 50m, 75m,100m,150m, 200m –325kHz;
12.5m, 25m, 37.5m, 50m -780kHz
Operating speed
1-6 knots, but note that the physical limitations of cable drag and layback may limit operating speed
Maximum towing speed
12 knots
Acoustic pulse rates
500 / [selected range-limit], e.g. 10 scans/second @ 50m
Array length and beamwidths (2-way 3dB points)
0.41m -325kHz & 100kHz; 0.3m –780kHz;
0.3º horiz., 40º vert. asymmetric –325kHz;
1.0º horiz., 50º vert. –100kHz;
0.2º horiz., 50º vert. –780kHz
Lateral resolution
19mm -780kHz; 39mm -325kHz; 156mm -100kHz
Beam depression (of maximum sensitivity axis)
10º or 20º, adjustable without tools
Bottom-tracking (altitude) measurement and resolution
Automatic altimeter, from integral echo sounder; 78mm altitude resolution
Safety features
Weak link, breaks to give tail-first towing
Sensor options
Heading, pitch & roll; depth, 0-1000m
Construction
Stainless steel; no aluminium
Towfish dimensions and weights
1.24m length; 17.9kg in air, 12.1kg in seawater –DF; 17.1kg in air, 11.3kg in seawater –EDF
Towfish temperature range
-10 to +45ºC operating; -20 to +50ºC non-operating

STR

The Sonar Transceiver (STR) interfaces the towfish to an external data acquisition computer via a USB link. It makes the sonar appear to the computer as a USB peripheral. The STR also powers the towfish.

USB1 interface
Digital echo data plus control and status (contact C-MAX for protocol)
Dimensions (mm) and weight
297W x 204D x 62H, 2.2kg
Power
10-18V DC, 3A max, <2A typical at 12V, optional 24V DC, 2A max, <1A typical (BNC version)
10-28V DC (all later BNC units and all MIL-C-5015 units)
100-240V AC via external power adapter
Environment
0 to +45ºC; 10 to 80% RH; 5G, operating
-10 to +55ºC; 2 to 90% RH; 40G, non-op
IP54

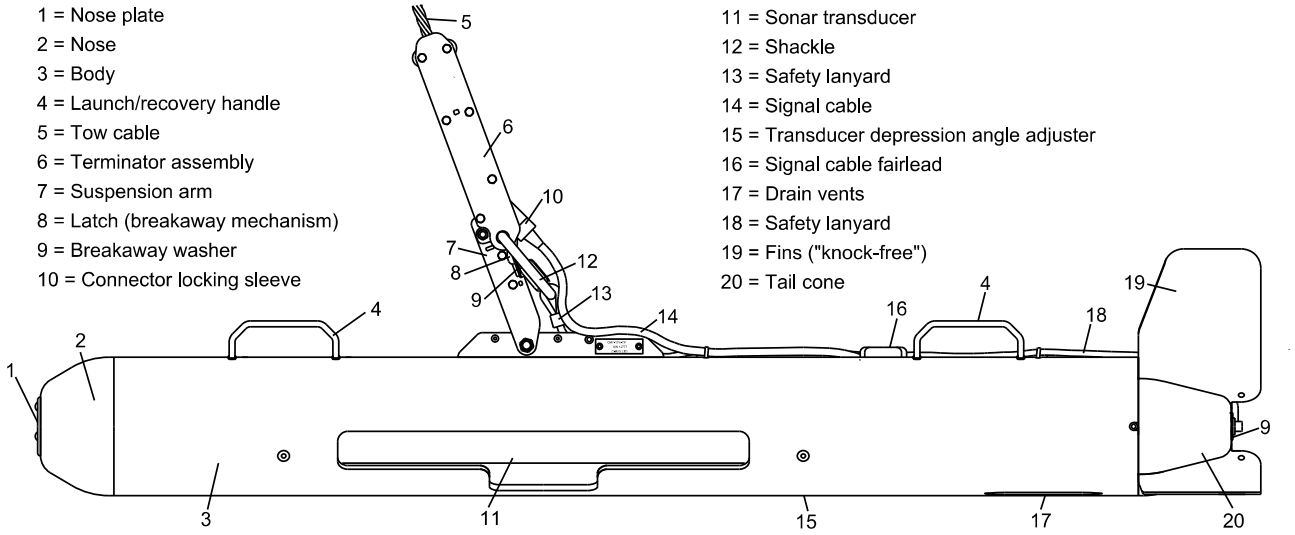
Tow Cables

Tow cable, types available
Coaxial or twisted pair; circuit resistance 200ohm max.
Tow cable diameter options
5.8 or 4.7mm, stainless steel armoured
11.4, 8.2, or 6.4mm, galvanized steel armoured
8mm "soft", polyamide reinforced, PU sheathed
Custom cables also available; also suits some "legacy" cables
Tow cable terminator weak link (breakaway washer)
75kgf nominal actuation tension, actuates to reverse-tow the towfish (DeepTow:150kgf)

16. DEEPTOW TOWFISH

Introduction

The CM2 DeepTow towfish is an optional alternative to the standard CM2 towfish, specifically designed for use where a heavyweight towfish is required for maximum towing depth, primarily when very long, larger diameter, tow cables are used. It uses the same electronics, firmware and transducers, as the standard towfish. The following description concentrates on aspects where the DeepTow differs from the standard towfish.



DeepTow Towfish

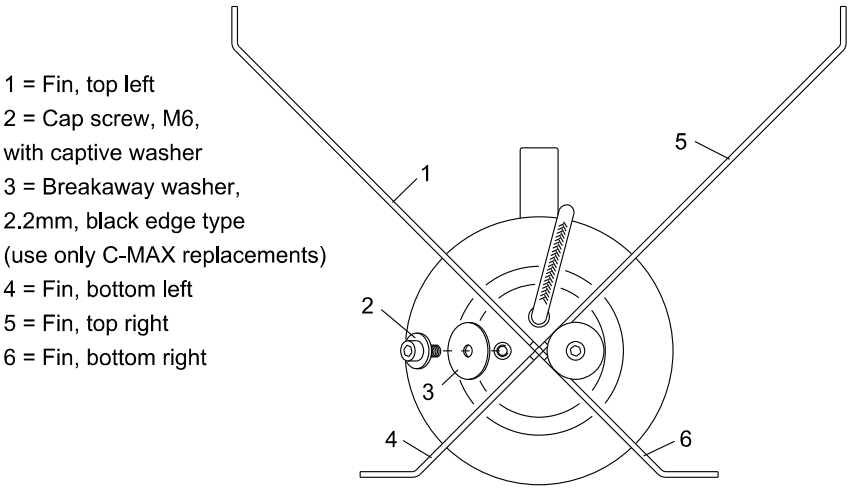
Attaching the Fins

Insert the shorter, bottom fins in the slots of the tail cone, with the tips horizontal. Ensure that the projection on the inner forward edge of each fin engages inside the steel towfish body.

Insert one of the longer, top fins, with the tip vertical. The vertical tip is intended minimize damage if the towfish swings into the side of the ship during launch or recovery.

Secure the two fins on that side of the towfish using a breakaway washer (2.2mm thick type for DeepTow, marked with a black edge, not the 1.4mm standard type) and the M6 cap screw with captive washer, as shown in the illustration. Use the 5mm hex key to tighten this screw. The breakaway washer is designed to fracture under excessive load.

Repeat for the other side.



Fin attachment, rear view

Looping the Fins together

To save the fins in the event of an impact, the user may retain them with a loop of line.

To do this pass a length of line through the hole in each of the fins and around the safety lanyard. The line should be tied off to make a loop. This loop must have at least 25mm (1") of slack.

The fins may be removed and stored with this line in place, after extracting the safety lanyard from the loop. When re-installing the fins for the next deployment the user must remember to pass the safety lanyard through the loop again.

Attaching the Tow Cable

Straighten out the end of the tow cable and ensure that there is no more than half a turn of inherent twist in it.

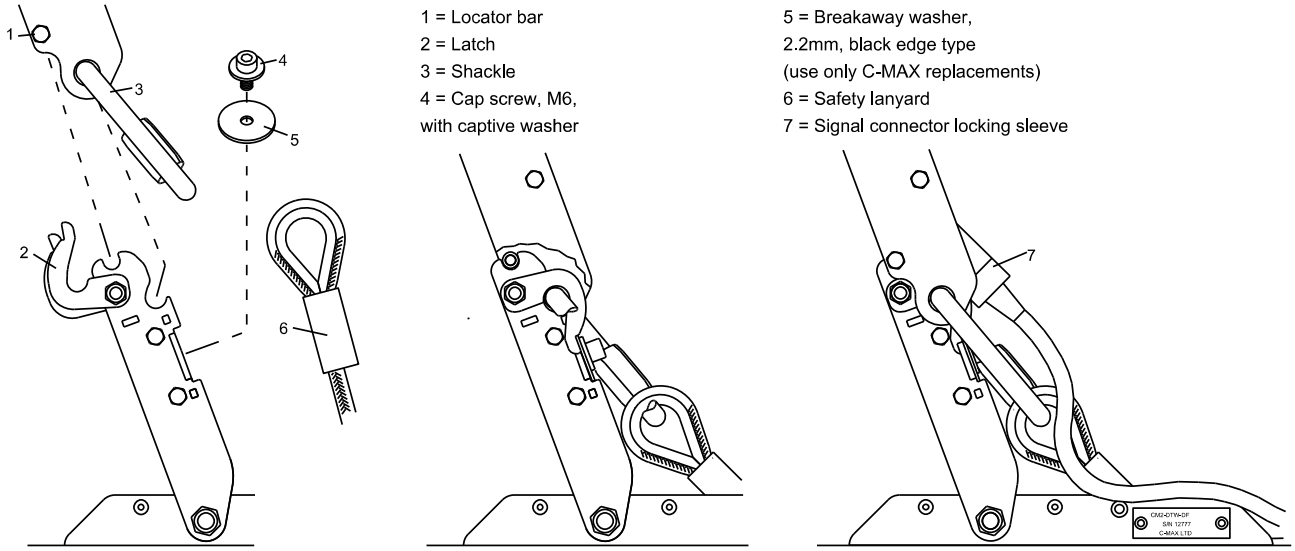
Attach the tow cable terminator to the suspension arm as shown in the illustration.

Note that the latches need to be rotated progressively as the terminator approaches the suspension arm; they cannot be rotated if the terminator is already engaged in its final position.

Secure the latches in position using the breakaway washer (2.2mm thick type for DeepTow, marked with a black edge, not the 1.4mm standard type) and the M6 cap screw with captive washer. Use the 5mm hex key provided to tighten this screw.

Remove the dust cap from the tow cable underwater connector and engage the towfish signal cable with the terminator socket, being careful to align the connector correctly. It is good practice to keep this plug clean and and only very lightly grease the rubber sleeves of the pins with the silicone grease provided.

Secure the connector with the locking sleeve.



Attaching the Tow Cable

Check that the screw barrel on the shackle (quick-link type) is fully engaged and that the terminator can freey move to the fully forward position without being restrained by the lanyard or signal cable.

Finally check that the two cable ties securing the lanyard and signal cable, and the lanyard alone, are properly fitted.

Adjusting the Transducer Depression Angle

The depression angle of the DeepTow transducers can be adjusted between 7º and 17º.

Use 7º transducer depression in normal circumstances; use 17º depression if the bottom image is being obscured by reflections from the sea surface.

The angle adjuster is located on the underside of the towfish, adjustable using the 5mm hex key.To set the transducers to 17º depression screw the adjuster fully clockwise.

To set to 7º unscrew the adjuster 8 full turns, allowing the transducers to pivot outwards until they hit their limiting stops. Unscrewing the adjuster more than 8 turns will have no further action.

Accessing the Internal Components

Remove the fins and the two cable ties holding the signal cable and lanyard to the towfish body. Set the transducers to 17º depression by screwing the adjuster fully clockwise (inwards) using the 5mm hex key.

Use a 3mm hex key to remove the three M5 screws from the nose plate.

Use a 13mm socket wrench to remove the M8 nut and crinkle shakeproof washer from the recess in the nose. This releases the central tie rod that secures the nose to the tail cone.

Remove the tail cone, with tie rod attached. Remove the nose cone (although this is not necessary for access to the electronics or transducers).

CAUTION: WHEN THE TIE ROD IS ABSENT THE LEAD BALLAST WEIGHT IS NOT SECURE IF THE TOWFISH IS ROLLED SIDEWAYS.

The ballast weight is located by two M6 countersunk screws below the towfish body near the forward end.

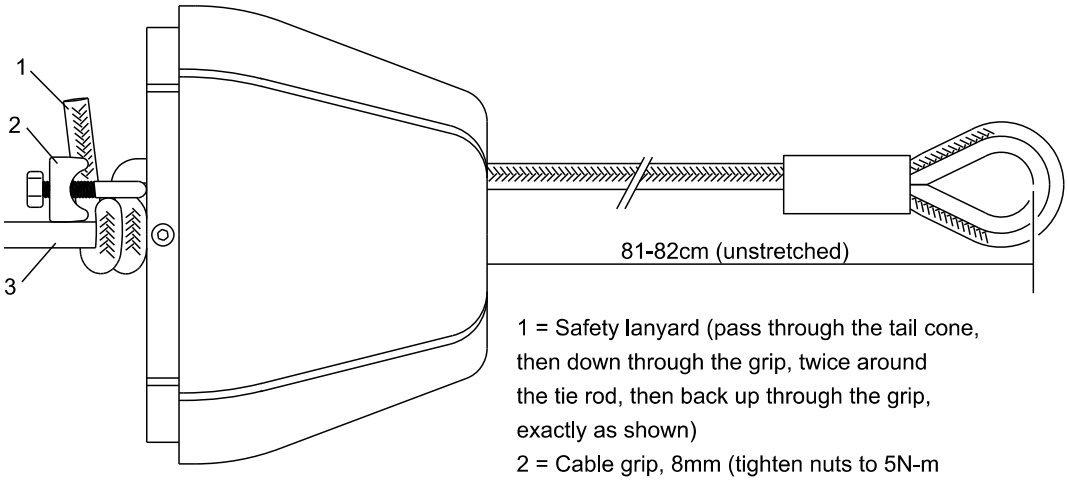
Never undo these screws. There is normally no need to remove the ballast weight but, if required, it can be removed by inserting a large flat-bladed screwdriver between the weight and the body, to one side of the screws, and lifting the weight. As soon as the weight has been lifted above the screws it can be slid forward, out of the body.

Use an 8mm wrench inside the rear of the towfish body to grip the M5 nyloc nut below the white fairlead. Then use a 3mm hex key to remove the screw from above. Remove the fairlead.

Unscrew the locking sleeve holding the signal cable to the internal electronics bottle and completely remove the cable from the towfish body.

Use a 4mm hex key to remove four M6 countersunk screws from the outside of the towfish, near both ends of the transducer apertures. Then extract the internal assembly carrying the transducers and electronics bottle through the rear of the towfish body.

Access to the Towfish PCB within the electronics bottle is very similar to that described in Section 12 for the standard towfish.



Replacing the Safety Lanyard

If the safety lanyard is to be replaced, fit the replacement lanyard carefully following the instructions in the illustration.

Reassembly is the reverse of the above procedure, noting the points below.

Align the guide plate on the electronics bottle bulkhead with the channel that supports the bottle. This aligns the internal heading sensor (if fitted).

Adjust the position of the transducer/electronics bottle assembly by gripping the transducers; do not lever the screw holes into position. Do not overtighten the four M6 countersunk screws.

CAUTION: BEFORE INSERTING THE CENTRAL TIE ROD, PULL THE EXCESS LENGTH OF SIGNAL CABLE OUT THROUGH THE FAIRLEAD (BUT STILL CONNECTED INTERNALLY TO THE ELECTRONICS BOTTLE). THIS ENSURES THAT THE TIE ROD DOES NOT PASS THROUGH A LOOP IN THE SIGNAL CABLE.

Note that if the cable comes under tension in use, it must be free to pull into a direct line between the electronics bottle and the fairlead without being wrapped around the tie rod.

When replacing the cable ties first replace the aft tie, while the lanyard is tensioned forward.

Before fitting the forward cable tie temporarily connect a tow cable terminator to the suspension arm and connect the signal cable connector. Then, with the terminator in its fully forward position, fit the forward cable tie giving the signal cable only a few millimetres of slack between the tie and the terminator. The lanyard should again be tensioned forward while this tie is tightened. Alternatively, if a terminator is not available, align the end of the signal cable connector pins with the forward end of the suspension arm before attaching the forward cable tie.

The excess length of signal cable, aft of the forward cable tie, should now be pushed into the towfish body through the fairlead slot. This excess length lets the cable remain connected and not under stress if an obstruction should cause the breakaway washer to break and release the terminator.

Tighten the nut on the nose end of the tie rod to 7 N-m (5lb-ft).

DeepTow Specifications

As standard towfish, specified in Section 15, except as follows:-

Operating speed
: 1-8 knots but note that the physical limitations of cable drag and layback may limit operating speed

Beam depression (of maximum sensitivity axis)
: 7-17º single screw adjustable with hex key

Sensor options
: Heading, pitch & roll; depth, 0-1000m

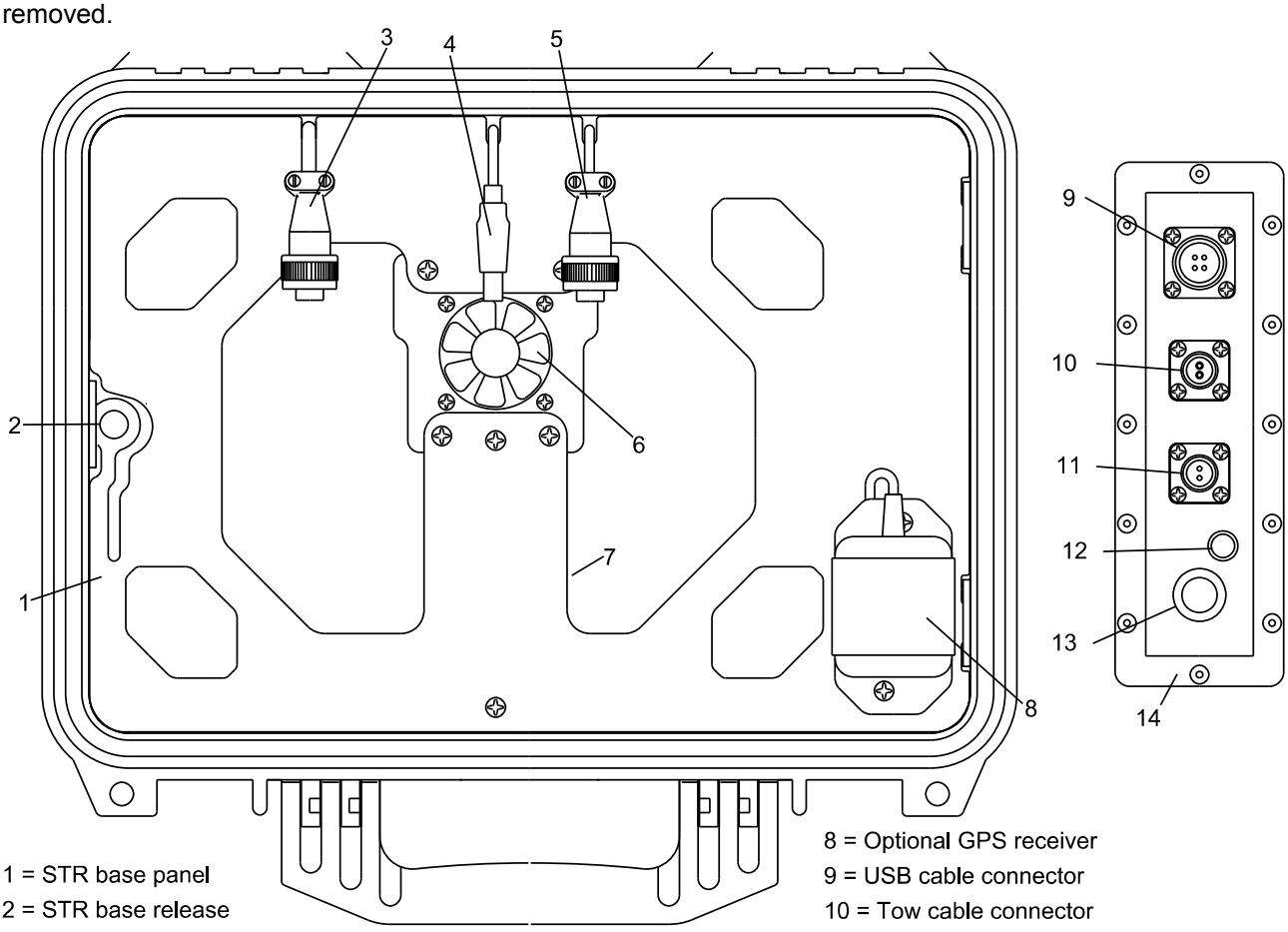
Construction
: Stainless steel and acetal; no aluminium

Towfish dimensions and weights
: 1.26m length, 0.14m body diameter; 42kg in air, 32kg in seawater

17. C-SHELL ENCLOSURE

Introduction

The C-Shell is an optional polypropylene clamshell enclosure for the STR. The C-Shell converts an STR into a fully waterproof (IP66) unit, complete with waterproof connectors. The STR can be quickly fitted or removed.



1 = STR base panel
2 = STR base release
3 = STR power
4 = STR link to USB hub
5 = STR link to tow cable
6 = Fan (12VDC)
7 = 4-way USB hub, below STR base panel, for dongle, GPS, and STR
8 = Optional GPS receiver
9 = USB cable connector
10 = Tow cable connector
11 = Power input connector, 10-28VDC
12 = Power LED
13 = Power switch, push-on/push-off
14 = External connector panel

C-Shell, Panel and Connectors

The C-Shell includes a 4-way USB hub that can be used to house a dongle for the acquisition software. The C-Shell can also be specified with an integral GPS receiver: the GPS output is fed to the hub for transmission to the external USB link.

To gain access to the internal parts of the C-Shell release the black plastic panel (STR base) and then remove the two M3 nuts holding the black anodised cover from the connector panel. This reveals the printed circuit board mounted on the back of the connector panel that carries the 20x5mm 10A fuse in the DC supply to the STR. This PCB also includes the voltage regulator for the fan and power LED.]

C-Shell Interface

PC link
MIL-C-5015, size 14, threaded, 4-way bulkhead connector
Pin A = gnd, pin B = 5V, pin C = data-, pin D = data+ ; USB1.1 or 2.0
Tow cable or winch deck cable
MIL-C-5015, size 10, threaded, 2-way bulkhead connector
Sockets A and B; polarity not significant
Power input
MIL-C-5015, size 10, threaded, 2-way bulkhead connector
Pin A = +ve, pin B = gnd; see C-Shell Specifications for power requirements

C-Shell Specifications

The C-Shell provides a waterproof housing for an operating STR, with waterproof external connectors. It also has an internal location for a dongle for the acquisition software.

Interfaces
Tow cable, USB, DC power
Dimensions (mm) and weight, including STR
406W x 330D x 174H, 6.4kg
Power, single voltage version (with BNC tow cable socket)
12V (10-18V) DC, 3A max, <2A typical @ 12V
optional 24V (20-28V) DC, 2A max, <1A typical @ 24V
100-240V AC via external power adapter
Power, wide range voltage version (with MIL-C-5015 tow cable socket)
12-24V (10-28V) DC, 3A max, <2A typical @ 12V; 2A max, <1A typical @ 24V
100-240V AC via external power adapter
Environment
0 to +45ºC; 10 to 80% RH; 5G, operating
-10 to +55ºC; 2 to 90% RH; 40G, non-op
IP65

18. CM2-WIN-300 WINCH

Introduction

The optional CM2-WIN-300 portable winch handles 4.7mm diameter, steel-armoured tow cable. This type of cable cannot be handled manually.

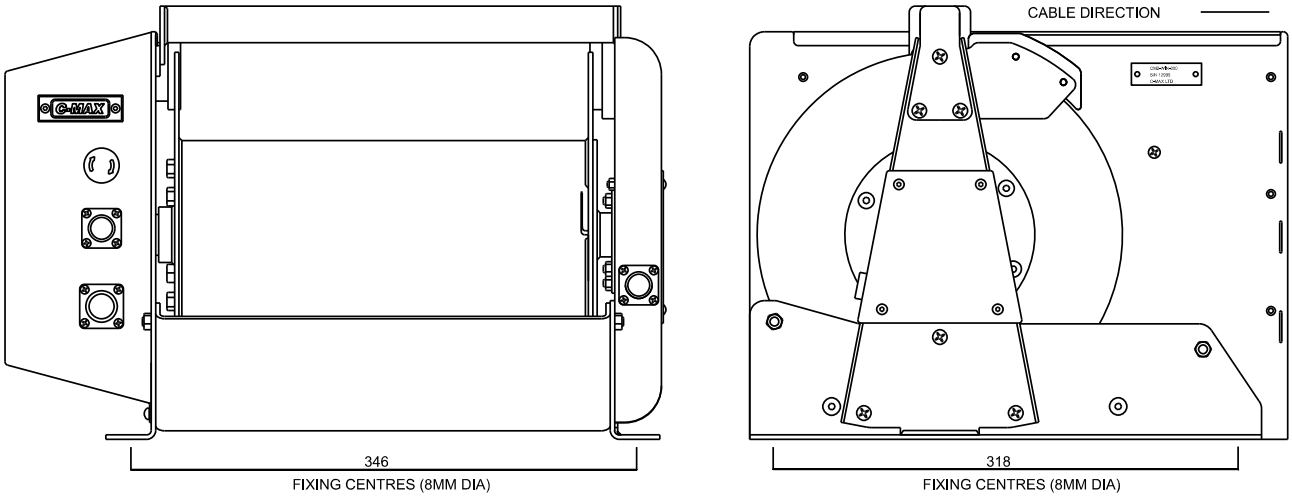
This model of portable winch, designed and manufactured by C-MAX, was introduced in 2006. It superseded the SK172 series described in the next section.

Installing the Winch

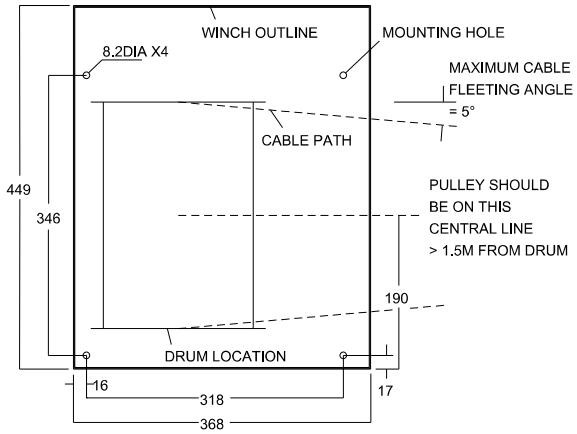
The winch should be secured to a flat surface using four M8 or 5/16” screws on 346 x 318mm centres. The winch should be located at least 1.5m directly forward of the pulley or fairlead so that the angle of the cable remains almost perpendicular to the axis of the drum.

24V DC must be provided via cables of at least 6 sq mm copper cross-sectional area, connected to a pair of 12V automotive batteries in series to give 24V, or a single 24V truck battery. A normal generator is unlikely to be able to supply the peak starting currents.

If the supply is fused the fuses should be slow-blow of at least 50A rating.



CM2 Winch, Fixing Centres



CM2 Winch, Footprint

Overload Clutch

The cable drum is driven via an internal clutch that is intended to slip under excessive load. The slipping torque is determined by a pair of internal disc springs. The pre-load on these springs is adjusted by the four hex-headed, clutch tension screws on the flange nearest the motor plate. If the clutch is slipping under normal use tighten these by rotating them all one-half turn clockwise. All four screws must be rotated an equal amount.

As a guide, with the cable almost fully wound on to the drum, the clutch should not slip until the cable is pulled with a force in the range 50-70kg (300m cable) or 60-80kg (200m cable).

Alternatively the clutch tension screws can be reset by unscrewing each until the head is just bearing on the flange but with no force. When all four are at this state, each should be screwed clockwise 2.5 turns (900 degrees).

Soft Start

Later units are fitted with a “soft start” circuit that reduces the initial acceleration of the winch motor and minimizes the starting surge current. The starting current is controlled by a module that is in the electrical path from the –ve terminal of the external power connector to the –ve terminals of the contactors (relays). If this solid-state soft start module were to fail it can be bypassed to allow the winch to continue to operate.

The soft-start function is temporarilly disabled if the temperature limit of its local heatsink is exceeded, such might be caused by excessive start-stop “inching”. If and when the soft-start function is disabled in this way the winch will continue to function but starting and stopping will be sharp instead of smooth.

Temperature Alarm

Later units are fitted with an audible motor temperature alarm. The alarm is intended to protect the winch motor from excessive temperatures, particularly when recovering cable with the towfish fitted with the optional wing depressor.

The alarm sensor is fitted to the end of the motor casing. If the casing temperature exceeds 80C the alarm sounds intermittently; if it exceeds 90C the alarm sounds continuously. The alarm sound stops when the temperature falls back below these limits.

If the alarm sounds, the user should minimize use of the winch to avoid possible damage. Note that the alarm should sound briefly when power is initially connected to the winch.

Signal Cable

The signal cable (or “deck” cable) running from the winch to the STR should preferably be a shielded twisted pair. If the cable is no more than 10m an RG58 coaxial cable is suitable. Polarity of connection is not important. Pins B and F are used on the winch connector. The other end of the cable should be fitted with a BNC or MIL-C-5015 connector, depending on the version of the STR, etc.

Control Pendant

The control pendant supplied with the winch includes a pair of switches, mechanically interlocked so that only one (wind in or wind out) can be operated at any instant. The connections for the control pendant are as follows:-

Pin E…White button (wind out)
Pin H…Common (+24v)
Pin A…Black button (wind in)

Winch Specifications

Capacity
300m of 4.7mm tow cable
Power
24V at up to 50A peak (100A where “soft start” bypassed or absent)
Construction
Stainless steel
Winch dimensions (mm) and weight
45OW x 350D x 300H
47kg when fitted with 300m cable
63kg packed in transit case with control pendant, power cables, etc
Environment
-10 to +45ºC operating; -20 to +50ºC non-operating

Replacing the Tow Cable

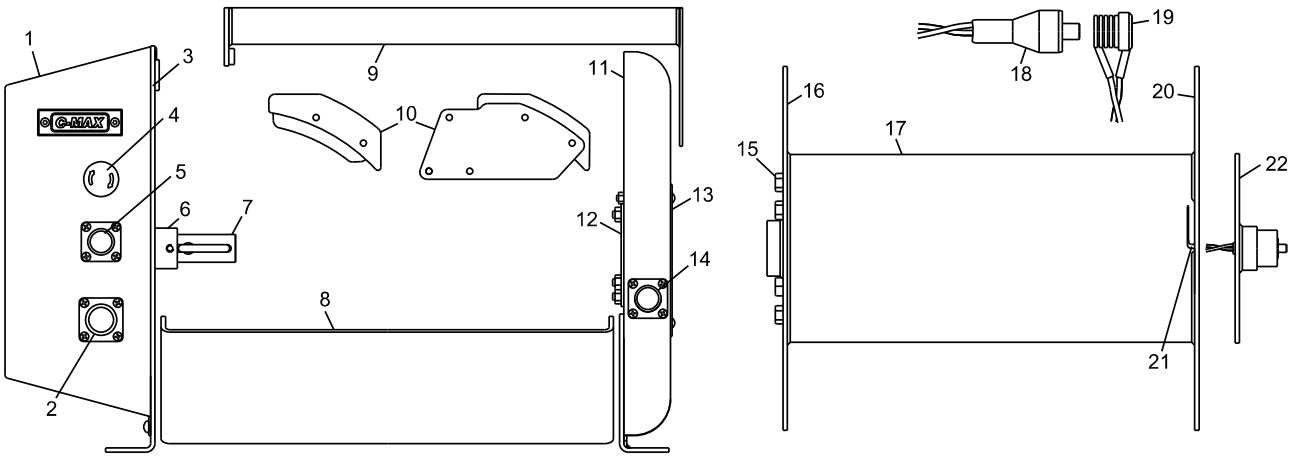
Tools required include metric hex keys, metric combination wrenches (10mm, 8mm, 7mm) and a No2 Pozidrive (or a Phillips) screwdriver. Loctite 243 or equivalent (not high strength Studlock) is also needed.

If a tow cable is fitted, wind its full length, except for a couple of turns, off the winch on to another temporary reel.

To remove the cable drum the winch handle has first to be removed. The handle is secured to the motor mounting plate by two M5 screws whose nuts or heads (depending on model) are accessed beneath the motor cover. The motor cover is released by removing the 3 M4 screws at its base then lifting it clear. On later units there is a soft-start module mounted to the inside of this cover and care must be taken not to pull on any of the attached wires.

Disconnect the handle from the motor mounting plate, then remove the 4 M4 screws holding the slip ring cover. Pull the white nylon body of the slip ring connector off the black body of the Mercotac slip ring unit. Whilst pulling at the connector hold the black slip ring unit in its recess; some force may be required. If the slip ring unit is accidentally pulled out of its recess during this process, secure it again afterwards with flexible silicone sealant.

1 = Motor cover
2 = 24V DC power connector
3 = Motor mounting plate
4 = Emergency stop button
5 = Control connector
6 = Bronze sleeve
7 = Drive shaft and key
8 = Forward cross brace
9 = Handle (later version)
10 = Cable guard (left & right)
11 = Bearing support assembly
12 = Bearing retainer
13 = Slip ring cover
14 = Signal connector
15 = Clutch tension screws
16 = Flange, motor end
17 = Cable drum, shown empty
18 = Slip ring unit (enlarged view)
19 = Slip ring connector (enlarged view)
20 = Flange, bearing end
21 = Cable entry slot
22 = Hub and slip ring unit



CM2 Winch Disassembled

Remove the 4 M6 fasteners holding the bearing support assembly to the two cross braces.

Slide the bearing support assembly, together with the winch drum, off the motor shaft.

Separate the bearing support assembly carefully from the winch drum. On earlier units, where the handle is not removable from the bearing support assembly, this operation requires some manipulation of the handle and its fasteners. On later units the handle is secured to the bearing support assembly by 3 M5 screws; these screws should be loosened temporarily.

On the inside of the hub identify the pair of wires between the end of armoured tow cable and the rear of the slip ring unit. Cut this pair of wires so as to LEAVE A LENGTH of approximately 100mm still attached to the slip ring unit.

Undo the cable grip on the tow cable and remove the cable from the drum.

Feed the new cable through the slot in the drum. Attach a cable grip to the tow cable to prevent it being withdrawn (in normal use several cable turns must always be present on the drum because the cable grip is not intended to hold full towing forces)

Attach the 2 insulated wires to the pair of wires projecting from the slip ring unit, insulating the joints with heatshrink sleeving. Polarity is not important. Check for electrical continuity using a resistance meter.

Re-install the hub, drum, bearing support assembly and handle, by the reverse of the disassembly procedure. Those fasteners that are not fitted with nylon lock nuts should be secured using Loctite 243 or equivalent.

Temporarily connect the other end of the tow cable to a towfish, and connect the winch deck cable to an STR. Start the system and check for satisfactory operation. After correct operation has been checked, disconnect the deck cable again.

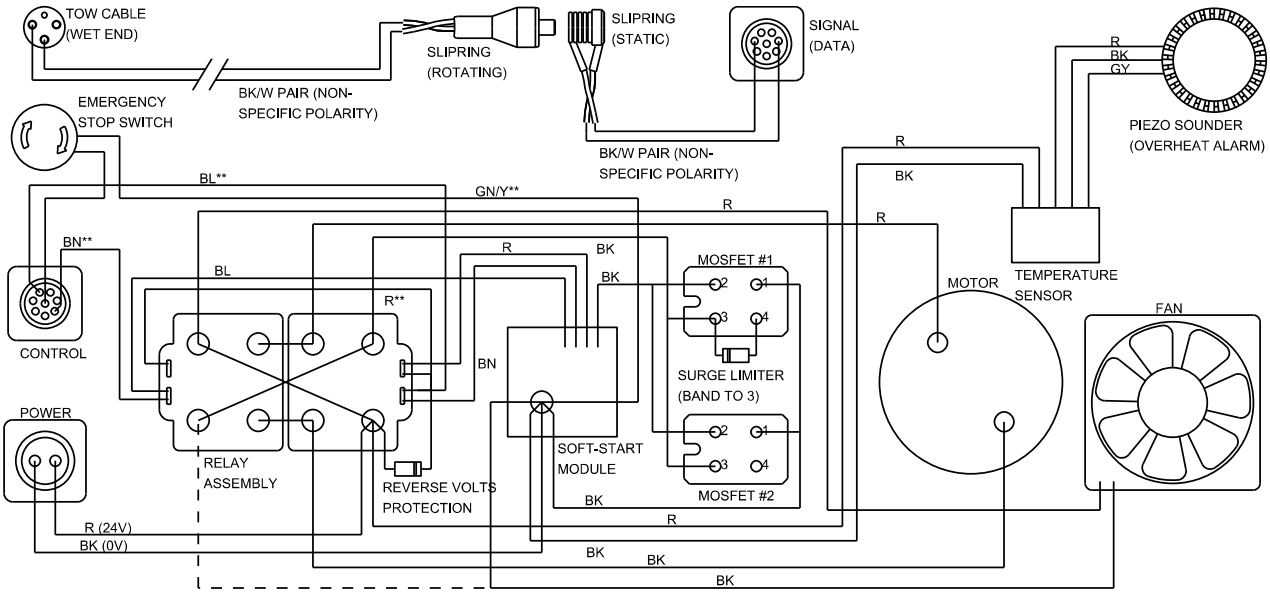
Seal around the cable slot in the drum with flexible silicone sealant and wind at least several turns on to the drum so that the sealant cures in the correct position. Finally, replace the motor cover, being careful to align the tabs on the cover with the slots in the motor plate, and secure it with the three M4 x 6 screws.

Accessing the Winch Drive Components

The winch drive components include the integrated motor-gearbox unit, pair of switching relays, soft-start module and its power transistors, cooling fan, and motor temperature alarm. These are all accessible beneath the motor cover. Note that some of the components may be absent from early units.

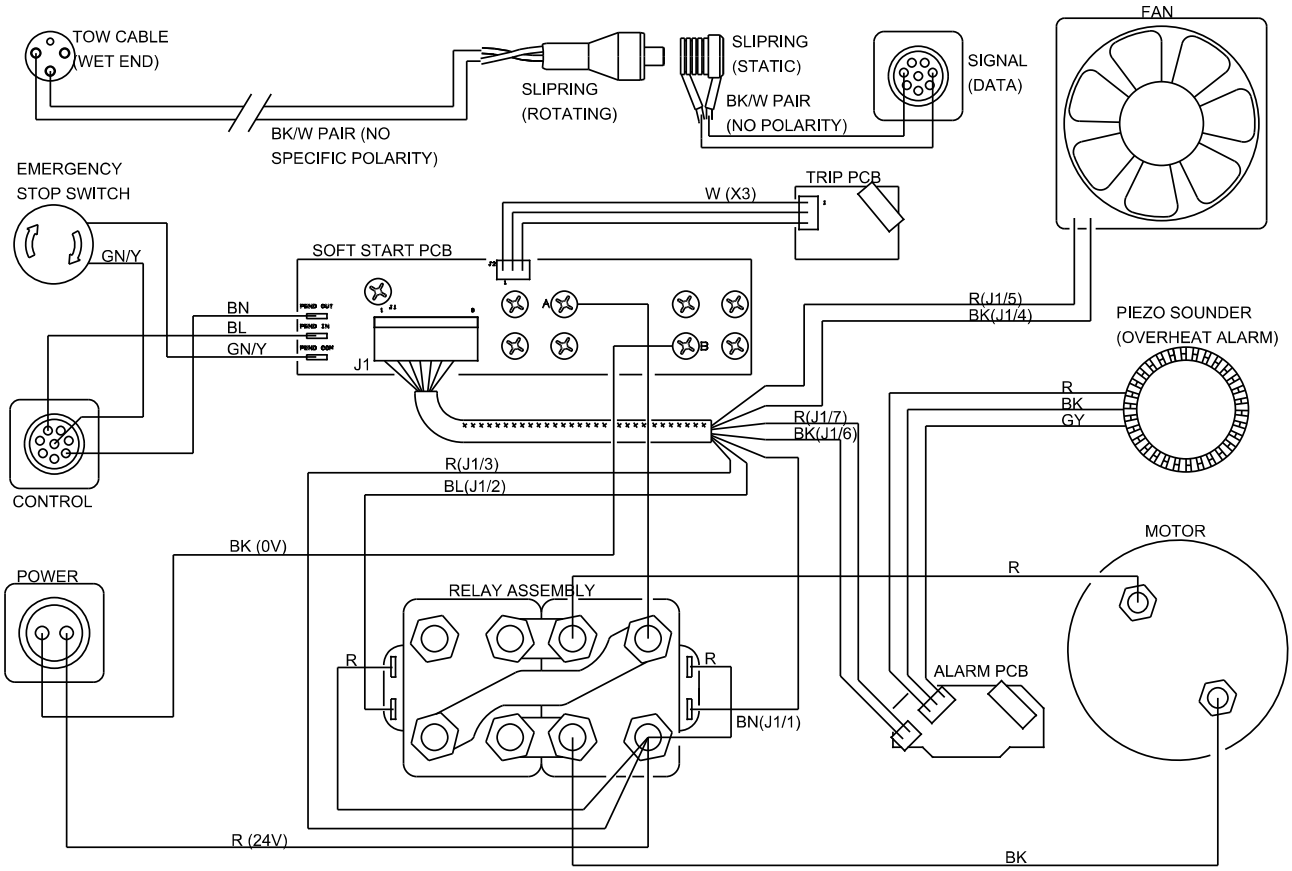
The motor cover is released by removing the three M4 screws at its base then lifting it clear. The soft-start assembly is mounted on the inside of this cover (except early units) and care must be taken not to pull on any of the attached wires.

Note that there have been several iterations of the electronics configuration, as shown in the diagrams below. In case of difficulty consult C-MAX Ltd..



NOTES:
1. CONNECTORS, EXCEPT TOW CABLE, SHOWN FROM REAR
2. BLUE** IS WHITE ON EARLY UNITS
3. BROWN** IS RED ON EARLY UNITS
4. GREEN/YELLOW** IS BRAID SCREEN ON EARLY UNITS
5. RED** IS BLACK ON EARLY UNITS
6. BROKEN LINE SHOWS ALTERNATIVE ROUTING ON EARLY UNITS
7. SOFT START CONTROLLER AND MOSFETS
NOT FITTED TO EARLY UNITS; CAN BE RETROFITTED
8. SOME UNITS FITTED ONLY WITH SOFT START
AND MOSFET #1; MOSFET #2 CAN BE RETROFITTED
9. EMERGENCY STOP SWITCH NOT FITTED TO EARLY
UNITS; CAN BE RETROFITTED
10. TEMPERATURE SENSOR AND PIEZO SOUNDER NOT
FITTED TO EARLY UNITS; CAN BE RETROFITTED;
11. NOTE THAT THE SENSOR AND SOUNDER MUST BE
FITTED IF WINCH IS USED WITH WING DEPRESSOR,
OTHERWISE WINCH WARRANTY IS VOID
12. IN EMERGENCY, IF SOFT START FAILS, BYPASS
THE SOFT START; REMOVE THE CONNECTION
TO TERMINAL 3 AND ATTACH IT TO TERMINAL 1
ABOVE THE ORIGINAL TERMINAL 1 CONNECTION

CM2 Winch, Early Versions, Circuit Schematic



CM2 Winch, Later Version, Circuit Schematic

19. SK172 WINCHES

Freeing the Drum in an Emergency

On the optional SK172 and SK172E portable winches, an extended 5mm A/F key can be used to release the winch drum for hand rotation in an emergency, by unscrewing the two locking screws in the bronze drive bush. When released in this way the slip rings still function normally.

The locking screws should normally be kept tight and their tightness checked as part of the maintenance routine.

Replacing the Tow Cable

If a tow cable is fitted, wind its full length, except for a couple of turns, from the winch on to another temporary reel.

Remove the sheet steel cover that protects the motor, gearbox and slipring assembly, and then remove the slipring cover. Identify the two signal wires that emerge from the central conduit through the drive shaft; these wires are attached to terminal blocks on the (rotating) end of the slipring assembly. Disconnect these signal wires.

Remove the end plate holding the outboard bearing for the drum. Remove the screws securing the drum flange and lay the flange aside. Note how the tow cable is routed.

Reach into the drum, loosen the central sealing gland, and then withdraw the coaxial signal cable that extends from the end of the tow cable. Replace the tow cable by the reverse of the above procedure, first inserting the tow cable in the slot in the winch drum. Identify the two conductors extending from reduced-diameter section of the tow cable. Twist these together and push them down the central conduit.

Connect the conductors to terminals 1 and 2 on the rotating portion of the slip ring. Polarity is not important. Check the slip ring connections through to pins B and F on the external connector.

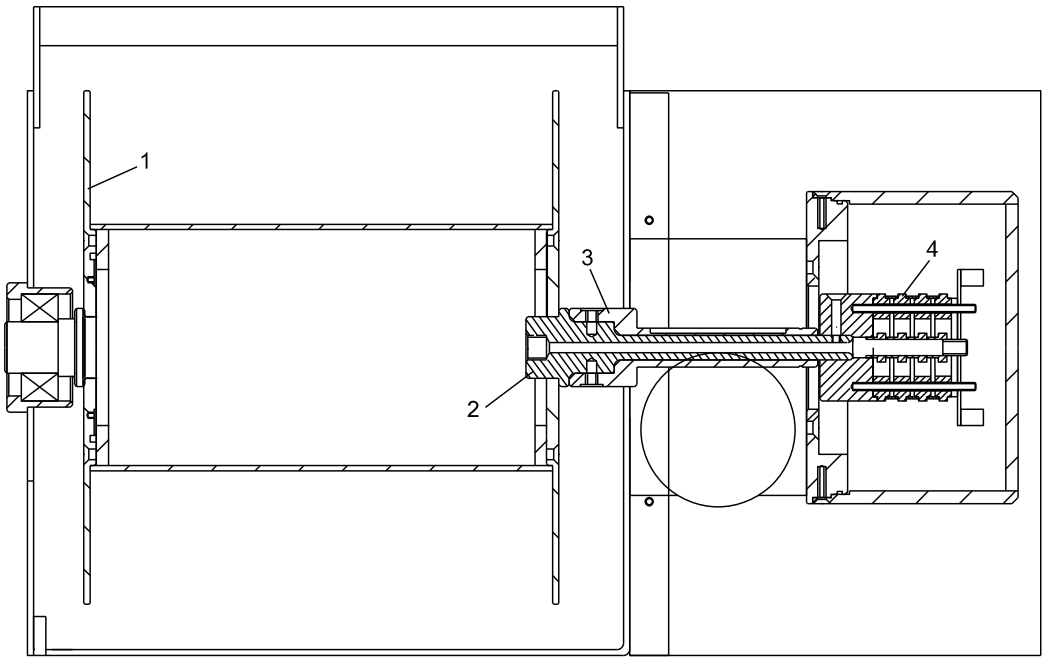
Use a small amount of silicone rubber compound to fix the two signal cable wires to the rotating section. This will prevent the wires vibrating and fracturing.
Reach in to the drum and tighten the central gland.

Temporarily connect the other end of the tow cable to a towfish, and connect the winch deck cable to an STR. Start the system and check for satisfactory operation. After correct operation has been checked, disconnect the deck cable again.

Replace the flange in the end of the drum, and fit the end bearing plate. Rotate the winch several times to position the cable firmly around the drum. Then seal the cable exit slot using silicone rubber compound.

The control pendant connections are as follows: -

Pin E…White button (winding out)
Pin H…Common (+24v)
Pin B…Black button (winding in)



1 = Drum flange (removed to fit cable)
2 = Rotating cable conduit to slip ring chamber (sealing gland not shown)
3 = Phosphor bronze drive tube & locating screws
4 = Slip ring assembly & locating screws

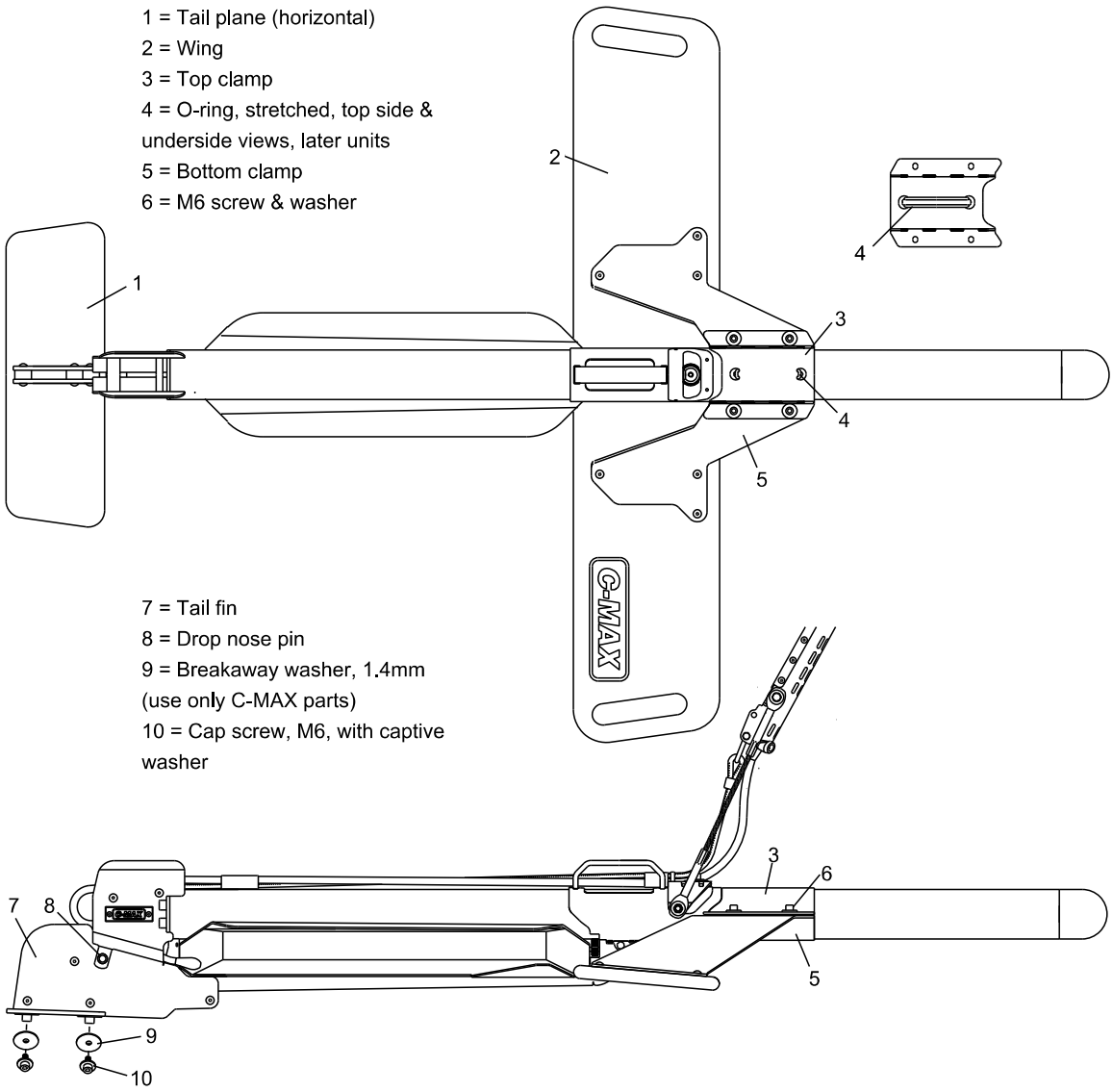
SK172 Winch, Cross-Section

20. WING DEPRESSOR

Introduction

The tow cable of a sidescan sonar is subjected to significant drag forces at normal survey speeds, causing the towfish to rise. Therefore more cable must be veered or the tow speed must be lowered in order to keep the towfish at the desired depth.

The purpose of the wing depressor is to tension the cable downwards, without attaching additional static weight to the towfish or tow cable. Because almost all of the extra tension is generated dynamically, launching and recovery are far easier than if static ballast weight is used. Also, the load on the winch motor can be eased simply by reducing tow speed whilst heaving, an option that is not available with static ballast.



CM2 Wing Depressor

Fitting the Wing and Tail to the Towfish

Attach the wing to the towfish as shown in the illustration, with the wing clamp directly in front of the towfish handle assembly. There should be no gap between the towfish handle assembly and the wing clamps. Use the four 20mm M6 screws and washers to secure the wing clamps.
Check that the wing is tight on the towfish tube with no ability to rotate. On early units the gripping action is provided a compressed rubber strip inside the bottom clamp. If missing, this strip must be replaced or, preferably, the top clamp updated to the later version, as described next.

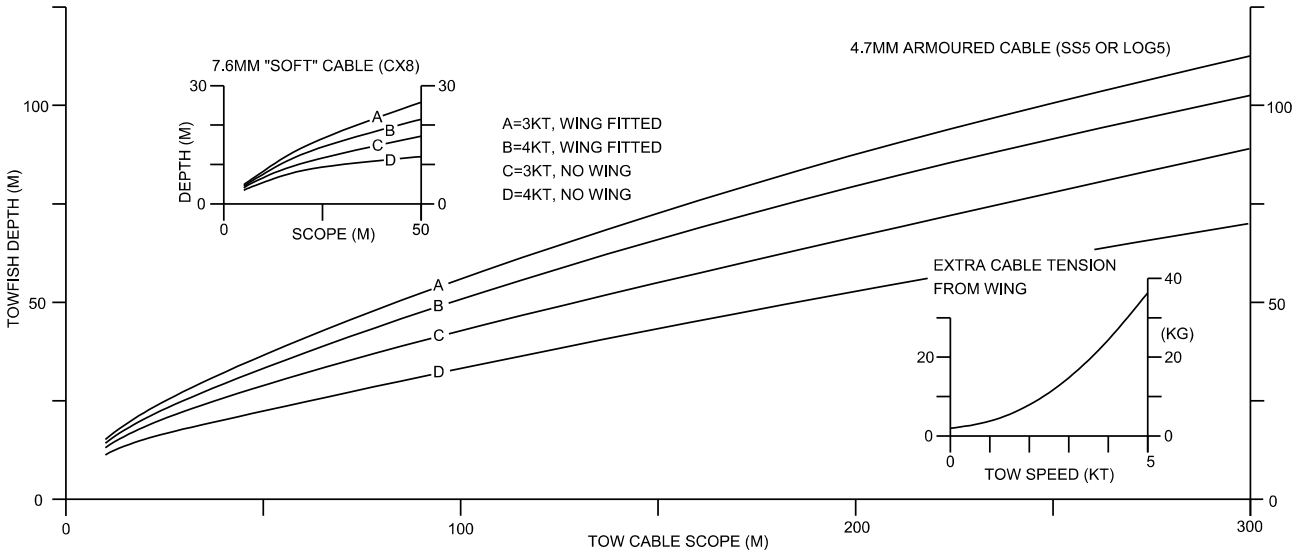
On later units the grip is provided by an O-ring located inside the top clamp, stretched between two apertures. This O-ring is identical the O-rings used to seal the towfish rear bulkhead and the nose, and is available as a standard spare.

On early units, the tail is attached using the 35mm drop-nose pin instead of the normal 25mm pin. Store the removed 25mm pin in a safe place. Later units use the original 25mm pin to secure the tail.

Launching the Towfish and Wing

Use the handle at the end of the wing when initially lowering the towfish. The wing handles can also be used when reaching for the towfish to recover it.

Be aware that the wing can cause the towfish to glide forward on launch. Be careful that it does not head for a propellor.



Depth Performance with and without Wing Depressor

Towing the Towfish when Wing is fitted

Refer to the illustration for the effect of the wing hydrodynamic down-force on the towfish depth. For any particular depth a shorter length of cable can be used, with reduced layback.

Note also the increase in tow cable tension. Extra tension increases the power consumption of the winch (if used) whilst hauling in the cable, and care must be taken not to overheat the winch motor.

CAUTION: WHEN HAULING THE TOW CABLE, IF THE WING IS FITTED, REDUCE WINCH POWER CONSUMPTION BY REDUCING SPEED AS SOON AS THE TOWFISH IS HIGH ENOUGH FOR SAFETY

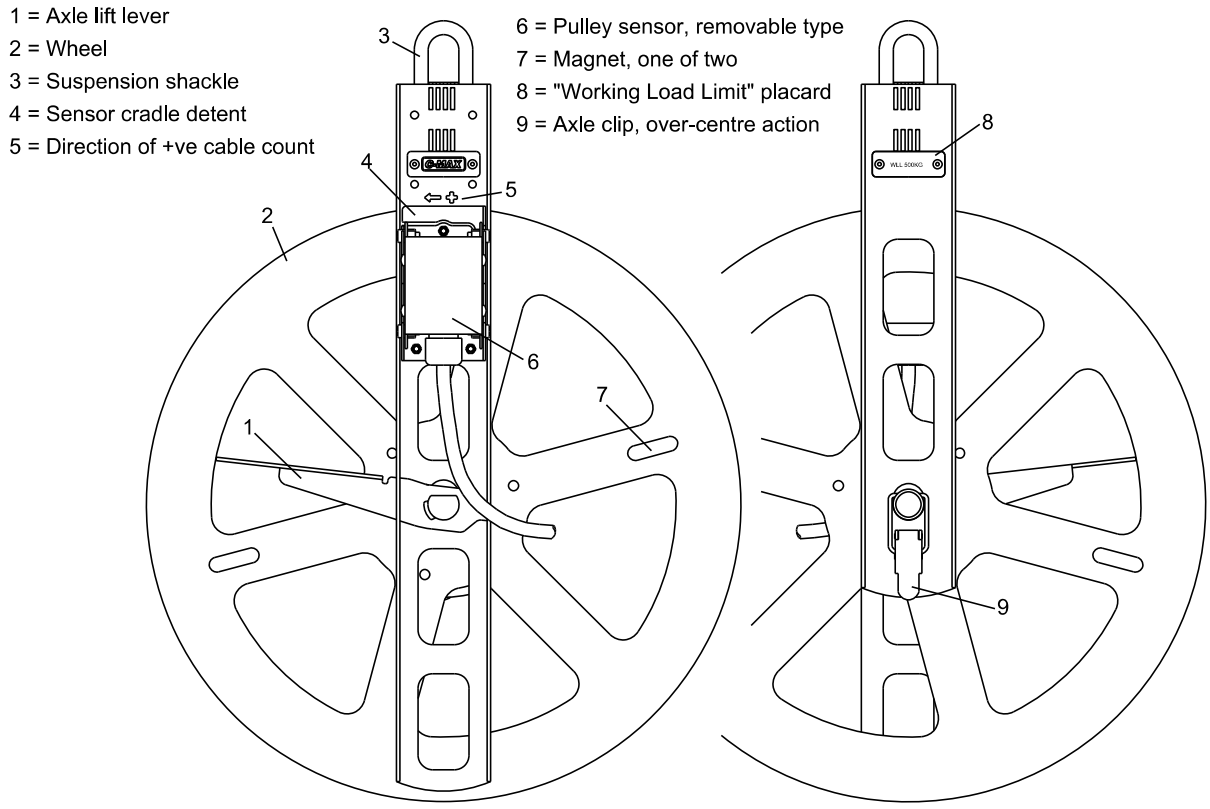
21. PULLEYS AND COUNTING PULLEYS

Pulley Types

There are two sizes of the pulley designed for use with CM2 tow cables. These are snatch-block types; the pulley does not need to be disassembled to fit or remove the cable. The smaller of the two sizes has two versions; the original pulley, of a different design than that illustrated here plus the later "Standard" type with the same 16cm diameter wheel but a later style of frame. The "Large" type has a 32cm wheel and also has the later style of frame.

The pulleys with a 16cm wheel are suitable for use with "soft" aramid-reinforced cables up to 8mm diameter and with steel-armoured cables up to 6.4mm diameter. The 32cm wheel is suitable for use with "soft" cables and with steel-armoured cables up to 11.5mm diameter.

All types may be used as simple pulleys or, with addition of a Pulley Sensor and cable, are suitable for conversion to counting pulleys.

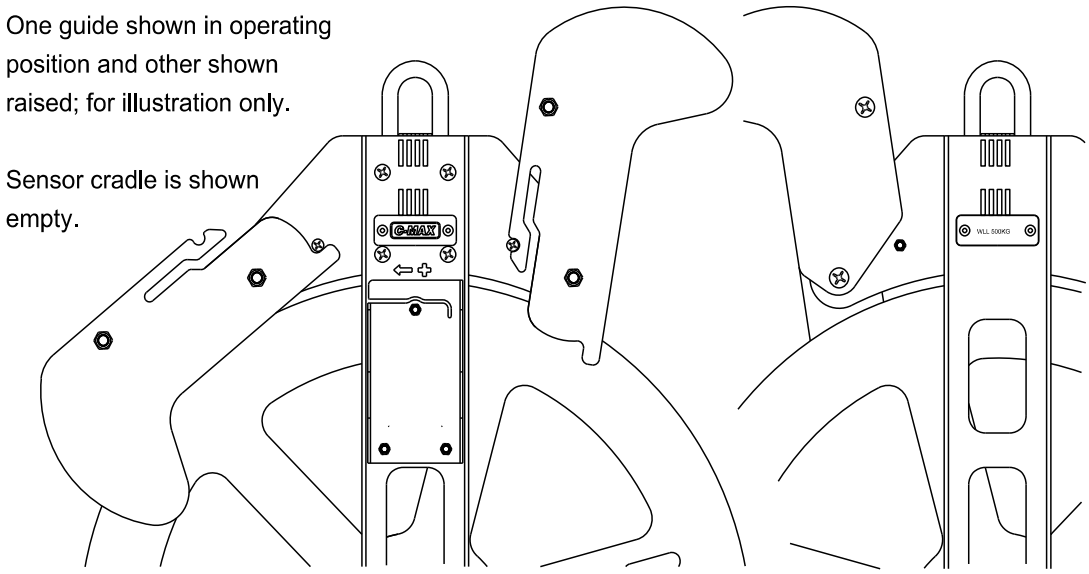


Counting Pulley, Large

Cable Guides

If a pulley is to be used with a polyurethane-sheathed tow cable there may be circumstances where the “stickiness” of the cable would cause it to ride up on the rim of the pulley and jam where it reaches the supporting arms. This is more likely when the cable is only under light tension, insufficient to pull the pulley into line with its path. This behaviour is unlikely to occur with a steel-armoured cable in normal use.

To avoid the problem of soft cables riding up, an optional cable guide set is available for fitting to the 32cm pulleys. These guides are raised for loading the cable, then dropped into position over the pulley rim to guide the cable and ensure that it cannot ride up.



Pulley Cable Guides

Counting Pulley

The purpose of the counting pulley is to allow the tow cable scope (i.e. the length currently outboard) to be displayed to the sonar operator and be recorded within the sonar record.

Note that the cable scope and layback (the horizontal distance of the towfish behind the reference point on the vessel) are not the same. Layback includes the offset from the reference point to the pulley plus a proportion of the scope dependent on the cable weight and drag, towfish weight, speed through the water and towfish depth. Unless a specific cable scope-to-layback conversion program is available, such as in MaxView, layback must be estimated and entered manually.

Installing the Counting Pulley

The counting pulley consists of a CM2 pulley fitted with a pulley sensor. All CM2 pulley wheels are all fitted with one magnet (16cm) or two magnets (32cm) so the rotation can be detected at intervals equivalent to half-metre movement at the circumference.

The pulley sensor is connected to a PC's serial port via a counting pulley deck cable. Depending on the PC the deck cable may need to be terminated in a serial-to-USB converter. The PC may be the same computer that is used with an STR or may be a navigation PC for example.

To install the counting pulley software, install the Counting Pulley Display CD that is supplied with the pulley sensor, and follow the on-screen instructions.

Locate the pulley in accordance with the advice given in Section 3. Route the counting pulley cable so that it is not under tension at any point, nor likely to be tripped over.

When the pulley is not in use it is advisable to remove the pulley cable and replace the cap on the pulley sensor.

Note that later sensor units have a moulded-in cable and have no connector at the sensor end. This type of sensor is clipped into a cradle instead of being attached to the pulley by screws. These units are intended to be removed together with the pulley cable when not in use.

If a connector is present the cable connections are as follows: (sensor>D-type) F>2, D>3, C>4, H>5, A>7.

22. POLEMOUNT BRACKET

Introduction

Some users prefer to use a rigid overside mount for the towfish in certain circumstances, instead of towing it. The advantage is that the towfish is not endangered when manoeuvring in restricted depths or near obstructions.

Note that the disadvantages of rigid mounting are

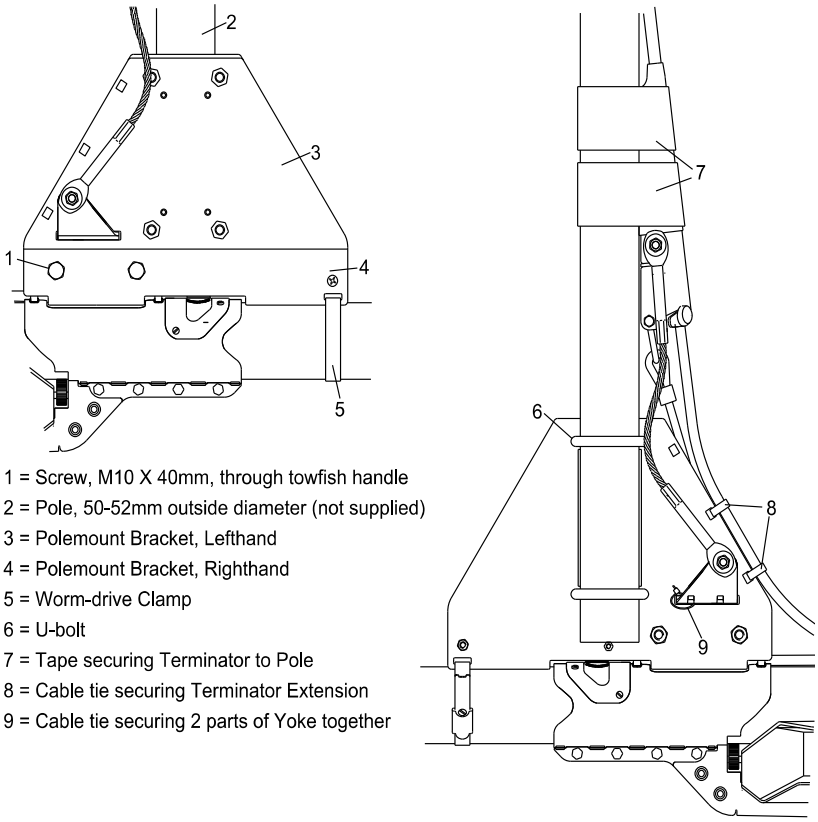
a) The towfish motion is not isolated from roll, pitch and yaw of the boat
b) The towfish altitude cannot be adjusted to give the optimum image; rigid mounting generally means the towfish is too high off the bottom for best central coverage and for best shadow angles
c) The image from the beam passing under the hull can be affected by reflection from the hull resulting in multipath distortion

An alternative to rigid mounting is towing from the bow or from the beam.

Fitting the Polemount Bracket

The positioning of the overside pole and its mounting to the hull is outside the scope of this manual.

Fit the CM2 polemount bracket to the lower end of the pole as shown in the illustration, tightening the U-bolts and ensuring that shakeproof washers are fitted under the M8 nuts. Tape the terminator in position using duct tape or similar.



Fitting the Polemount Bracket

Use cable ties to secure the tow cable extension, to prevent it oscillating and chafing in the flow, and also to secure the two halves of the yoke assembly together, located in the slot in the bracket..

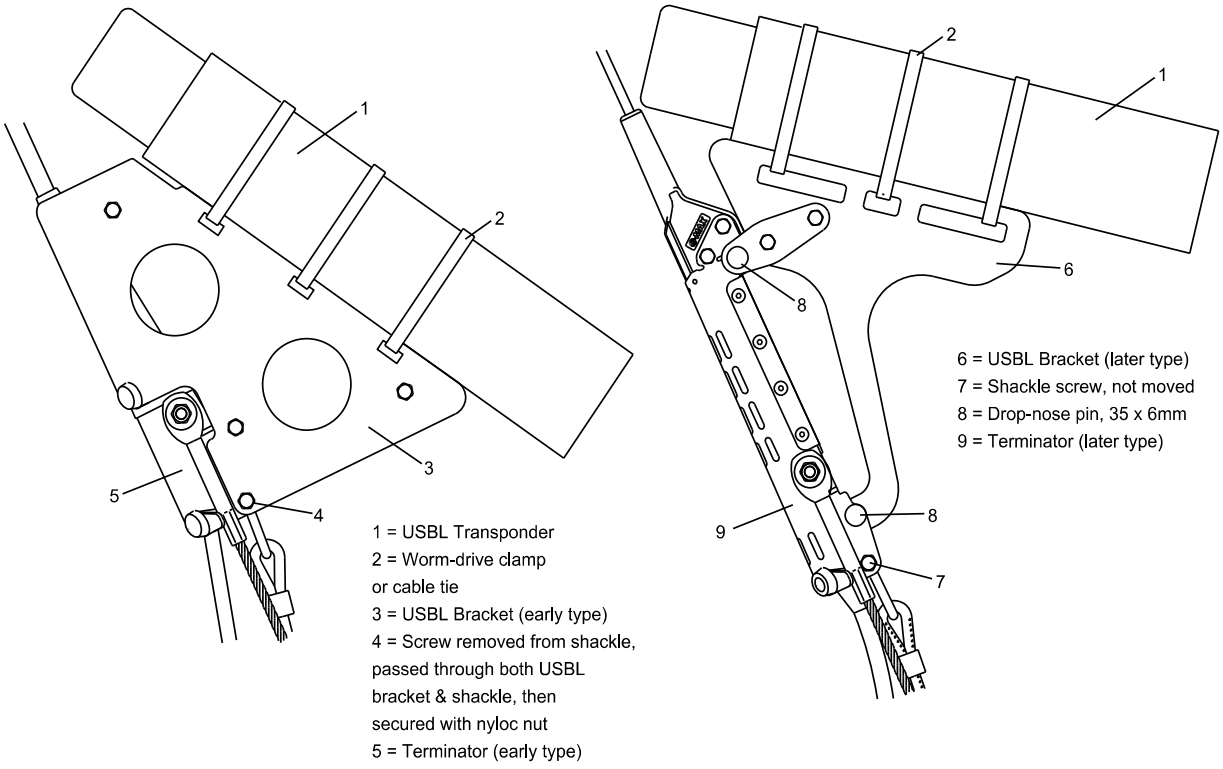
23. USBL TRANSPONDER BRACKET

Introduction

Where accurate tracking of the position of the towfish is required, C-MAX recommends the use of an ultra-short-baseline (USBL) acoustic tracking system. Suitable USBL systems are available from several manufacturers, and should be chosen so that their effective range is at least that of the maximum length of tow cable to be used with the CM2 system. These systems require the use of transponder on or near the towfish.

The purpose of the CM2 USBL bracket is to hold a USBL transponder securely to the tow cable terminator. If the transponder is simply secured to the terminator using duct tape it may generate eddy currents and oscillate; these oscillations may be enough to fracture the bail arms after a period of use.

The USBL bracket also holds the transponder at an angle so that it is closer to pointing at the USBL transceiver array fitted to the towing vessel.



Fitting the USBL Bracket to the Tow Cable Terminator

Fitting the Bracket, Early Type

Remove the screw holding the safety lanyard shackle to the terminator. Slide the transponder bracket over the tow cable and then lower it around the terminator. as shown in the illustration. Replace the screw through both the bracket and terminator and secure it with the original locknut.

Secure the transponder to the bracket using worm drive clamps or cable ties.

Fitting the Bracket, Later Type

Fit the bracket to the terminator. as shown in the illustration, using two 35 x 6mm drop-nose pins. Secure the transponder to the bracket using worm drive clamps or cable ties.

24. TOWFISH SENSORS

Heading Sensor

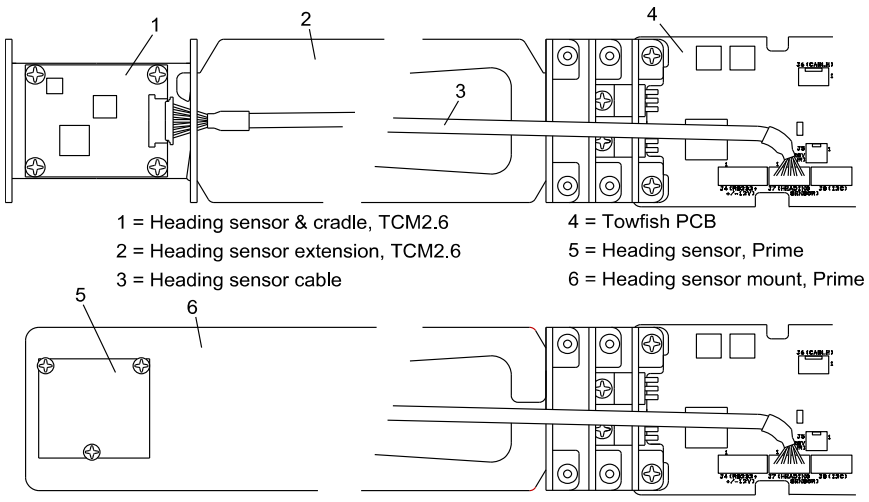
The towfish heading may be different from the direction of the towfish track if there is a cross-current. Heading information, if available, may be used to correct the apparent location of targets by compensating for the yaw of the towfish relative to its track.

The heading sensor output also includes towfish pitch and roll. These parameters are not relevant to processing the image but can indicate if, for some reason, the towfish is not towing correctly.

The optional heading sensor may be already installed in the towfish when delivered or may be retrofitted in the field.

To fit the sensor, first open the towfish to expose the towfish PCB. See the section on Replacing the Towfish PCB for advice on opening the towfish.

Attach the Heading Sensor Extension to the towfish PCB as shown in the illustration. Then attach the Heading Sensor itself to the extension. The heading sensor cable connects to J7 on the towfish PCB.



Fitting the Heading Sensor and Heading Sensor Extension to the Towfish PCB

Note that towfish PCBs of V.6 onwards accept full RS232 voltage levels, so they can be connected directly to the sensor. Earlier PCBs require a converter built in to the cable, to convert from full sensor voltage to 0-5V levels.

Later sensor installations may differ in detail from those illustrated here.

The heading sensor specification is in Section 15.

Note that the output of the heading sensor is “magnetic” not “true”.

Depth Sensor

The primary vertical measurement is towfish altitude (bottom tracking) which is standard in the CM2 towfish. Towfish depth is normally of less importance and can usually be estimated by subtracting towfish altitude from water depth measured by the ship's echo sounder.

Although it may not always be required there are two advantages to including a direct measurement of towfish depth.

The first is that depth and cable scope (the amount of cable deployed) can be combined by MaxView to provide an estimate of layback. Other software packages may also have this capability.

Secondly, a record of towfish depth plus altitude can provide a bathymetry trace for the survey line.

The optional depth sensor may be already installed in the towfish when delivered or may be retrofitted in the field.

To fit the sensor, the rear bulkhead must be exchanged for a replacement bulkhead fitted with a pressure capsule. To replace the bulkhead see the section on Replacing the Towfish PCB for advice on opening the towfish.

Two types of pressure capsule are in use. The earlier type is fitted under a protective cover below the RH transducer connector. The later type is fitted centrally between the RH and LH transducer connectors. This later type of capsule has no protective cover but is normally obscured by the fin assembly. The capsule diaphragms are should be treated as being fragile.

CAUTION: DO NOT APPLY ANY HARD OBJECT, INCLUDING A FINGERNAIL, TO THE PRESSURE CAPSULES.

Internally the depth sensor is connected to J8 on the Towfish PCB.

25. ADDITIONAL CAPABILITIES

Towing a Magnetometer

The CM2 towfish is able to tow a Marine Magnetics Explorer or SeaSPY magnetometer, allowing the magnetometer to extract power from the towfish and to share the CM2 tow cable as its data link to the surface. This avoids the need for a separate tow cable for the magnetometer and therefore allows it to be towed deeper or at shorter scope.

This function is only available if the towfish is ordered with the magnetometer interface option.

For this application please refer to the CM2 Magnetometer Supplement.

Note that caesium vapour magnetometers are not supported as their power demands are too high.

ROV and AUV Configurations

Although the CM2 is usually operated as a towed system its elements may also be fitted to remotely-operated and autonomous vehicles.

For these applications please refer to the CM2 AUV/ROV Supplement.

26. WARRANTY

Scope

CM2 components manufactured by C-MAX are warranted for a period of 36 months from the date of dispatch. Winches from third-party suppliers, all cables and all other items are warranted by C-MAX for satisfactory operation for a period of 12 months from the date of dispatch.

MaxView software is warranted for a period of 36 months from the date of dispatch. Defects will be corrected free of charge during this period.

Any item that fails because of a defect in design, material or workmanship will be repaired or replaced by C-MAX without charge.

Limitations

C-MAX is not responsible for any consequential loss, nor for any failure caused by improper use, mishandling, or unauthorised attempts at repair, nor for cosmetic or other damage which may reasonably be classed as normal wear and tear.

In particular, if it is apparent from the condition of the CM2-WIN-300 winch that it has been abused or overheated, then repair or replacement of winch components will not be covered under this warranty.

Fault Reporting

Faults must be reported to C-MAX within the warranty period, quoting the equipment serial number together with a fully detailed description of the fault symptoms.

Returns

The agreement of C-MAX is required before items are returned to the Factory for inspection or repair. The customer is responsible for adequate packing and insurance.

Transferability

The benefits of this warranty are fully transferred to the current legal owner of the equipment.