

# MUSASINO

INTEGRATED SOLUTIONS FOR SAFE CARGO OPERATIONS

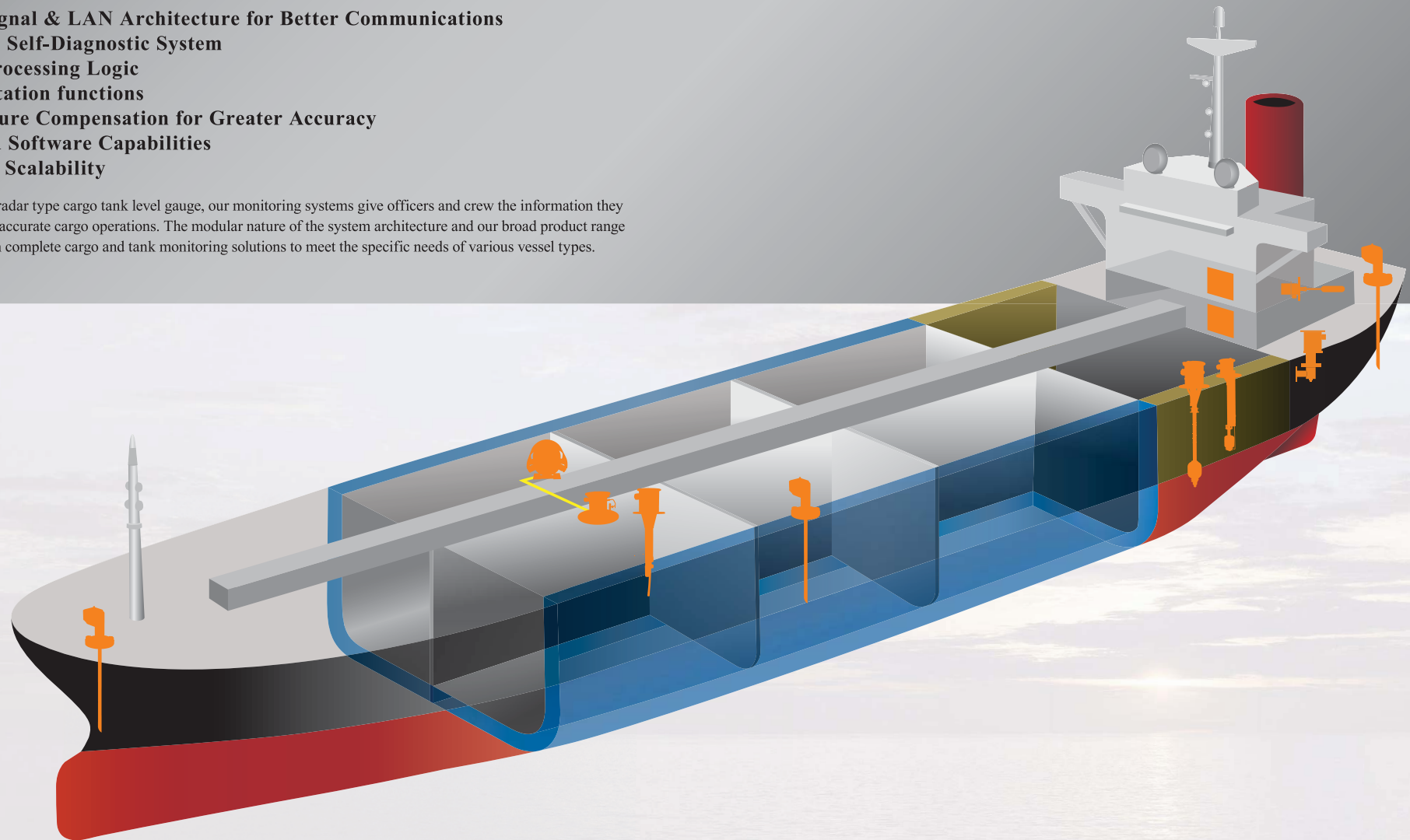
WORLDWIDE RELIABILITY

[www.musasino.biz](http://www.musasino.biz)

Musasino's cargo and tank monitoring systems integrate our years of experience in providing level gauging and tank monitoring solutions to the global shipping industry.

- Digital Signal & LAN Architecture for Better Communications
- Upgraded Self-Diagnostic System
- Robust Processing Logic
- Documentation functions
- Temperature Compensation for Greater Accuracy
- Expanded Software Capabilities
- Improved Scalability

Built around our radar type cargo tank level gauge, our monitoring systems give officers and crew the information they need for safe and accurate cargo operations. The modular nature of the system architecture and our broad product range allow us to design complete cargo and tank monitoring solutions to meet the specific needs of various vessel types.



Cargo Tank Radar Gauge



Independent Level Alarm



Main Monitor



System Control Unit



Local Indicator



Ballast Level Gauge



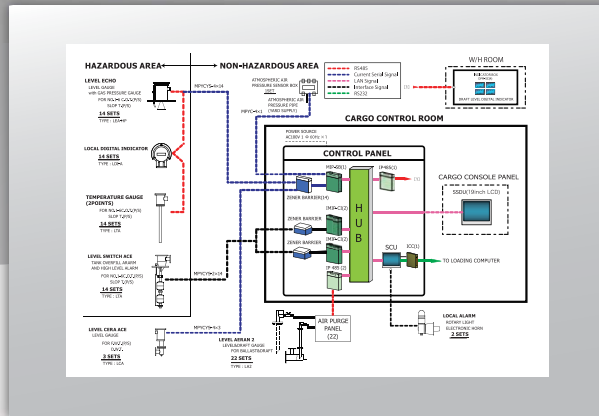
Bunker Level Gauge



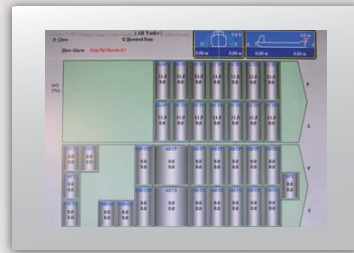
Bunker Level Alarm

## SYSTEM ARCHITECTURE AND CONTROL UNIT

- Board PC
- LAN Architecture
- Fewer Components
- No UPS Required
- Simple User Interface
- Simplified Cabling
- Small Panel



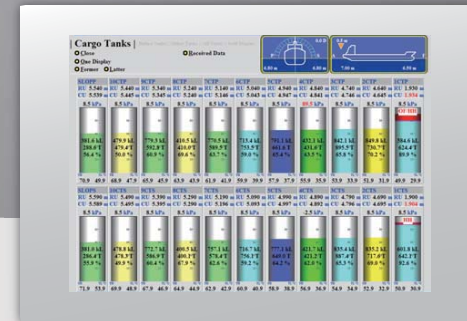
Musasino systems employ a streamlined architecture with a reduced number of components and simplified cabling, requiring little space. At the same time, the LAN architecture in the panels and distributed network architecture throughout the system provides efficient communications between the sensors and control units.



The main user interface is the 19-inch system support display unit mounted in the cargo control console or installed as a desktop unit depending on requirements. Here operators can monitor tank conditions and alarms, and can easily set variable alarms for level, temperature and pressure. From the same interface, Musasino's network management system gives operators a full overview of system conditions. The system uses a compact flash memory board computer, which is more stable, more resistant to vibrations and protects data if the power fails. The "brain" of the system – the system control unit (SCU) – is located in the main panel. A 10-inch touchscreen interface provides full system access and controls, audible and visual alarm indications, and can act as a backup monitor.

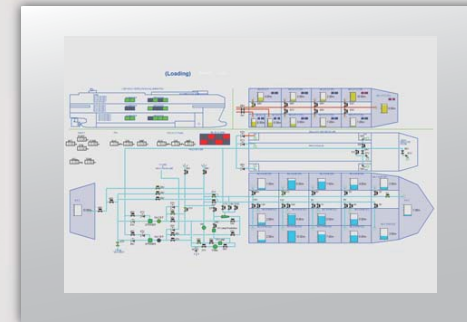
## TANK MONITORING

- Cargo operations documents
- Tank level, pressure and temperature indication
- Tank level, pressure and temperature alarm indication
- Draft, trim and heel indication
- Volume and capacity display
- Detailed information for cargo, ballast and other tanks
- Variable alarm setting



The tank monitoring software provides operators with an easy-to-understand graphic display of conditions in cargo, ballast and service tanks. Through this interface, operators can easily see current conditions for all tanks, as well as get detailed information from specific tanks as needed. The software also allows operators to set various parameters, such as type of cargo and variable alarm points.

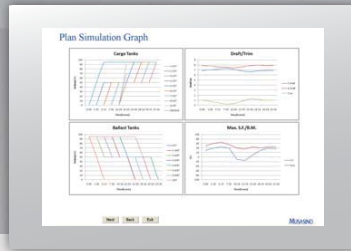
- Valve & pump monitoring
- Cargo pipeline, valve & pump monitoring
- Ballast pipeline, valve & pump monitoring
- Ballast valve & pump control



Musasino has developed software that allows operators to easily monitor valves in ballast and cargo pipelines. In certain applications, remote operation of the valves may be possible.

## CARGO PLANNING

- Cargo loading & discharging simulations
- Detailed, step-by-step cargo plan proposals
- Valve & pump timing
- Intact stability calculations
- Damage stability calculations



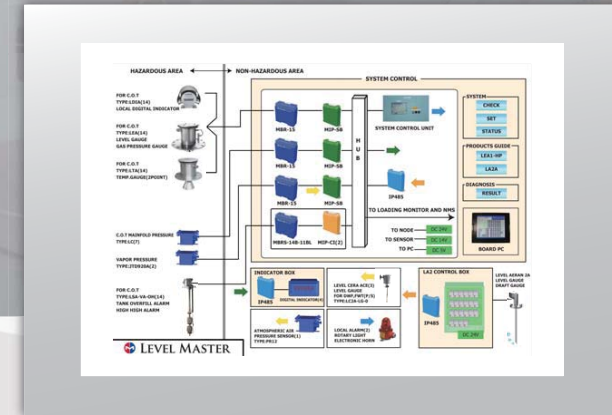
Musasino's cargo planning software has been designed to support Chief Officers in planning cargo loading and discharging. The software uses information from two sources – operator input and Musasino's tank monitoring systems – to simulate and propose cargo operation plans. The operator inputs information regarding the cargo types and volumes to be loaded or discharged. Current tank conditions – level, pressure, temperature, volume – and trim, heel and list are gathered in from the tank monitoring systems. The software runs a simulation using all of this information, as well as pump flow rates. The end result is a detailed proposal for cargo operations presented in graphic and table forms. At each step in the proposed plan, strength and stability calculations are confirmed to help ensure the safety of the vessel and her crew.

## DOCUMENTATION

A new documentation function has been added to the tank monitoring software to support officers in completing documents related to cargo operations. Information from level gauges and other sensing equipment is automatically imported to the appropriate document. For example, ullage reports, pump operation data, safety checklists, etc. can be completed efficiently in the tank monitoring software and easily printed as needed.

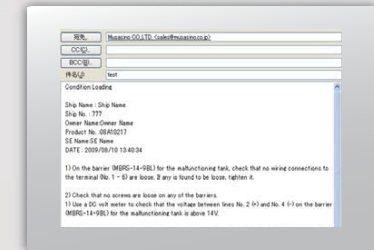
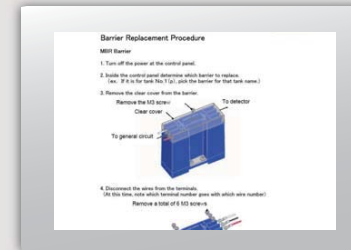
## NETWORK MANAGEMENT SYSTEM

- System self-diagnostics
- Troubleshooting & repair guides
- System reports
- Automated data logging
- Tank level trend function



A reliable tank monitoring system is essential for safe cargo operations. With that in mind, Musasino developed the Network Management System (NMS) to help keep the system fully operational. NMS contains the software interface for Musasino's self-diagnostic system. Communication between all parts of the system is continually monitored to ensure everything is working as it should be.

- Increases reliability and confidence
- Reduces time and cost of troubleshooting and repairs
- Predicts maintenance issues
- Reduces time and cost of commissioning



If a signal is dropped, a device goes off-line, or abnormal data is received, NMS immediately alerts the operator and identifies which device is malfunctioning. The crew can then follow the included troubleshooting guide to further identify and repair the problem.

NMS also contains a tank level trend function. When used with Musasino's radar tank level gauge, the software tracks and anticipates trends in the level data. If an out-of-trend or erratic reading is received, the software will hold the indication steady while it verifies the reading. This means that sloshing or waves in the cargo tank will not cause fluctuating readings.

## LEVEL GAUGES

- Radar Level Gauge ————— X-Radar
- Magnetic Float Level Gauge ————— Level Master Ace
- Air Purge Level Gauge ————— Level Aeran 2
- Hydrostatic Pressure Level Gauge ————— Level Cera Ace

## LEVEL ALARMS

- Magnetic Float ————— Level Switch Ace
- Ultrasonic ————— Level Watch 2 ACE
- Horizontal Float Switch ————— Float Switch
- Ultrasonic Water Ingress Alarm ————— Level Watch III

## PORTABLE LEVEL GAUGES

- Air Purge ————— Level Porta
- Hydrostatic Pressure ————— Level Cera Portable

## X-RADAR

tank radar level gauge

- **Self-calibrating for long-term accuracy**
- **Robust processing logic**
- **No warm-up required**
- **Interchangeable electronics**
- **Inspection & maintenance in closed tank conditions**
- **Self-diagnostics**
- **Remote monitoring**
- **Built-in tank I.G. pressure sensor**
- **Small on-deck space requirements**
- **Minimal cabling requirements**

Musasino X-Radar has been designed specifically for marine applications. The 10GHz frequency modulated continuous wave (FMCW) radar provides accurate and reliable tank level gauging on oil, product and chemical tankers. Additionally, the gauge is self-calibrating to compensate for the effects of temperature fluctuations and aging, and maintain high accuracy over its lifetime. Robust processing logic identifies extra echoes from tank structures and ensures accurate cargo level readings. Even the most reliable system will eventually require maintenance, so we designed X-Radar with interchangeable electronics boxes that can be replaced and set up in a few simple steps. This eliminates the need for service attendance and reduces system downtime and costs. To further save time and costs surrounding maintenance, the electronics and I.G. pressure sensor can be serviced, calibrated or replaced without having to gas-free or open the tank.



### Level Gauge

<b>Application(s)</b>	Crude Oil, Refined Petroleum Products, Chemical
<b>Measuring Method</b>	FMCW
<b>Frequency</b>	10GHz Band
<b>Measurement Range</b>	0.5 to 22m
<b>Beam Angle</b>	11°
<b>Resolution</b>	±1mm
<b>Accuracy</b>	±2mm
<b>Ambient Temperature</b>	-25 to + 70°C
<b>Explosion Protection</b>	Intrinsically Safe Exia IIC T4
<b>Protection Class</b>	IP66
<b>Flange Material</b>	SUS316L
<b>Cable</b>	4-core sealed marine cable

### Pressure Sensor

<b>Type</b>	Absolute Pressure
<b>Measurement Range</b>	± 0.1 to + 0.3 bar
<b>Accuracy</b>	± 0.004 bar
<b>Rated Pressure</b>	2 bar
<b>Maximum Pressure</b>	4 bar

\*See product specification sheets for complete specifications.

## LEVEL MASTER ACE

magnetic float type level gauge

- Proven accuracy, reliability, and durability
- Simple, robust design
- Wide range of applications
- Various options and functions
- Maximum 40-meter measuring range
- Low maintenance
- Available self-diagnostic function

Level Master Ace (LMA) has proven its reliability, accuracy and durability over thousands of installations since it was first commercially deployed in 1965. Although the basic methodology of the gauge has remained the same, LMA has been upgraded over the years with new features to meet the industry's changing needs. With a range of options for float types and functions, LMA is easily matched to a variety of applications. Built-in tank gas pressure and temperature sensors allow for a single deck penetration and simplified wiring.



### General Specifications\*

<b>Application(s)</b>	Crude oil, petroleum products, chemicals, LPG, fuel oil, sea water, fresh water, etc.
<b>Ambient Temperature</b>	M-LMX, M-LMV, M-LMV2: -25 to 70°C (-13 to 158°F)
<b>Intrinsically Safe</b>	M-LMX, M-LMV, M-LMV2: Exia IIC T6
<b>Accuracy</b>	±25mm, ±15mm, ±10mm
<b>Measuring Range</b>	0.13 to 40m
<b>Temperature Sensor</b>	Two points (measuring range: -5 to 100°C)
<b>Protection Class</b>	IP56
<b>Wiring</b>	MYPCYS-4, MYPCYS-7

\*See product specification sheets for complete specifications of specific models.

## LEVEL WATCH 2 ACE

ultrasonic type independent alarm

- Simple and robust structure
- No moving parts
- Simple operational testing
- Digital signal processing
- Standard self-diagnostic function
- Wide range of applications

Level Watch 2 (LW2) is an independent high level and/or overflow alarm for liquid cargo tanks, particularly aboard chemical tankers. The detector features a robust design which makes it resistant to the effects of vibrations, sloshing, cleaning and other harsh tank conditions. No calibration is required for different types of liquid cargos, and there are no moving parts, reducing maintenance requirements. Using a simple testing tool, the alarm can be easily tested prior to cargo loading. A self-diagnostic function has been built-in to further boost reliability.



### General Specifications\*

<b>Application(s)</b>	Chemicals, petroleum products, fresh water, sea water
<b>Measurement Method</b>	Ultrasonic wave
<b>Measuring Range</b>	Up to 2 m
<b>Ambient Temperature</b>	-25 to 100°C (-13 to 212°F)
<b>Intrinsically Safe</b>	Exia IIC T6
<b>Weight</b>	Approx. 20 kg (2 alarm points)
<b>Accuracy</b>	±5mm
<b>Power Supply</b>	DC 12V approx. 13mA
<b>Flange</b>	φ265 (150A)
<b>Protection Class</b>	IP66
<b>Main Material</b>	SUS316L/SUS304

\*See product specification sheets for complete specifications.

## LEVEL SWITCH ACE

magnetic float independent level alarm

- High accuracy
- Proven reliability
- Simple, durable design
- Built-in self-diagnostics
- 1 or 2 alarm points
- Digital signal output

Level Switch Ace (LSA) is an accurate and reliable independent level alarm for cargo tanks aboard oil and product carriers. Over thousands of installations, LSA has proven durable against harsh tank environments, including sloshing, vibrations and tank cleaning on a range of vessel types and applications. LSA features a simple testing rod, which makes it easy to test alarm functionality prior to cargo loading.



### General Specifications\*

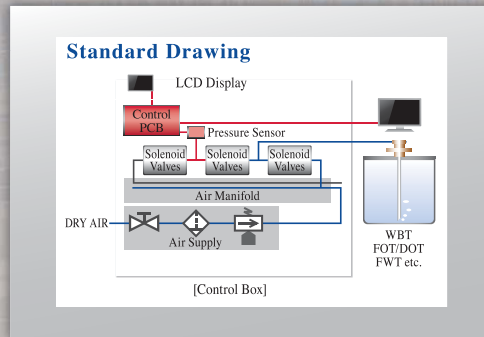
<b>Application(s)</b>	Crude oil, fuel oil, sea water, fresh water
<b>Ambient Temperature</b>	-25 to 100°C (-13 to 212°F)
<b>Intrinsically Safe</b>	Exia IIC T6
<b>Weight</b>	Approx. 20kg
<b>Accuracy</b>	±5mm
<b>Measuring Range</b>	2m
<b>Power Supply</b>	DC 12V
<b>Flange Size</b>	JIS 5K-200 (φ320) JIS 5K-150 (φ265)
<b>Cable</b>	MPYCYS-2 (1 float) MPYCYS-4 (2 floats)
<b>Protection Class</b>	IP66

\*See product specification sheets for complete specifications.

## LEVEL AERAN 2

air purge type level gauge

- High accuracy
- Reliable and efficient
- Automated air and pressure controls
- Small footprint
- Self-diagnostic system
- Low maintenance



Level Aeran 2 (LA2) employs unique technology to deliver high accuracy level readings for ballast tanks and drafts. Unlike most conventional air purge systems, LA2 uses a set of micro-computer controlled solenoid valves to regulate air supply, pressure during measurement, and atmospheric pressure adjustments. By intermittently stopping the flow of air during measurement for a steady pressure, LA2 achieves an accuracy of  $\pm 50\text{mm}$  at full scale. In addition, the system overall requires less air – and less energy – than other systems. A higher pressure purge of air during each cycle also helps keep the purge mouth free of clogs, resulting in lower maintenance requirements. The compact control box can be outfitted for up to 24 gauges, but still takes up little room.



### General Specifications\*

Application(s)	Sea water, fresh water, fuel oil
Ambient Temperature	-25 to 70°C (-13 to 158°F)
Accuracy	$\pm 50\text{mm}$ Full Scale
Measuring Range	30m (option 35m)
Air Supply	5 - 9.5bar from engine room to control box 4.5bar (tanks of more than 10m) 2bar (tanks of less than 10m)
Maximum Air Consumption	9-10 NI/min (per unit purge line)
Average Air Consumption	2.7NI/min
Power Consumption	5W/tank
Flange	JIS20A
Protection Class	IP66

\*See product specification sheets for complete specifications.

## LEVEL CERA ACE

hydrostatic pressure type level gauge

- Corrosion-resistant ceramic diaphragm
- Digital signal output
- Fixed or detachable mounting
- Simple design, simple maintenance
- Relative or absolute pressure detection
- No moving parts in the tank

Level Cera Ace uses an electrostatic capacitance pressure sensor to detect the difference in atmospheric pressure and liquid pressure at the sensor diaphragm, converting it to an electronic signal that displays changes in liquid level on an indicator. Level Cera Ace corrects for temperature to provide high accuracy readings. Level Cera is primarily used in ballast and fresh water tanks, along with numerous draft gauge installations.



### General Specifications\*

Application(s)	Fresh water, sea water, fuel oil
Ambient Temperature	-25 to 70°C (-13 to 158°F)
Intrinsic Safety	Exia IIC T6
Weight	Approx. 13 kg
Measuring Range	1.0 – 10.0 m (pressure rating 100kPa) 2.0 – 20.0 m (pressure rating 200kPa) 3.0 – 40.0 m (pressure rating 400kPa)
Accuracy	$\pm 0.1\%$ full scale (lab test)
Protection Class	IP66 (terminal box), IP68 (sensor)

\*See product specification sheets for complete specifications.

## FLOAT SWITCH

horizontal float switch

- Reduced weight
- Simple maintenance
- Competitively priced

Float Switch (FS) mounts on the sidewall of a tank to provide high or low level indications. Once the level of the liquid in the tank passes the float arm, a magnet in the base of the arm triggers a reed switch in the detector. It is a simple design that requires very little maintenance.



### General Specifications\*

Application(s)	Water, sea water, chemicals, petroleum products
Ambient Temperature	-25 to 120°C (-13 to 248°F) (SUS316 float)
Intrinsic Safety	Exia IIC T6
Weight	Approx. 2.5 kg
Protection Class	IP56

\*See product specification sheets for complete specifications.

## LEVEL WATCH III

ultrasonic type water ingress alarm

- Simple, robust architecture
- No moving parts
- Simple maintenance
- Various installation options

Level Watch III (LWIII) uses ultrasonic waves to detect the presence of water or other liquids in the cargo holds of bulkers and other dry cargo ships, as well as in other areas where it may be necessary to detect water ingress. Various mounting configurations for LWIII are available, but the basic functions of the detector remain the same. LWIII is mounted at a set point. When water submerges the transmitter and receiver in the probe, there is a change in the ultrasonic wave that reaches the receiver. This change activates the alarm.



### General Specifications\*

Application	Water ingress alarm (fresh & sea water)
Ambient Temperature	-25 to 70°C (-13 to 158°F)
Intrinsic Safety	Exia IIC T6
Min. Weight	4 kg
Protection Class	IP68
Accuracy	$\pm 30\text{mm}$

\*See product specification sheets for complete specifications.

## LEVEL PORTA

portable air purge type level gauge for ballast tanks on bulk carriers

- Efficient, accurate ballast tank readings
- Compact and light
- Digital display
- Allows productive deployment of crew
- Simple operation
- Battery-powered
- Automatic shut off



Level Porta is the world's first portable air purge level gauge for ballast tanks, providing fast and accurate level readings. Once set up, tank readings can be made in just ten to 15 seconds.

Inside the housing of each unit is a set of solenoid valves which controls the air flow into the purge line. When connected to the on-deck air supply, the valves stabilize the air flow during measurement for better accuracy. Adjustments for temperature and atmospheric pressure are made automatically, and the level is displayed digitally on the built-in screen.

### General Specifications\*

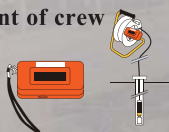
<b>Application(s):</b>	Sea water
<b>Measurement Range:</b>	0 to 35 m
<b>Accuracy:</b>	± 0.5% Full Scale
<b>Ambient Temperature:</b>	Operating: 5 to 50°C (41 to 122°F) Storage: -10 to 70°C (14 to 158°F)
<b>Air Supply Particulate Limit:</b>	Less than 0.6 µm
<b>Air Supply Pressure:</b>	0.45 MPa minimum
<b>Measuring Air Pressure:</b>	0.45 MPa
<b>Power:</b>	9V Dry-cell battery
<b>Protection Class:</b>	IP66
<b>Weight:</b>	Main Body: Approx. 5 kg Purge Hose & Reel: Approx. 3.6 kg

\*See product specification sheets for complete specifications.

## LEVEL CERA PORTABLE

hydrostatic pressure type level gauge for bunker tanks

- Efficient, accurate ballast and fuel tank readings
- Wireless transmission
- Compact and light
- Digital display
- Allows productive deployment of crew
- Simple operation
- Battery-powered



Level Cera Portable is the world's first portable pressure type level gauge for ballast and fuel tanks with wireless communications for remote indication. In addition to indicating the level on the local display, the level is transmitted wirelessly to a handheld indicator and can be easily transferred to a computer. Standard LC-P sets for fuel tanks include four detectors with indicators, two relays and one handheld indicator.

### General Specifications\*

<b>Application(s):</b>	Fuel oil, sea water, fresh water, non-corrosive liquids
<b>Measurement Range:</b>	0 to 30 m
<b>Accuracy:</b>	± 50 mm (lab test)
<b>Ambient Temperature:</b>	Indicator: -20 to 70°C (-4 to 158°F) Detector: 5 to 50°C (41 to 122°F)
<b>Power:</b>	DC 2.4V, Max 45mA (2 Nickel Hydride Batteries)
<b>Protection Class:</b>	IP56 Equivalent (Controller) IP68 Equivalent (Sensor)
<b>Maximum Pressure:</b>	343 kPa (3.5kg/cm <sup>2</sup> )
<b>Weight:</b>	Main Body: Approx. 4.5 kg Relay: Approx. 200 grams Remote Indicator: Approx. 400 grams

\*See product specification sheets for complete specifications.

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MUSASINO OFFICES  
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