MUSASINO

MUSASINO

INTEGRATED SOLUTIONS For SAFE CARGO OPERATIONS

WORLDWIDE RELIABILITY

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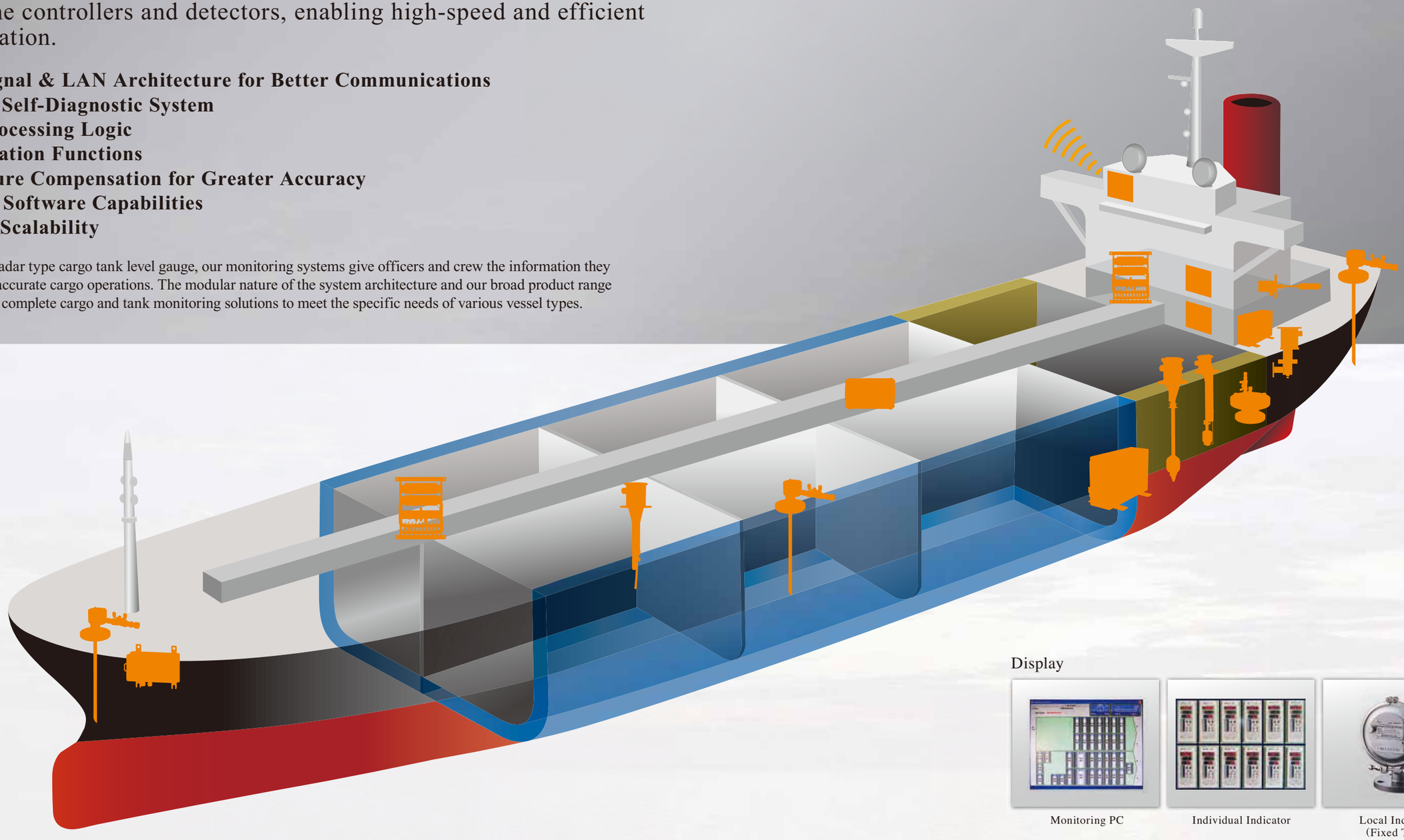
Musasino system proposals consist of compact equipment, using digital communications and reducing the number of cable cores required.
At the same time, the system employs LAN communication technology between the controllers and detectors, enabling high-speed and efficient communication.

- **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.



Level Gauge

Radar Type Level Gauge

Pipe Radar Type Level Gauge

Magnetic Float Type Level Gauge

Pulse Purge Type Level Gauge

Hydrostatic Pressure Type Level Gauge

Display

Monitoring PC

Individual Indicator

Local Indicator (Fixed Type) (Portable Type)

Alarm Systems

Radar Type

Ultrasonic Type

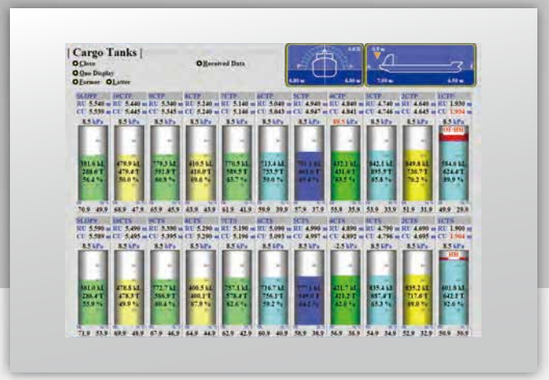
Float Type (Horizontal / Vertical)

Pulse Purge Type

Hydrostatic Pressure Type Level Gauge

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

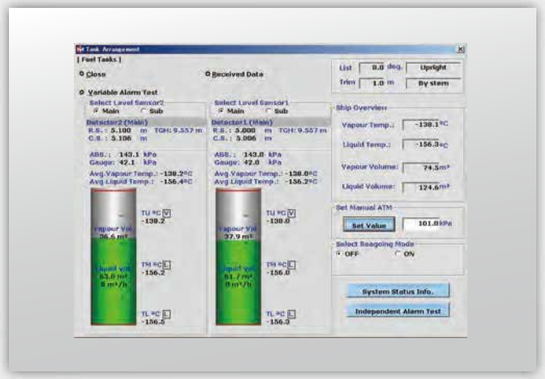


The tank monitoring software provides operators with an easy-to-understand graphic display of conditions in cargo, ballast and service tanks. Through this interface, operators can easily see current conditions for all tanks, as well as get detailed information from specific tanks as needed. The software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

Fuel Tank Monitoring

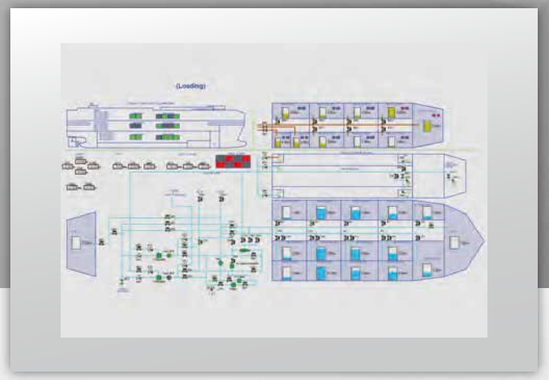
Gas Carrier / FGSS

- Liquid gas volume, temperature, and tank pressure monitoring
- Liquid gas volume, temperature, and tank pressure alarm monitoring
- Current and maximum capacity displays
- Detailed gas tank information displays



Valve Control (MIMIC)

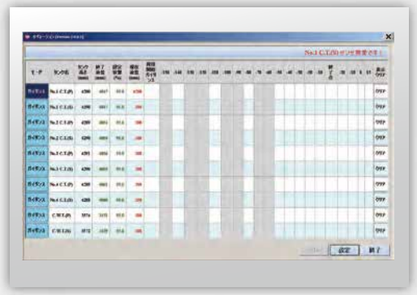
- Valve & pump monitoring
- Cargo pipeline, valve & pump monitoring
- Ballast pipeline, valve & pump monitoring
- Ballast valve & pump control



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.

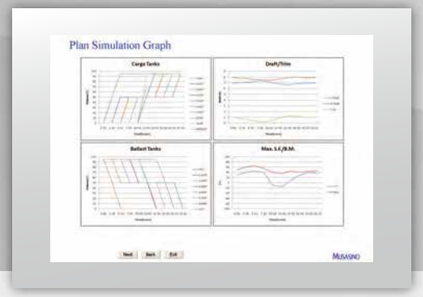
Voice Guidance

- Real-time notification of liquid level information for each tank through the speaker of the ship
- Possible to monitor conditions when away from control panel
- Verbal notification of alarm sources



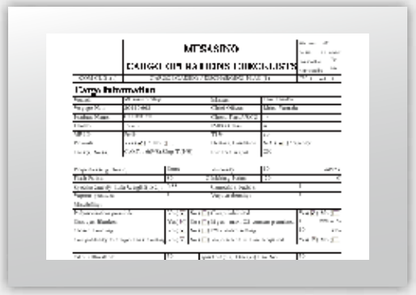
Cargo Planning

- 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.

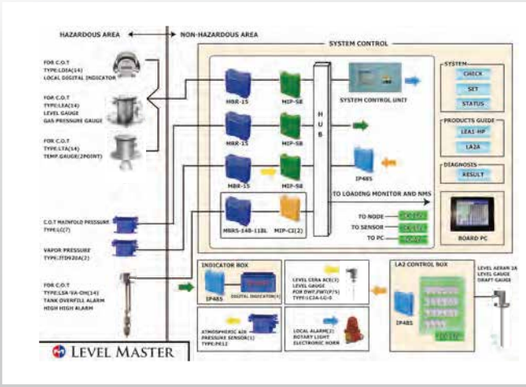
Documentation



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.

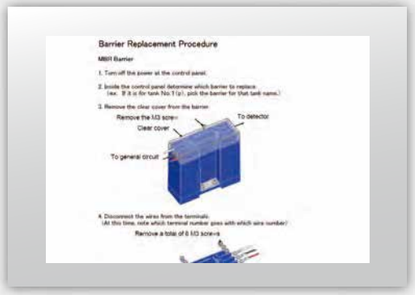
Network Management System

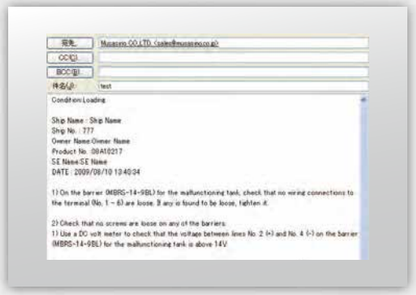
- System self-diagnostics
- Troubleshooting & repair guides
- System reports
- Automated data logging
- Tank level trend function



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.

X-RADAR

Radar Type Level Gauge (Crude Oil, Petroleum Products, Chemicals)

- **Self-calibration for long-term accuracy**
- **Robust processing logic**
- **No system warm-up required**
- **Easily interchangeable electronics**
- **Inspection & maintenance on closed tanks**
- **Self-diagnostics**
- **Remote monitoring**
- **Built-in I.G. pressure sensor**
- **Small footprint**
- **Minimal cabling**
- **Interfaces with peripheral devices, such as temperature sensors and local indicators**

Musasino's X-Radar is designed specifically for marine applications. The 10 GHz 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. The robust processing logic also identifies extra echoes from tank structures, ensuring accurate cargo level readings.
Even the most reliable systems eventually require maintenance, so Musasino designed X-Radar with easily interchangeable electronic boxes that can be replaced and set up in a few minutes, eliminating the need for service attendance and reducing system downtime.
To further save time and reduce costs, the electronics, and I.G. pressure sensor can be serviced, adjusted, or replaced without having to gas-free or open the tank.

Level Gauge

Application(s)	Crude Oil, Refined Petroleum Products, Chemical
Measuring Method	FMCW
Frequency	10GHz Band
Measurement Range	0.5-30m
Beam Angle	11°
Resolution	1mm
Accuracy	±2mm
Ambient Temperature	-25~+70℃
Explosion Protection	Exia IIC T5
Protection Class	IP66
Flange Material	SUS316L
Cable	4-core sealed marine cable

Pressure Sensor

Type	Absolute Pressure
Measurement Range	-10~+30kPa
Accuracy	±0.4kPa
Rated Pressure	200kPa
Maximum Pressure	400kPa

*See product specification sheets for complete specifications.

X-RADAR

Pipe Radar Type Level Gauge (Liquid Gas Carriers, FGSS)

- **All-in-one with 1-inch pipes**
- **CTS technology**
- **Maintenance on closed tanks**
- **Self-calibration for long-term, stable operation**

The all-in-one design houses level gauges (Main / Sub), temperature gauges, pressure gauges (Main / Sub), and an independent level alarm in a compact structure that contributes to reduced outfitting work.
Musasino has applied the experience and technology cultivated in the custody transfer system (CTS) installed in Japan's first LNG bunkering vessel.

Level Gauge

Application(s)	LNG/LPG
Measuring Method	FMCW
Measurement Range	0~25m
Accuracy	±5mm
Explosion Protection	Intrinsically Safe Exia / Ex ia IIC T5
Protection Class	IP66

Temperature Sensor

Measuring Method	PT-100
Measurement Range	-200~100℃
Accuracy	±0.2℃ (-165℃~-145℃) ±1.5℃ (-145℃~+40℃)

Pressure Sensor

Measuring Method	Diaphragm Type
Measurement Range	0 bar to 20 bar
Accuracy	0.5% FS

*See product specification sheets for complete specifications.

Devices 200A Type	• Level ×2 (Main / Sub) • Temp.×2 (4-pt Main / Sub) *If only main, max. 6 pts. • Press.×2 (Main / Sub) • Independent Alarm x 1
Option	150A ・ 80A Type *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*

Application(s)	Crude oil, petroleum products, chemicals, LPG, fuel oil, sea water, fresh water, etc.
Ambient Temperature	M-LMX, M-LMV, M-LMV2: -25 to 70˚C (-13 to 158˚F)
Intrinsically Safe	M-LMX, M-LMV, M-LMV2: Exia IIC T6
Accuracy	±25mm, ±15mm, ±10mm
Measuring Range	0.13 to 40m
Temperature Sensor	3points (measuring range: -5 to 100ºC)
Protection Class	IP66
Wiring	MPYCYS-4

*See product specification sheets for complete specifications.

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 overfill 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*

Application(s)	Chemicals, petroleum products, fresh water, sea water
Measurement Method	Ultrasonic wave
Measuring Range	Up to 2 m
Ambient Temperature	-25 to 70°C (-13 to 158°F)
Intrinsically Safe	Exia IIC T6
Weight	Approx. 20 kg (2 alarm points)
Accuracy	±5mm
Power Supply	DC 12V approx. 13mA
Flange	ϕ265 (150A)
Protection Class	IP66
Main Material	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*

Application(s)	Crude oil, fuel oil, sea water, fresh water
Ambient Temperature	-25 to 100˚C (-13 to 212˚F)
Intrinsically Safe	Exia IIC T6
Weight	Approx. 15kg
Accuracy	±5mm
Measuring Range	2m
Power Supply	DC 12V
Flange Size	JIS 5K-200 (ϕ320) JIS 5K-150 (ϕ265)
Cable	MPYCYS-2 (1 float) MPYCYS-4 (2 floats)
Protection Class	IP66

*See product specification sheets for complete specifications.

Level Aeran X

Pulse-Purge Type Level Gauge, Draft Gauge

- **High-accuracy**
- **Reliable and efficient**
- **Automated air and pressure controls**
- **Small footprint**
- **Self-diagnostics**
- **Low maintenance**

Level Aeran X (LAX) uses Musasino's patented pulse-purge technology to deliver high-accuracy measurements. Compressed air is periodically discharged at a higher pressure, and then stopped for the measurement. This eliminates pressure loss and fluctuation in the piping – suppressing hysteresis – making accurate level measurements possible.

General Specifications

Measurement Method	Pulse Purge type
Power supply	AC100~220A
Accuracy	±25mm
Protection Class	MPP unit:IP44 / Alarm Panel:IP22
Air Supply	Dry Air for measurement
Ambient Temperature	5-55℃(MPP Unit/Alarm Panel)
Interface	LAN, RS485
Ship Class	ABS, BV, CCS, DNV-GL, KR, LR, NK

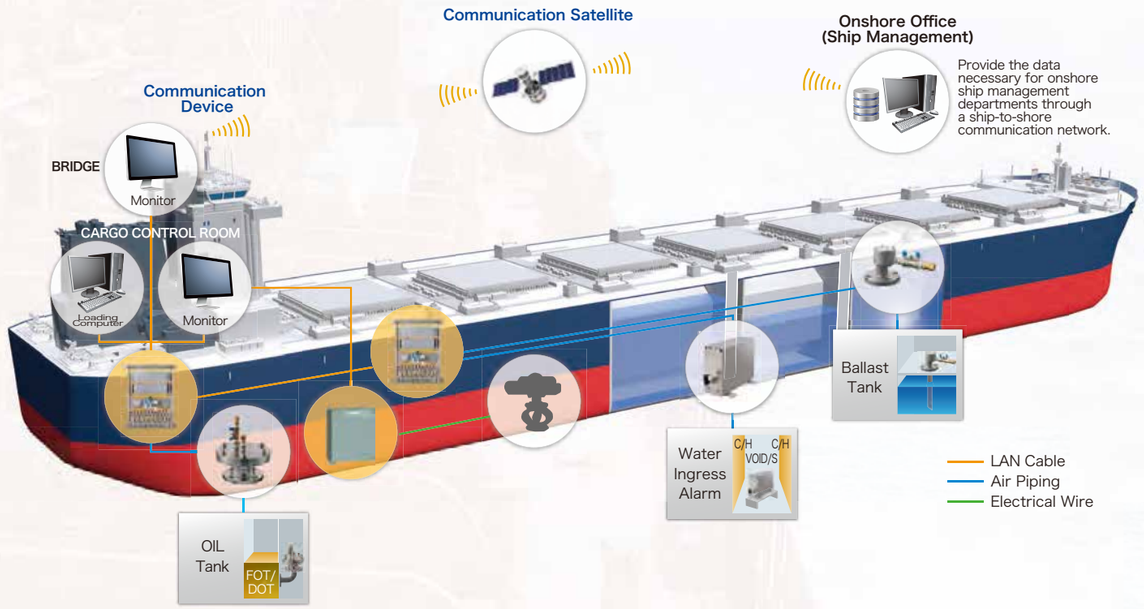
The industry's first level gauge and alarm control device to use the pulse-purge method L-Core supports cargo handling, hull monitoring and management.

Cargo Handling Support

LAX combines with various cargo handling support applications to ease the burden of cargo handling operations on crew, and support quick, accurate cargo operations.

Ship Management Support

Data from high-accuracy level measurements is used to support optimal ballasting and improve fuel efficiency. In addition, hull stress is monitored and recorded in real time, and gives a visual representation of hull operating conditions.



LAX-WAC

Level Gauge

- **Diaphragm Type**
- **Bubbleless Measurement**

Accuracy	±25mm
Applications	Drinking Water, Fresh Water, Settling, Storage, Service, and Other Tanks

LAX-ADM

Water Ingress Detector

- **Fail-Safe Function**
- **Level Measurement after Alarm Activation**

Accuracy	±30mm
Applications	Ingress Alarm, Bilge Alarm

Electronic Trim-Heel Detector

The detector measures along both X and Y axes, which is used to correct the liquid level in each tank for trim and heel, and convert to the correct liquid volume. When used to build an auto-trim/heel system, the hull attitude can be kept in an optimal state, providing stable, comfortable, and safe operation, as well as reducing fuel consumption.

*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)
Measuring Range	0.0-10.0m (pressure rating 200kPa) 0.0-30.0m (pressure rating 500kPa)
Accuracy	±1.0% FS
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 T5
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 T5
Min. Weight	4 kg
Protection Class	IP68
Accuracy	± 30 mm

*See product specification sheets for complete specifications.

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