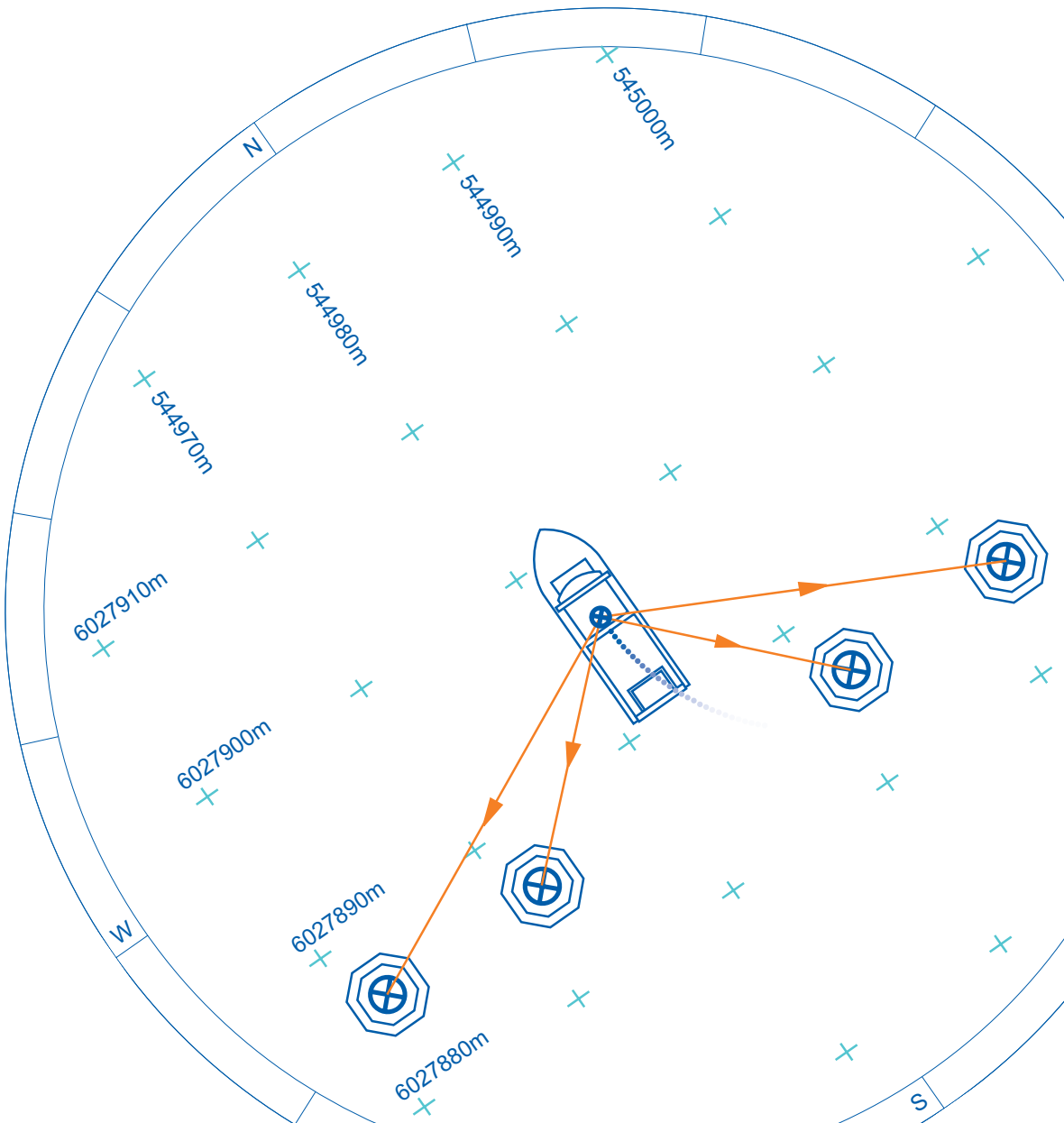
Sonardyne
SOUND IN DEPTH

# Ranger USBL
## Acoustic Positioning System for DP Reference and Survey Positioning



# Ranger USBL
## DP Reference and Survey Positioning

**Ranger USBL + Lodestar AHRS**
Lodestar is an IMO certified Attitude and Heading Reference System that, when integrated with Ranger USBL, delivers the ultimate positioning performance for DP and survey

**Mini Compatt 5**
All the performance of Sonardyne's most advanced subsea transponder in a small, lightweight housing for easy installation on towed subsea vehicles

**OTS Deployment Pole**
A modular, easily installed, over-the-side deployment pole for instruments and transceivers; designed for vessels where through-hull deployment is not available or practical

### Introduction

Ranger system is a high performance, survey grade Ultra-Short BaseLine (USBL) acoustic positioning system designed for Dynamic Positioning (DP) reference and ROV/towfish tracking operations.

The system incorporates Sonardyne Wideband® acoustic signal technology to enable seamless multi-vessel 'SIMOPS' capability ensuring no vessel down time. It is recognised as the optimum solution for deep water DP and construction survey as it offers a proven and risk-free solution with the capability to be integrated with Long BaseLine systems to perform tasks such as metrology.

Two versions of Ranger are available allowing operators to choose the system that best suits their needs.

Ranger is designed for DP reference and general target tracking of ROVs and towfish. Up to four targets can be tracked simultaneously to ranges of greater than 6,000 metres. The system supports a wide range of industry standard telegrams and is compatible with a wide range of transponders including Kongsberg and Sonardyne's Wideband Sub-Minis, DPTs and advanced Compatt 5.

Ranger-Pro is designed for more advanced survey applications. Incorporating Sonardyne's unique 'ping stacking' technology, the system offers fast position update rates (one second independent of water depth), tracking of up to 10 targets and full ocean depth operating range (>6,000 metres). Ranger-Pro also supports many more Sonardyne and non-Sonardyne medium frequency transponders.

A feature available in both Ranger systems is the ability to undertake Inverted USBL (iUSBL) tracking of towfish over long laybacks. Rather than mounting the USBL transceiver on the vessel in the traditional manner, with iUSBL the transceiver is installed on the towed body itself.

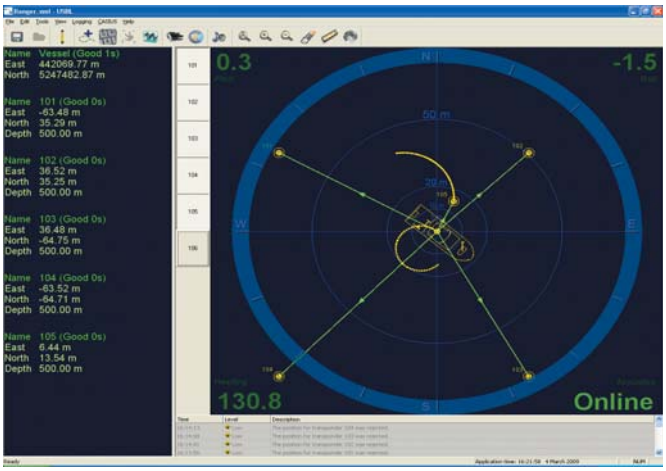
This method eliminates the need for repeated system calibration, whilst the accuracy and repeatability of the acoustics is improved as the transceiver is located in a low noise, dynamically stable environment.

A Ranger Marine Riser Angle Monitoring System (MRAMS) option is also available. It operates with a pair of DPT transponders fitted with inclinometers to provide precise riser and BOP differential angle monitoring during drilling operations.

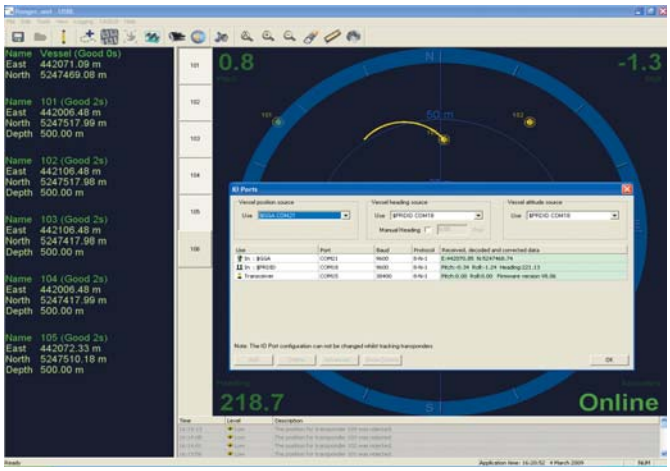
As Ranger systems share the same topside hardware as Sonardyne's most advanced USBL system, Fusion, users can easily and cost effectively upgrade their capabilities as their experience and requirements grow.

# Ranger USBL
# System Overview

**Ranger Software**
Ranger software is simple to learn, set up and operate and rewards the user with immediate success




**I/O Ports Page**
The I/O ports page provides feedback on the operational status of all the Ranger system's inputs and outputs




## System Overview

Ranger and Ranger-Pro systems are comprised of four main components: a rack-mounted or portable Data Fusion Engine, control software, acoustic transceiver and seabed or vehicle mounted transponders.

### Data Fusion Engine

The Data Fusion Engine is the heart of the system and is an integrated PC and acoustic processor platform running Ranger software. The unit is designed to meet the complete onboard hardware requirements of any acoustic operation, thereby eliminating the need to install and set up separate systems to meet different acoustic positioning scenarios. As the user's requirements grow, this one-box solution can be upgraded from a Ranger system through to a deep water Fusion USBL system and ultimately a Fusion LBL system able to undertake complex subsea construction survey tasks.

The Navigation Controller Unit (NCU) is the interface between the acoustic instruments, sensors and the Navigation Computer. In addition to accurately time stamping incoming data from external devices such as GPS, VRU and gyro, the NCU also provides power and communications for ship-borne acoustic transceivers.

The Navigation Computer is a powerful, marine PC that is used in conjunction with the Navigation Controller Unit. Features include front-mounted USB ports for when access to the rear of the unit is restricted by rack mounting and dedicated monitor power supply.

### Software

Both versions of Ranger are based upon a common software application that is easy and intuitive to use, requiring only basic operator training to become familiar with it.

During set up, the system automatically identifies the type of transceiver connected to the system and configures it accordingly. Multiple attitude, heading and position instruments can be added in a simple I/O ports page which provides feedback on the operation of all inputs and outputs. Instruments are shown in green if working and red if not.

Adding transponders to a job is simple and once the system is configured, tracking can be turned on and off with a single click.

In the event of a power failure, the only action the user needs to take to get the system tracking again is to restore power. The application will start the Navigation Computer and automatically restart tracking the transponder it was tracking before power was lost.

A key design principle of the UI is that an operator can assess the operation of the system at a glance from across the bridge. For example, positions are displayed in either green for a good position with update rate, yellow for a good range but bad USBL signal therefore no position computed, red for no reply to the interrogation and finally grey to indicate no information has

# Ranger USBL
## System Overview

**Data Fusion Engine**
The heart of a Ranger USBL system; an integrated PC and Navigation Controller Unit running Ranger software

**Ranger USBL Transceivers**
Ranger systems are supplied with a Type 8021 transceiver although existing Scout USBL users can opt to use the system with a Type 8024 transceiver


been received for more than twice the update rate.

For advanced tracking of up to 10 targets with the maximum position update rate, Ranger-Pro incorporates Sonardyne's unique 'ping stacking' technology, originally developed for ultra deep water drilling operations. This technique allows the system to transmit acoustic interrogations from the transceiver to the transponders before the last reply was received. This enables the system to maintain position update rates of better than one second in any water depth.

All Ranger software includes an extensive array of tools to allow the user to optimise the performance of the system. These include utilities to measure acoustic noise, a signal analyser to filter out a specific transponder's signal and a comms viewer to monitor any NCU or serial port. To correctly calibrate gyro and VRU offsets and therefore improve positioning accuracy, Sonardyne's CASIUS calibration tool is also included.

### Ranger USBL Transceivers

The most popular transceiver for use with Ranger and Ranger-Pro is the Type 8021, an all purpose MF frequency unit proven for general survey and DP operations where tracking could be at shallow angles or straight up and down.

For high noise environments, the Type 8023 transceiver is optimised to receive signals arriving within a ±50° cone. Any noise generated outside of this area, for example by thrusters, is attenuated therefore improving the signal to noise ratio and thus the positioning accuracy. In practice, this has been proven to allow the accurate positioning of the noisiest vessels.

To optimise tracking of targets at shallow angles, such as long range towfish tracking, a tilt adaptor can be used with both Type 8021 and Type 8023 transceivers. The advantage of this is that the target being positioned remains within the optimal operating envelope of the transceiver thereby maintaining positioning performance.

Ranger-Pro is also compatible with Type 8024 USBL transceivers, an HF frequency transceiver originally designed for use with Sonardyne's shallow water USBL system, Scout. Now the same transceiver can be used with Ranger-Pro topside equipment, therefore providing existing Scout users with a cost effective upgrade path to a deep water USBL system.

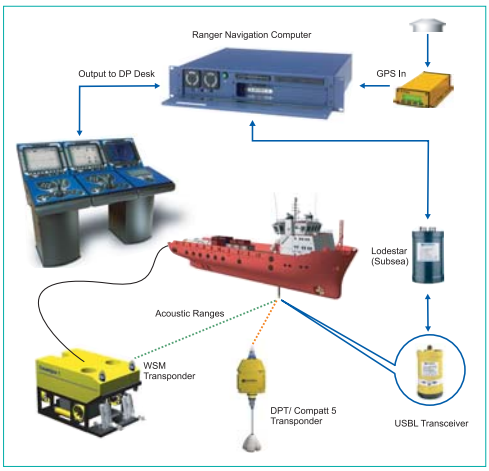
### Transceiver Deployment Machines

The performance of any USBL system is greatly affected by the mounting of the transceiver. Sonardyne has extensive experience in both through-hull and over-the-side deployment and can assist clients with the selection of the right solution for their vessel. Customer support services also include inspection visits to vessels, system installation, commissioning at sea and operator training.

# Ranger USBL + Lodestar AHRS
## Optimised Positioning Performance

**(Below and middle)**
Subsea Lodestar AHRS units installed above USBL transceivers to provide optimised USBL performance

**Optimised USBL**
In an optimised Ranger USBL system, the Lodestar AHRS is connected to the transceiver, providing it with power and directly processing raw USBL range and bearing data




### Introduction

The dramatic improvements in USBL positioning accuracy brought about by the introduction of Sonardyne Wideband® technology, together with measures such as appropriate transceiver deployment arrangements described earlier, can be further enhanced by use of a highly accurate attitude motion reference unit.

Sonardyne has developed the Lodestar Attitude and Heading Reference System (AHRS) specifically to complement its USBL and LBL product range. Although suitable for multiple applications onboard the vessel such as multi-beam compensation and helideck monitoring, Lodestar offers distinct performance advantages when used in conjunction with acoustic systems such as Ranger USBL.

As a stand alone unit, the Lodestar AHRS provides precise readings for vessel heave, heading, roll and pitch with negligible latency. Due to the high quality accelerometers and gyroscope elements in Lodestar, the unit is capable of significantly outperforming traditional survey grade sensors.

Lodestar has been accredited IMO approval which allows the unit to be utilised as the master heading device of the vessel and as a direct feed for a vessel's DP system for heading, roll and pitch.

### Optimised USBL

In an optimised Ranger USBL system, the Lodestar AHRS is mounted immediately above the USBL transceiver at the top of the deployment pole. The Lodestar is connected to the transceiver, providing it with power and directly processing raw USBL range and bearing data. This achieves a tightly compensated positioning solution that is not available through the use of other commercially available attitude reference devices.

A high speed Ethernet link between the Lodestar AHRS and Ranger USBL computer ensures fast data transfer and zero latency, resulting in a further improved USBL position solution output to the survey team and/or DP desk.

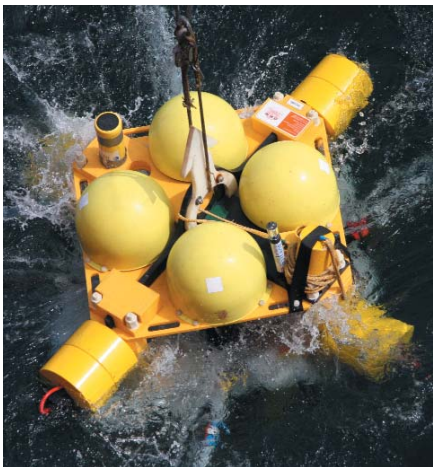
This tight integration of all the product elements within a Ranger USBL system means that Sonardyne's optimised USBL can achieve a greater accuracy in position than has been previously available to the market-place. This improved performance allows users to utilise the optimised USBL system to meet the positioning specifications of a wider range of subsea projects.

Lodestar AHRS has a direct upgrade path to a Lodestar Acoustically Aided INS (AAINS) solution. Adding this capability, provides a robust and smooth input for the DP thereby reducing its workload. AAINS is particularly suited for high accuracy survey projects in deep water.

# Ranger USBL
# Transponder Options

**Wideband Sub-Mini**
A versatile USBL transponder and responder designed for tracking subsea targets such as seismic recording nodes; options include remote transducers and external releases

**Dynamic Positioning Transponder**
The Dynamic Positioning Transponder is a Wideband subsea transponder designed for target tracking, DP reference and riser angle monitoring



## Wideband Sub-Mini

The WSM is a versatile range USBL transponder/ responder designed for positioning ROVs, towfish and other mobile targets in water depths up to 4,000 metres.

Compact and rugged, WSMs incorporate the latest Sonardyne Wideband® signal technology which offers superior ranging accuracy, operation in a mulit-user, multi-vessel environment and fast USBL position updates. WSMs also support traditional Sonardyne tone and HPR 300 and HiPAP® channels.

For applications requiring an acoustic release function, for example releasing a clump weight on a seabed instrument package, WSMs can be connected to an external mechanical release mechanism or conventional burn-wire release via the endcap.

The new 8071-07 WSM has a cable connected, omni-directional remote transducer which offers greater flexibility when installing it on a small vehicle with restricted space. The electronics bottle can be mounted internally within the vehicle whilst the transducer can be conveniently located anywhere with line-of-sight to the surface.

## Dynamic Positioning Transponder

The DPT is a full sized transponder designed specifically for large target tracking and DP reference. Available in 3,000 metre rated omni-directional or directional transducers. For deep water applications, the DPT is available with a high power super directional transducer that is depth rated to 7,000 metres.

DPTs support Sonardyne Wideband® signals, tone frequencies and all HPR 300/HiPAP® channels.

## Compatt 5

Compatt 5 is Sonardyne's most advanced USBL and LBL (Long BaseLine) Wideband transponder designed to support integrated positioning and robust, through-water data communications. Options include depth ratings to 7,000 metres, dual axis inclinometers, DigiQuartz depth sensors and the capability to interface to external equipment for data telemetry to the surface.

## Back Deck Test Units

WSMs, DPTs and Compatt 5s are supplied with PC utility software that allows users to set up and program the transponders prior to deployment. A dedicated Deck Test Unit (DTU) or Pocket Test Terminal (PTT) device is also available.

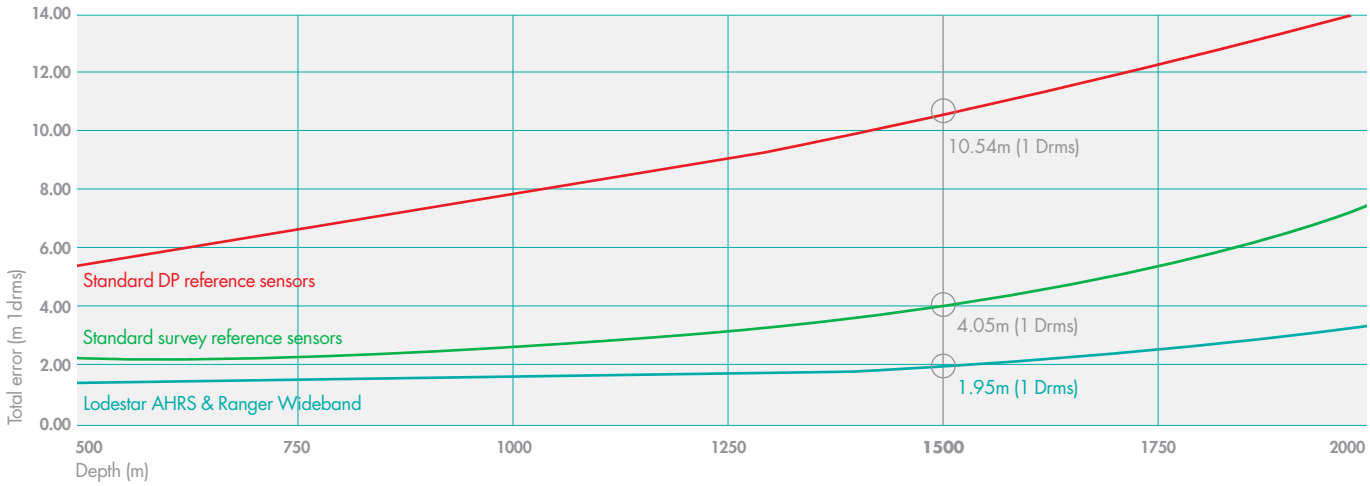
Supplied in a rugged portable case, the DTU is used initially to program the channel of the transponder, acoustically test the transponder in air and then load the acoustic release mechanism.

Running on a dedicated PDA platform, the Pocket Test Terminal offers all the main features of the PC-based utility software but from a small, portable, splash-proof device. It is therefore ideal for taking on to the back deck to set up and test transponders prior to deployment.

# Ranger USBL
## System Specifications

**Sonardyne Ranger USBL Performance with Different Attitude and Heading Sensors**

The graph below shows the total system level performance that can be achieved with existing USBL configurations of reference systems as typically used today and the significant improvement in performance seen with Wideband USBL and Lodestar tightly coupled together. With many fields being developed in 1,500 metres the improvement in total error from 10m to 2m (1Drms) enables positioning specifications to be met more cost effectively and can certainly provide performance 'headroom' against weather and other factors.




### System Performance

#### General

| | |
|---|---|
| Operating Range* | >6,000 metres (Proven) |
| Acoustic Coverage | ±90° or ±50° (Depending on transceiver type) |
| Accuracy* (Typical) | 0.27% 1 Drms Slant Range (63% of fixes within 2.7 metre radius in 1,000 metres water depth)<br>or 0.20% 1 Sigma Slant Range (39.4% of fixes within 2 metre radius in 1,000 metres water depth) |
| (Achievable) | 0.13% 1 Drms (Lodestar Optimised USBL) |
| Tracking | Supports tracking of 1 surface vessel and 4 subsea targets (Ranger)<br>Supports tracking of 1 surface vessel and 10 subsea targets (Ranger-Pro) |
| Maximum Update Rate | 1 second, independent of water depth (Ranger-Pro only) |

*Note: The absolute accuracy and operating range of the system is dependent upon the quality of attitude and heading sensors, beacon source level, vessel noise, environmental noise, water depth, the mechanical rigidity of the transceiver deployment machine, GPS and proper calibration of the total system using CASIUS.

### Ranger USBL Transceivers

| Type Numbers | 8021 | 8023 |
|---|---|---|
| Operating Frequency | MF (18-36kHz) | MF (18-36kHz) |
| Ranging Accuracy | Better than 0.2 metres (0.03 metres Wideband) | Better than 0.2 metres (0.03 metres Wideband) |
| Positioning Repeatability | Better than 0.1% of slant range 1 Drms | Better than 0.1% of slant range 1 Drms |
| Deployment Method | Through-hull or Over-the-Side | Through-hull or Over-the-Side |
| Dimensions (LxDia) | 410mm (16.14") x 225mm (8.86") | 487mm (19.16") x 300mm (11.81") |
| Weight in Air | 28kg | 41kg |
| Weight in Water | 13.5kg | 21kg |

### Ranger USBL Transponders

**See separate datasheets for full specifications**

### Navigation Controller Unit (NCU)

**See separate datasheet for full specifications**

### Navigation Computer

**See separate datasheet for full specifications**

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